PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES.

AT the annual meeting of the Academy of Sciences, held on December 16, 1901, the presidential address was given by M. Fouqué and the following prize awards were announced:—

Geometry.—M. Léonce Laugel is awarded the Francœur prize and M. Émile Borel the Poncelet prize.

Mechanics.—The extraordinary prize of six thousand francs is divided between M. Tissot for his work relating to the utilisation of wireless telegraphy in the Navy, and M. Marbec for his calculations on the strength of tubular boilers; M. Aimé Witz receives the Montyon prize, and M. Boulvin the Plumey prize for his applications of the entropy diagram to the steam engine. The Fourneyron prize, the subject proposed for which was the theoretical or experimental study of steam turbines, is not awarded.

Astronomy.—The Lalande prize to M. Thome, and the Valz prize to M. Charles André for his treatise on stellar astronomy.

Physics.—The La Caze prize is awarded to M. Curie for his work on radium and on piezo-electricity of crystals, the Gaston Planté prize to M. G. Boucherot, the Kastner-Boursalt prize to MM. H. Gall and de Montlaur for their electrochemical work.

Statistics.—The Montyon prize for statistics is given to M. G. Baudran for his work on tuberculosis in the Department of the Oise, a very honourable mention being accorded to the memoir of MM. Delobel, Lebrun and Cozette on the statistics of contagious diseases of animals in France, and to M. Lowenthal.

Chemistry.—The Jecker prize is divided between MM. Moureu, Simon and Léo Vignon, MM. Wyrouboff and Verneuil receiving the La Caze prize for their researches on the rare metals.

Mineralogy and Geology.—The Delesse prize is awarded to M. Gaston Vasseur for his work on the classification of the Tertiary strata in the west and south-west of France.

Physical Geography.—The Gay prize is divided between MM. Franchet and Saint-Yves.

Botany.—MM. Matruchot and Molliard receive the Bordin prize for their work on the influence of the external conditions on the protoplasm and nucleus in plants, M. Karl E. Hirn the Desmazières prize, M. Mazé the Montagne prize for his researches on the mechanism of the fixation of nitrogen by the Leguminosæ, M. Ferdinand Debray the de la Fons-Mélicocq prize, and M. N. Patouillard the Thore prize for his taxonomic essay on the families and genera of the Hymenomycetes.

Anatomy and Zoology.—The grand prize of the Physical Sciences is awarded to M. Maupas for his two memoirs on the biology and the origin of the sexual elements in Nematods, and the Savigny prize to MM. Jules Bonnier and Ch. Pérez for their exploration of the Red Sea and the Persian Gulf.

Medicine and Surgery.—The Montyon prize is divided between MM. Buffard and Schneider, Lignières, and Claude and Balthazard, the Barbier prize between MM. Moreigne, Tissier, and Goyon, the Breant prize in equal parts between MM. Jules Courmont and V. Montagard, Weil, and Levaditi; M. René le Fur receives the Godard prize, M. Gley the Mége prize, whilst the Bellion prize is divided between MM. Landouzy and G. Brouardel, and M. Sauton, very honourable mentions being accorded to M. Razou and M. Pégurier. The Lallemand prize is divided between MM. Catois, J. C. Roux and J. Lépine, MM. F. Bernheim and A. Comte receiving very honourable mention. M. Catrin receives the Baron Larrey prize for his work on mental alienation in the Army, an honourable mention being accorded to MM. Tostivint and Remlinger for their memoir on the comparative pathology of the European and Arabian races.

Physiology.—The Montyon prize for experimental physiology is awarded to M. Marcel Mirande, M. Bonniot being accorded an honourable mention, the Pourat prize to M. Tissot for his researches on the cooling due to muscular contraction, the La Caze prize to M. Charpentier, the Philipeaux prize being divided between MM. L. Camus and M. Moussu.

General Prizes.—The Lavoisier medal is awarded to M. Emil Fischer, professor of chemistry at the University of Berlin, correspondant of the Academy, for the whole of his works and in particular for those relating to the syntheses of the sugars. The Montyon prize (unhealthy trades) is divided between MM. Albert Dormoy and L. Vaillard, M. Halphen receiving an encouragement. M. Baubigny receives the Wilde prize for his work on atomic weights, MM. Fosse and Grignard the Cahours prize (in equal parts), P. Stanislas Chevalier the Tchihatchef prize for meteorological and astronomical studies in China, M. Gabriel Lippmann the Jean Reynaud prize, M. F. Foureau the Leconte prize for his scientific explorations in southern Algeria, M. Foureau the Janssen gold medal, and MM. N. Villatte, E. Verlet-Hanus and A. P. de Chambrun silver gilt medals for their work in the Sahara, M. Gabriel Kœnigs the Petit D'Ormoy prize for his researches in geometry and mechanics, M. Bouvier the Petit D'Ormoy prize (natural sciences), M. Guichard the Saintour prize, M. A. Ponsot the Gegner prize, M. Frémont the Trémont prize.

The Baron de Joest prize is divided between MM. Verschaffel and Saint-Blancat for their astronomical work, the prize founded by Mme. la Marquise de Laplace being given to M. Japiot, and that founded by M. Félix Rivot to MM. Pellarin, Ott, Japiot and Guillaume.

ELECTRIC WAVES.

THE annual meeting of the German Association of Men of Science and Physicians was held last autumn in Hamburg. It is twenty-five years since the Association last met in the birthplace of Heinrich Hertz, who was then a young man of nineteen, not yet entered upon the active period of his life, which ended by his death in 1894, and which, though so short, was yet so great and full of usefulness. It fell, therefore, to the lot of Prof. Ernst Lecher to deliver this address[1] in memory of Hertz and to review the further development, which has taken place since his death, of his greatest work, the experimental proof of the existence of electric waves.

It is, indeed, a long chain of events, as Hertz himself expressed it, to which the discovery of electric waves belongs, one event linking itself into another, the whole forming perhaps the most noble and convincing proof that our modern methods of scientific thought and research are true and exact. Prof. Lecher gives an interesting sketch of this in the pamphlet before us. The first link in the chain was forged by Faraday. Until his time the scientific world was dominated by the old Newtonian ideas of force acting at a distance, an idea which seems to us now, on close examination, to be manifestly absurd. It required, however, the genius of Faraday to break loose from this line of thought and to perceive that a medium is necessary in order that one body may exert a force upon another; and to the eye of Faraday the whole of space became filled with lines and tubes of force, real changes of condition in the intervening media, which, although invisible, were as clear to him as the objects acted upon themselves. The way was thus paved for Maxwell, who collected these ideas in his really magic formulæ of the electrodynamical theory of light. According to Maxwell there are electric currents in insulators, these being of the nature of displacement currents. Although these currents are of very short duration, yet they must have like magnetic and inductive effects to the ordinary currents in a conductor. If, now, a displacement current vibrates backwards and forwards, then in a neighbouring insulator displacement currents will be induced, and so forth; a transversal wave-motion is thus propagated until it is absorbed by induction in a conductor and transformed into heat. On calculating the velocity of this wave propagation it was found that two quantities appeared in the result—the dielectric coefficient and the permeability. The square of the velocity is equal to the reciprocal value of the product of these two values. It was found, however, that whole powers of this value were always appearing in different branches of the theory of electricity, and, most extraordinarily to say, the value was always found to be equal to the velocity of light. Maxwell, therefore, came to the theoretical conclusion in 1865 that an electromagnetic wave must travel in an insulator, *e.g.* in air or vacuum, with the velocity of light. But not only the velocity, concluded Maxwell, should be the same, but also the geometrical and other properties must be equal; a ray of light was therefore a series of electric waves, light was electricity. These ideas, immediately after their enunciation by Maxwell, did not meet with any great acceptance, and an experimental proof of their accuracy was looked upon as being altogether out of the question. This feeling was even shared by Hertz himself, for in his description of his classical experiment where, by means of a

[1] Ueber die Entdeckung der elektrischen Wellen durch H. Hertz und die weitere Entwicklung dieses Gebietes. (Leipzig: Johann Ambrosius Barth.

spark gap in a loop of wire, he showed the sparks induced by the electric waves at a distance of ten metres from the transmitter, he said: "It appears impossible, nearly nonsensical, that these sparks should be visible, but in a perfectly dark room they *are* visible."

Since the death of Hertz it can hardly be said that another link in the chain of development has been forged. Our knowledge and study of electric waves have spread and expanded enormously, and the practical utilisation of the same is seen in the modern wireless telegraphy. The possibility, as Marconi has shown, of already sending messages without the use of wires for a distance of 300 kilometres is the direct result of the labours of Hertz. From a theoretical standpoint the work of the many investigators of the last few years has simply increased the burden of proof that the fundamental ideas of the electrodynamical theory are correct. Many points, however, yet remain to be cleared up. In the domain of the ether itself very few difficulties have been encountered. Very different has been the case when the ether pure and simple has been left and the theory and ideas extended to ordinary bodies and materials. Chief among these difficulties must be mentioned the phenomena of anomalous absorption and dispersion, and the relative interaction of mass and ether is to-day one of the most perplexing and yet enticing fields of scientific work. Perhaps here we are, though it is not mentioned in the pamphlet, just commencing the forging of yet an entirely new link, which will be seen in the full development of the corpuscle and electron theories, and the explanation of the many at present very strange phenomena included under these names. Besides being a very interesting address, this booklet would be very useful in serving as an index to the many investigations which have been made and published in this branch of science.

C. C. G.

THE CIVILISATIONS OF HALLSTATT AND LA TENE.[1]

THE publications of the Prehistoric Commission of the Imperial Academy of Science in Vienna, in their present form, date from the year 1887, when it was resolved to discontinue the practice of publishing their reports as integral parts of the *Transactions* of the Academy. The primary object of this commission was to prosecute palæo-ethnographical investigations throughout the Austrian dominions, taking special care that the necessary excavations would be conducted in a thoroughly scientific manner. Since 1887 five parts, in all 363 pages, in quarto, with plates and numerous illustrations in the text, have been issued, giving on an average only twenty-eight pages per annum—a rate of progress which, *primâ facie*, does not suggest that such researches are advancing with rapid strides in that part of Europe. Looking, however, at the contents of the various papers and reports, which range over the whole field of prehistoric archæology, I am constrained to say that, in forming a fair estimate of the archæological value of the labours of the commissioners, we must be guided by quality and not by quantity.

The part now before me (No. 5) contains two papers, one by Dr. Moritz Hoernes and the other by Mr. Josef Szombathy, both officials in the prehistoric department of the K.K. Naturhist. Hofsmuseum in Vienna. Dr. Hoernes describes five different groups of antiquities from the vicinity of Vukovar, on the south side of the Danube and not far from the great bend which the river makes in changing its course from south to east. One group consists of the débris of a settlement of the Stone Age, two—one being a hoard—are of the Bronze Age, while the remaining two are respectively interments of the Hallstatt period and of Slavish times (eleventh or twelfth century). The first station, which bears the name Vučedol, is considered of some importance inasmuch as its relics, especially the pottery, illustrate the evolution of ornament; and so the author discusses at some length the points of resemblance and difference between them and those of a number of other analogous stations, such as Butmir (Bosnia), Tordos (Transylvania), Sarvas, near Essegg (Slavonia), the lake-dwellings of Laibach Moor, &c. But as Dr. Hoernes' opinions on these matters are already known, or at any rate accessible, to archæologists through his great work on the history of prehistoric art in Europe ("Urgeschichte der bildenden Kunst in Europa," Wien, 1898), I shall pass on to the next paper, which, having an important bearing on the development of the early Iron Age in Europe, is of some consequence to British archæologists who may be desirous to trace the late Celtic remains of their own country to their proper source.

Mr. Szombathy's valuable monograph, "Das Grabfeld zu Idria bei Bača," takes the form of a report on excavations made, in 1886 and 1887, in forty-seven graves discovered in the valley of the Idria in the Julian Alps. The little cemetery, occupying an area of 5 to 10 metres in breadth and 30 metres in length, is situated on the right bank of the river some 20 metres above the river-bed and about an hour's walk to the south-east of the great necropolis of Santa Lucia—one of the most famous landmarks of the Hallstatt period in Europe. These graves had, on the average, a depth of one metre and a breadth and length of 50 to 80 centimetres; and all of them, with the exception of two, contained interments after cremation. They are numbered in the order in which they were excavated, but in the report they are described in chronological sequence beginning with the oldest, *i.e.* the middle Hallstatt period (about 600 B.C.). As this sequence comes down to late Roman times we have in the contents of the cemetery of Idria a remarkable evolutionary series of remains, extending over a period of nearly 1000 years. The successive stages of civilisation disclosed by the investigation, together with the number of graves assigned to each, are as follows:—Middle Hallstatt represented by 1 grave, late Hallstatt by 13, early La Tène by 2, middle La Tène by 13, late La Tène by 7, early Roman by 8, and late Roman by 2.

Mr. Szombathy's description of the relics, with 212 illustrations in the text, is a model of precision and brevity, without any lack of essential details, and therefore admits of no curtailment. The following remarks will, however, give readers some idea of their salient features.

Ornaments.—Among this class the fibulæ are the most interesting. One or two, of the boat-shaped type, having a long, straight foot, belong to the middle Hallstatt period. The Certosa fibula and its contemporary the cross-bow fibula are respectively represented by fourteen and three specimens. The La Tène fibulæ—early, middle and late forms—are numerous, and well worth careful study by those who have not acquired precise notions of the progressive stages thus designated. Five hinge fibulæ, peculiar to Roman remains, complete the list. Among the early La Tène group there are two very remarkable, if not unique, specimens. These are ornamented with amber beads placed in pairs on five pins projecting from the upper surface of the bow and attached to a bronze wire which, in a succession of small, graceful coils, follows the curve of the bow from head to foot. The middle La Tène specimens have the recurved foot ending in a circular expansion, which appears to have contained a setting of some kind of enamel. Iron fibulæ are scarce. The other objects of personal ornament consist of earrings, studs, finger-rings (one with three twists), bracelets with one or more coils, glass beads and torques.

Vessels.—Bronze caldrons and situlæ with movable handles, round or flat bottoms, and bulging, slanting or upright sides, are well represented. Two bronze dishes, one of the milk-plate type (5½ inches wide and 3¾ inches deep) and the other a small bowl with a ring-handle, have *graffiti* inscriptions on the outside of their rims, said to be in Venetic or old North Etruscan alphabet. A small bronze colander is perforated in such a manner as to form a geometrical pattern consisting of a central rosette surrounded by a fret border. Pottery is not abundant, and only a shallow dish, one or two jars with handles, and a conical vase with expanded base and slightly contracted mouth are figured.

Military Accoutrements.—A bronze helmet, with a projecting rim and central ridge, has an inscription in Roman characters scratched on it which reads *Protemus.*—There are also two iron helmets said to be of Roman workmanship. Among the weapons are a characteristic La Tène sword and sheath, both made of iron. Two other iron blades, also with their sheaths, are supposed to be like the Roman gladius. The iron blade in both specimens is separated from the grip (only the long tang of which now remains) by a circular guard of bronze. The sheaths were imperfect, but they appear to have been made of an iron frame, with panels of bronze and some non-durable material probably wood. There are also several spearheads, a knife-dagger still in its iron sheath and some fragments of shields showing conical bosses—all made of iron.

Industrial remains.—In this category are to be placed a

[1] "Mittheilungen der Prähistorischen Commission der K. Akademie der Wissenschaften in Wien." (Band i., No. 5, 1901.)