

The Open Court

A MONTHLY MAGAZINE

Devoted to the Science of Religion, the Religion of Science, and the
Extension of the Religious Parliament Idea

Editor: DR. PAUL CARUS.
Assistant Editor: T. J. McCORMACK.

Associates: } E. C. HEGELER.
 } MARY CARUS.

VOL. XVI. (NO. 11)

NOVEMBER, 1902.

NO. 558

CONTENTS:

<i>Frontispiece.</i> The Death of Siegfried. Illustrating Wagner's Opera. (After a Painting by Hermann Hendrich.)	
<i>The Theory of Heat.</i> A Critical and Historical Account of Its Development. Introduction.—Sketch of the History of Thermometry. Illustrated. DR. ERNST MACH, University of Vienna	641
<i>Richard Wagner.</i> A Biographical Sketch with Illustrations. (Concluded.) PROFESSOR E. P. EVANS, Munich	652
<i>The Mithraic Liturgy, Clergy, and Devotees.</i> Illustrated. PROF. FRANZ CUMONT, Ghent, Belgium	670
<i>Gospel Parallels from Páli Texts.</i> Translated from the Originals by ALBERT J. EDMUNDS. Eighth Series. Decline of the Faith. With Remarks on Maitreya	684
<i>Thanksgiving</i>	689
<i>History of Christianity in Japan</i>	690
<i>Ancient History for Beginners</i>	693
<i>Two Philosophical Poems of Goethe</i>	694
<i>The Discovery of Neptune</i>	696
<i>Book Reviews</i>	700
<i>Notes</i>	704

CHICAGO

The Open Court Publishing Company

LONDON: Kegan Paul, Trench, Trübner & Co., Ltd.

Per copy, 10 cents (sixpence). Yearly, \$1.00 (in the U. P. U., 5s. 6d.).

RECENTLY PUBLISHED!

The Science of Mechanics

A Critical and Historical Account of Its Development

THE SCIENCE OF MECHANICS. A Critical and Historical Account of Its Development. By **Dr. Ernst Mach**, Professor of the History and Theory of Inductive Science in the University of Vienna. Translated by **Thomas J. McCormack**. *Second Enlarged Edition*. 259 Cuts. Pages, xx, 605. Cloth, Gilt Top, Marginal Analyses. Exhaustive Index. Price, \$2.00 net (gs. 6d. net).

Comments on the First Edition.

"Mach's *Mechanics* is unique. It is not a text-book, but forms a useful supplement to the ordinary text-book. The latter is usually a skeleton outline, full of mathematical symbols and other abstractions. Mach's book has 'muscle and clothing,' and being written from the historical standpoint, introduces the leading contributors in succession, tells what they did and how they did it, and often what manner of men they were. Thus it is that the pages glow, as it were, with a certain humanism, quite delightful in a scientific book. . . . The book is handsomely printed, and deserves a warm reception from all interested in the progress of science."—*The Physical Review*, New York and London.

"Those who are curious to learn how the principles of mechanics have been evolved, from what source they take their origin, and how far they can be deemed of positive and permanent value, will find Dr. Mach's able treatise entrancingly interesting. . . . The book is a remarkable one in many respects, while the mixture of history with the latest scientific principles and absolute mathematical deductions makes it exceedingly attractive."—*Mechanical World*, Manchester and London, England.

"The book as a whole is unique, and is a valuable addition to any library of science or philosophy. . . . Reproductions of quaint old portraits and vignettes give piquancy to the pages. The numerous marginal titles form a complete epitome of the work; and there is that invaluable adjunct, a good index. Altogether the publishers are to be congratulated upon producing a technical work that is thoroughly attractive in its make-up."—Prof. D. W. Hering, in *Science*.

"A masterly book. . . . To any one who feels that he does not know as much as he ought to about physics, we can commend it most heartily as a scholarly and able treatise. . . . both interesting and profitable."—A. M. Wellington, in *Engineering News*, New York.

"Sets forth the elements of its subject with a lucidity, clearness, and force unknown in the mathematical text-books. . . . is admirably fitted to serve students as an introduction on historical lines to the principles of mechanical science."—*Canadian Mining and Mechanical Review*, Ottawa, Can

"There can be but one opinion as to the value of Mach's work in this translation. No instructor in physics should be without a copy of it."—*Henry Crew*, Professor of Physics in the Northwestern University, Evanston, Ill.

THE OPEN COURT PUBLISHING CO., CHICAGO, 324 Dearborn St.

LONDON: Kegan Paul, Trench, Trübner & Co., Ltd.



THE DEATH OF SIEGFRIED

(NIBELUNG-RING)

After a Painting by Hermann Hendrich

Frontispiece to The Open Court

THE OPEN COURT

A MONTHLY MAGAZINE

**Devoted to the Science of Religion, the Religion of Science, and
the Extension of the Religious Parliament Idea.**

VOL. XVI. (NO. 11.)

NOVEMBER, 1902.

NO. 558

Copyright by The Open Court Publishing Co., 1902.

THE THEORY OF HEAT.

A CRITICAL AND HISTORICAL ACCOUNT OF ITS
DEVELOPMENT.¹

BY DR. ERNST MACH.

INTRODUCTION.

IT is a commonplace of history that the modes of thought with which a given period is conversant and which have been acquired by the labors of generations past, are not always conducive to the advancement of science, but frequently act as a clog on its progress. Time and again have inquirers who stood aloof from the schools, like Black, Faraday, and Julius Robert Mayer, been the originators of gigantic scientific advances,—such as could only have sprung from their lack of bias and their freedom from the traditional professional views. And though the intellectual vigor and unconstraint demanded by such performances are not the outcome of either art or education, but are distinctively a product of nature and the exclusive gift of individuals, nevertheless the mobility and untrammelled play of our thoughts may be greatly enhanced by scientific *education*, at least if it looks beyond the fostering of talents requisite merely for the mastery of the problems of the day. Historical studies are a very essential part of a scientific education. They acquaint us with other problems, other hypotheses, other modes of viewing things, as well as with the laws and conditions of their origin, growth, and eventual decay. Under the pressure of other facts, which stood formerly in the foreground, other notions than those obtaining to-day were formed, other problems arose and found their solution, only to make way in their turn for

¹ Translated from Mach's *Principien der Wärmehhre* by Thomas J. McCormack.

the new ones that were to come after them. Once we have accustomed ourselves to regard our ideas as merely a means for the attainment of definite ends, we shall not find it difficult to perform in our own thought the transformations that may be necessary.

A view, of which the origin lies bared before us, ranks in intimacy with one that we have personally and consciously acquired, and of whose growth we possess the distinctest memory. It is never invested with that immobility and authority which those ideas possess that are imparted to us by education. We change our personally acquired views far more easily.

Historical study affords still another advantage. A consideration of the development, mutations, and decay of ideas leads directly to the discovery, scrutiny, and criticism of the developmental process of *our own unconsciously formed views*. These latter, when their process of growth is not understood, confront us with all the *insuperable might* of some alien power.

The purpose of the present series of articles, which is similar to that of my *Mechanics*,¹ is to trace the evolution of the concepts which form the theory of heat. This task has been facilitated somewhat by a number of preliminary researches, but the undertaking is upon the whole a far more complicated one than that set in my earlier work. Whereas the development of the fundamental principles of mechanics was accomplished by three men within the brief space of nearly a century, the growth of the theory of heat took an entirely different course. Many investigators took part in the elaboration of this department of physics. Slowly and searchingly, by devious and uncertain ways, one little advance after another was made, and only very gradually did our knowledge of these phenomena attain to its present magnitude and solidity.

And the reason is apparent. The motions of bodies are immediately accessible to the senses of sight and touch, and admit of exact scrutiny in their entire behavior. Phenomena of heat, on the other hand, lend themselves far less readily to observation. They are accessible to one sense only, are perceptible only discontinuously and under special conditions, and usually only when they are observed intentionally; they therefore play a far more subordinate rôle in both our intellectual and our perceptual life. They can be brought within range of the dominant senses of sight and touch only indirectly and intricately. The devices for their inves-

¹ *The Science of Mechanics. A Critical and Historical Account of Its Development*. Translated from the German by Thomas J. McCormack. Second, greatly enlarged edition. With 259 cuts and illustrations. Pages, xx, 605. Chicago: The Open Court Publishing Co.

tigation therefore were from the very outset of a predominantly intellectual character, and there were thus insinuated into the very first observations of the subject much subconscious bias and many obscure metaphysical conceptions.

HISTORICAL SKETCH OF THE DEVELOPMENT OF THERMOMETRY.

Of the sensations which we assume to be provoked in us by surrounding bodies, the *sensations of heat* form a distinct series of elements bearing a definite relationship to one another. They are denoted by the words *hot, warm, cool, cold*, and so forth. The bodies which produce these sensations likewise exhibit, both as to themselves and as to other objects, a distinctive physical deportment, definitely associated with these sensational *indicia*. A very hot body glows, gives forth light, melts, evaporates, or burns away; a cold body congeals. A drop of water on a hot plate evaporates with a hissing noise; on a cold plate it freezes, etc. This collective physical behavior of a body corresponding to our sensational criteria of heat (its collective reactions) is termed its *thermal state*, or state with respect to heat.

We should be unable to follow the physical processes here involved with anything like definiteness if we were restricted to sensations of heat as our criteria of thermal states. Pour cold water from *A* (Fig. 1) and hot water from *C* into a third vessel *B*, and after holding the left hand for a few seconds in *A* and the right hand for the same length of time in *C*, plunge both hands into *B*; the *same* water will feel warm to the left hand and cold to the right. The air of a deep cellar feels cold in summer and warm in winter, although it can be definitely shown that its physical thermal reaction remains approximately the same the year round.¹

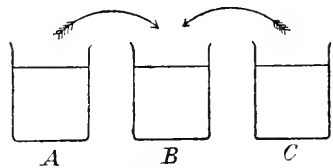


Fig. 1.

As a matter of fact, the sensation is determined not alone by the body producing it, but partly also by the condition of the perceiving sensory organ, the susceptibility of which is always appreciably affected by its antecedent states. In the same way the light of a lamp seems bright on coming from a dark room, but dull on coming from the sun-light. The sensory organs have, in fact, been

¹ Like considerations were early advanced by Sagredo (Letter to Galileo, February 7th, 1615). Cf. Burckhardt, *Erfindung des Thermometers*, Basel, 1867.

biologically adapted not for the advancement of science but for the maintenance of favorable conditions of life.

Where sensation alone is concerned, sensation alone is decisive. It is then an indisputable fact that a body reacting physically the same does feel at one time warm to us and at another cold. It would be utterly unmeaning to say that a body that we feel to be hot is really cold. But where the physical deportment of a body with respect to other bodies is concerned, we are obliged to look about us for some distinguishing characteristic of this deportment which shall be independent of the variable and intricate action of our senses; and such a distinguishing characteristic has been found.

It has long been known that the *volumes* of substances increase or diminish, other circumstances remaining the same, according as the sensations of heat produced by them are greater or less. In the case of air, this alteration of volume is striking in the extreme. It was familiar even to Hero of Alexandria.¹ It was Galileo, however, the great founder of dynamics, that appears to have first conceived the felicitous thought of employing the volume of air as a criterion of the thermal state, and of constructing on the basis of this idea a thermoscope or thermometer. It was taken for granted

that an instrument of this kind would indicate the thermal condition of the bodies with which it was in contact, on the principle that bodies which are unequally warm soon provoke exactly the same feeling of warmth when touched.

The dilatation of air by heat was employed by Hero mainly for the performance of conjuring-tricks. Figure 2, taken from page 53 of the Amsterdam edition of his work (1680), illustrates one of these devices. A fire being kindled on a hollow altar, the heated

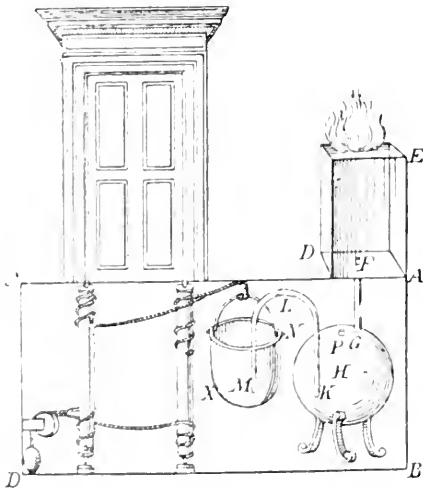


Fig. 2.

air in the enclosure expands, and, pressing against the water in the globe beneath, forces the same through a tube into a pail, which

¹ *Heronis Alexandrini spiritalium liber*, Amsterdam, 1680.

by its descending weight opens the door of the temple. When the fire is extinguished, the door closes.

Experiments of this character were quite to the liking of Cornelius van Drebbel, of Alkmaar in Holland, who enjoyed in his day the reputation of a magician. In his *Treatise on the Nature of the Elements, Winds, Rain, etc.*,¹ published in 1608, the experiment illustrated in Figure 3 is described. From a heated retort, the neck and orifice of which are plunged under water, air is expelled in bubbles, and is replaced, after the retort cools, by the inrushing water. The same experiment was described earlier by Porta,² who went so far even as to determine the amount of expansion of the air by marking the limits of the occupied space before heating and after cooling. But Porta did not light on the idea of making a thermoscope. In a translation by Ensl³ of the *Recréations ma-*

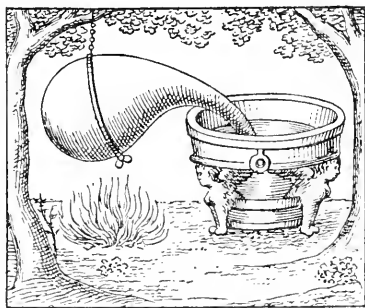
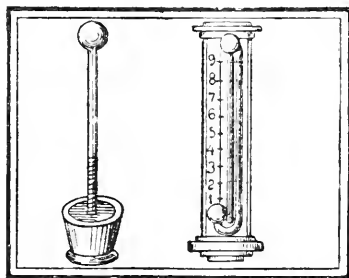


Fig 3.

PROBLEMA LXX XIII

Fig. 4. *De Thermometro, sive instrumento Drebbeliano.*

thématiques,⁴ page 132, the invention of the thermometer is ascribed, in the description appended to the cut reproduced in Figure 4, to Drebbel. But it appears from the researches of E. Wohlwill⁵ and F. Burckhardt⁶ that this supposition is entirely groundless. Neither is Santorio of Padua, to whom important applications of the thermoscope are rightly credited, the inventor of this instrument.⁷ Viviani states in his biography of Galileo that the latter physicist invented the thermometer in 1592. Galileo himself claims the invention, and this opinion is shared by Sagredo, who knows Santorio, in a letter to Galileo of March 15, 1615.

¹ According to Burckhardt, *loc. cit.*, there is a German edition of this book bearing the date of 1608.

² *I tre libri de spiritali di Giambattista della Porta*, Naples, 1606.

³ *Thaumaturgus mathematicus*, Cologne, 1651.

⁴ First edition, 1624.

⁵ *Pogg. Ann.*, Vol. 124, p. 163.

⁶ Burckhardt, *Die Erfindung des Thermometers*.

⁷ Cf. Burckhardt. *loc. cit.*

From Burekhardt's investigations, which we are here following in the main, it appears indisputable that Galileo was the first to employ the dilatation of air for registering states of heat, and that he therefore is the inventor of the thermometer. The form of this thermometer, as well as of those patterned after it, is given in its essential features in Figure 5. The chief inconvenience of the instrument is that its indications depend on the pressure of the atmosphere, for which reason only observations made in immediate succession furnish comparable results. The division of the scale is mostly quite arbitrary. Here begins the real history of the development of scientific thermometry, of which it is our



Fig. 5.

purpose to give a brief sketch in the following pages. In doing this, it shall be our endeavor so to array the facts that the mode in which each idea provoked its successor, and each step prepared for the one that came after it, shall be at once apparent.

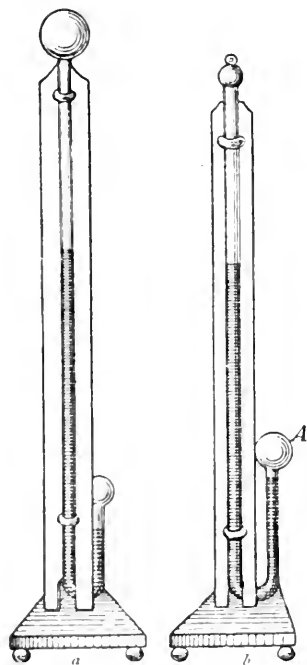


Fig. 6.

The form of the air-thermometer has undergone many modifications. Guericke's thermometer differs from the original type, above described, in external construction only, and by its greater expenditure of mechanical force.¹ The instrument described by Sturm,² on the other hand, is a closed differential thermometer and is independent of the pressure of the atmosphere. The air in the bulb (Fig. 6a) is confined by a column of liquid, which, on the temperature's rising, is forced into the longer tube, the air-space of which is shut off from the outside atmosphere.

A siphon-shaped air-thermometer closed at both ends and similar in form to the differential thermometer, but having only *one* bulb filled with air, the other containing a *vacuum*, was invented by the Frenchman Hubin³ (Fig. 6b). A similar but less perfect arrangement we owe to Dalencé.⁴

¹ Guericke, *Experimenta Magdeburgica*, 1672.

² *Collegium experimentale sive curiosum*, Nürnberg, 1676.

³ Cf. Reyher, *Pneumatica*, 1725, p. 193.

⁴ *Traité des baromètres et thermomètres*, 1688.

Entirely novel ideas were introduced into thermometry by Amontons.¹ His thermometers consist of a glass ball *A* about eight centimeters in diameter (Fig. 7), almost filled with air. This air is excluded from the atmosphere by a column of mercury, which partly fills the ball *A* and the thin vertical tube *BC* (1 mm. wide). When the ball is heated, the volume of the air contained in it is only very slightly altered, while its expansive force is increased greatly as is also the height of the column of mercury, *mn*, which it bears.

Amontons, who is acquainted with the works of Mariotte and makes reference to them, discovers that the total pressure, inclusive of that of the atmosphere, which a quantity of air in *A* will bear when immersed in cold water is *increased by one-third* of its amount when *A* is plunged into boiling water. This augmentation of pressure always amounts to exactly one third of the total initial pressure, whatever the latter be and whatever the quantity of air in the ball. On the strength of this experiment Amontons concluded that the temperature of boiling was constant. To obtain a greater range of pressure, he filled the ball with air by a simple contrivance until it bore at the boiling temperature the total pressure of a column of mercury 73 inches in height. With the air "tempered," as he phrased it, the column was some 19 inches shorter.

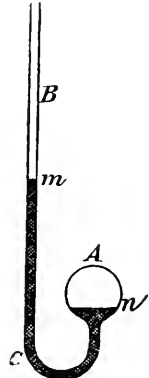


Fig. 7.

These air-thermometers are not independent of the pressure of the atmosphere, but the resulting errors admit of rectification by the barometer. Amontons discussed the great lack of conformity in the readings of the spirit-thermometers then in use, and made the attempt to graduate them more accurately by comparison with his own. He also endeavored to make determinations of high temperatures, by heating one extremity of an iron bar to white heat and ascertaining by the air-thermometer the temperature of the point at which tallow just begins to melt, the temperatures of the remaining points being determined by methods of intrapolation and extrapolation not entirely beyond criticism.

In one of his memoirs² Amontons actually declares the expansive force of the air to be the *measure* of the thermal state (temperature), and advances the conception that the lowest possible degree of cold answers to an expansive force of zero. In his view, accord-

¹ *Histoire de l'Académie des Sciences*, Paris, 1699, 1702, 1703.

² *Mémoires de l'Académie*, Paris, 1703, page 50 ff.

ingly, the greatest summer-heat was to the greatest winter-cold, in Paris, as 5:6.

A remarkable instance of bias is exhibited by Amontons in his adopting, in addition to the boiling-point of water, and in the face of his brilliant conception of an absolute zero-point of temperature, — the totally unreliable and unnecessary test of “cold” water for indicating a *second* fundamental point.

Amontons also gives expression to other interesting views. Having observed that the increase in the expansive force on a rise of temperature is proportional to the density of the air, he suggests explaining earthquakes by assuming very dense and heated layers of air in the interior of the earth. He computed that air at 18 leagues' depth would have the density of mercury. Nevertheless, the compressibility of air has in his opinion a limit, and cannot possibly extend beyond the point where the “springs” of which the air consists come in contact. Heat consists of “particles in motion.”

It will be seen that the ideas of Amontons in so far constitute a decided step in advance as they permit of the construction of genuinely comparable thermometers. Subsequently Lambert actively espoused them. The scale of temperature at present in use actually coincides with that of Amontons.

Lambert¹ makes considerable use of the air-thermometer. Like Amontons he regards the expansive force of the air as the measure of the temperature, and he also assumes an absolute point of cold to correspond to the expansive force zero. But following Renaldini he selects the melting-point of ice and the boiling-point of water as the fundamental points of his scale, fixes the expansive force of the air at the first point at 1000 and finds it at the latter to be 1417, whence would follow for the coefficient of expansion, 0.417, as contrasted with the 0.375 of Gay-Lussac. In a later experiment, Lambert² actually obtained the figures 0.375. Lambert also graduated spirit-thermometers by his air-thermometer, and attached to the latter, in view of the variations of barometric pressure, a *moveable* scale.

More than a century after Amontons, in the year 1819, two investigators, Clément and Desormes, without a knowledge of Amontons's researches, hit upon exactly the same idea of an absolute zero of temperature.³

In recent times very perfect air-thermometers have been constructed by Jolly and others. The most ingenious and original

¹ Lambert, *Pyrometrie*, Berlin, 1799, pages 29, 40, 74.

² *Loc. cit.*, page. 47.

³ *Journal de physique*, Vol. 89.

forms are those devised by Pfaundler. The description of them, however, does not fall within the scope of the present work, which is restricted to considerations of principle.

It is not surprising that the pronounced alterations of the volume of air when heated should have first attracted attention and that the less conspicuous alterations of the volumes of liquids should not have been noticed until later. The difficulty of handling the first air-thermometers and their dependence on the pressure of the atmosphere could not fail to arouse the desire of supplanting them by some more convenient instrument. The philosophical impulse to extend the results of single observations to new and untried cases, the impulse to generalise, was never wanting. Said Galileo: "In the opinion of the schools of the philosophers it has been proved to be a true principle that the property of cold is to contract and the property of heat to expand."¹ Reflections of this character must have prompted investigators to inquire whether the property observed in connection with the air could not be demonstrated also in connection with liquids. In all likelihood, a French physician, Jean Rey (1631), was the inventor of the liquid thermometer.² Viviani attributes the invention to Ferdinand II., Grand Duke of Tuscany (1641). The latter constructed sealed spirit-thermometers. The oldest of these instruments registered twenty degrees in snow and eighty degrees at the greatest heat of summer. The degrees were marked with beads of enamel fused on the glass stem. The form is given in Figure 8.

The shape and mode of division of these thermometers underwent considerable modification at the hands of the Florentine Academy. Sealed thermometers were at first recommended in England by Robert Boyle,³ who also called attention to the importance of a comparable thermometric scale and to the constancy of the freezing-point of water. As a fundamental point of reference, however, Boyle gave preference to the congealing-point of aniseed oil, which Halley seems to have made extensive use of. The most rational division of the scale, in Boyle's opinion, was that which directly indicated the fractional increment of volume by which the spirit expanded from the fixed point,—a convention which actually dispenses with a second fundamental point.

In France, De la Hire (1670) conducted observations with a sealed thermometer constructed by Hubin. Dalencé (1688) selected

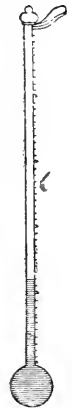


Fig. 8.

¹ Burckhardt, *l. cit.*, p. 19. ² Burckhardt, *l. cit.*, p. 37. ³ *Experiments Touching Cold*, 1665.

two points of reference, to the importance of which attention had been called by Fabri. Dalencé's fixed points were the freezing-point of water and the melting-point of butter, the distance between which he divided into twenty equal parts.

Halley¹ determined the amounts of expansion of water, mercury, and air between the points of intense winter cold and the boiling of water. He observed on this occasion that the temperature of the boiling-point was constant, and recommended mercury as a thermometric substance. Use of both the freezing and the boiling points for the graduation of thermometers was first made by Renaldini.² The same inquirer also proposed the taking of mixtures of definite weights of ice-cold and boiling water as standards for the graduation of thermometers.

The first really good comparable spirit-thermometers were manufactured, according to Ch. Wolff,³ in the year 1714, by Fahrenheit, who soon after also adopted mercury as his thermometric substance, and in 1724 made his method public.⁴ Fahrenheit denoted the temperature of a mixture of water, ice, and sal ammoniac by 0, that of melting ice by 32, and that of the blood by 96. He probably waived the use of the constant boiling-point of water.

Réaumur⁵ chose the freezing and boiling points for the construction of his spirit-thermometers, and divided the distance between them, which on the Fahrenheit scale occupies 180 divisions, into 80 divisions. Deluc retained Réaumur's scale, but substituted mercury for spirits. Celsius (1742) divided the interval between the fundamental points into 100 parts, calling the boiling-point 0 and the freezing-point 100. Strömer subsequently reversed this order, and produced the scale now in common use.

Most difficult to observe was the dilatation of solid bodies by heat. The first experiments in this direction were doubtless conducted by the Accademia del Cimento.⁶ It transpired that bodies which fitted exactly in orifices before heating could not be passed through them at all after heating. The difficulty of determining linear dilatations by the measuring rod was known to Dalencé (1688), Richer (1672), and others. Musschenbroek devised for this purpose in 1729 the well-known quadrant pyrometer, and S'Gravesande put the experiments of the Florentine Academy (the sphere and ring) into the form in which we now have them. Lowitz, in

¹ *Philosophical Transactions*, 1693.

² *Philosophia naturalis*, Padua, 1694.

³ *Acta Eruditorum*, 1714.

⁴ *Philosophical Transactions*, Vol. XXXIII.

⁵ *Mémoires de l'Académie des Sciences*, Paris, 1730, 1731.

⁶ *Saggi di naturali esperienze fatte nell'Accademia del Cimento*, Florence, 1667.

1753, measured in a very crude manner the elongation of a twenty-foot iron bar exposed to the noonday sun, and found its expansion to be the $\frac{1}{2500}$ part of its length.¹ In the case of solid bodies it was most natural to determine the linear dilatation, whereas with liquids and gases the voluminal dilatation was that most easily ascertained,—this being equal for slight expansions to three times the linear.

A comparison of the voluminal expansion, which alone has meaning when applied to *all* bodies, exhibits wide differences in the deportment of bodies. From the thermal state of melting ice to that of boiling water, air, and gases generally, expand roundly $\frac{1}{3}$ of their bulk, mercury $\frac{2}{100}$, lead not quite $\frac{1}{100}$, glass approximately $\frac{2}{1000}$. It is thus intelligible why first the dilatation of the air, then that of liquids, and lastly that of solids was exhaustively investigated.

The researches above summarised show distinctly the devious, laborious, and very gradual manner in which the fundamental facts of thermometry were reached. One inquirer discerns one important aspect, and another a single other. Things discovered are forgotten and must be rediscovered, in order to attain to permanent acquisitions. With the researches given, the period of preliminary tentative investigation ceases, and there succeeds a series of *critical* works, to which we shall next give our attention.

[TO BE CONTINUED.]

¹Lambert, *Pyrometrie*, Berlin, 1779, p. 121.

RICHARD WAGNER.

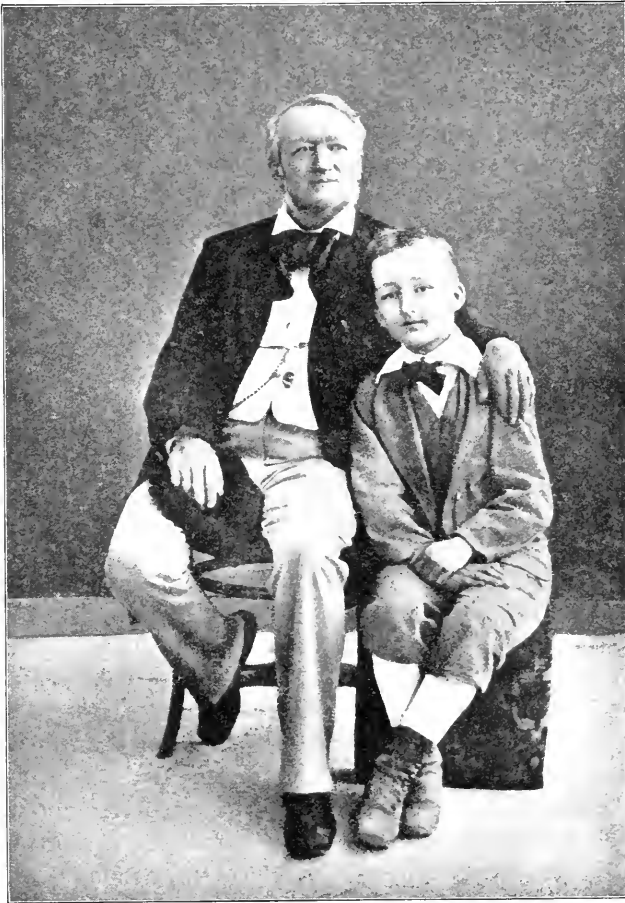
BY E. P. EVANS.

[CONCLUDED.]

WE spoke, at the conclusion of our former article, of Wagner's early cosmopolitanism and Gallomania, and of his conversion, on the appearance of the "Flying Dutchman," to an ardent and emotional patriotism.

In order to appreciate Wagner's subsequent course it must be remembered that this sudden fit of patriotic fervor had a purely personal origin and was only an individual application of the general maxim: *Ubi bene, ibi patria*. In Paris not one of the projects which he had so confidently entertained had been realised and he felt deeply humiliated and depressed as an artist and a man by the neglect and destitution he suffered during his sojourn in the French metropolis. In Dresden, on the contrary, the representation of his "Rienzi" had met with remarkable success, filling him with happy hopes and the inspiring thought that he had "now regained his Fatherland." It was with great joy, as he confesses, that he accepted at a small salary (1200 thalers) the position of musical director in the Royal Theatre of that city, since it opened to him the very field of activity he had so long desired. "On this occasion," he says, "I had within me the firm consciousness of the ability and power to accomplish whatever I might earnestly wish." But this strong conviction was of short endurance. The failure of the public to understand "The Flying Dutchman" and the sharp and somewhat invidious criticism to which he was subjected in the local press both as a conductor and a composer, and which he has satirised in "The Master-Singers of Nuremberg," thoroughly undeceived him and showed his vision to have been a mere *Fata Morgana*, in which he had seen everything magnified and inverted at a distance through the refracting medium of an excited and exalted imagination. Once when Jean Paul Richter and Goethe were to-

gether and fell into conversation concerning the scandalous gossip that was being circulated to their injury, the former remarked that he should pay no attention to it or at least should wait until he was accused of stealing silver spoons; whereupon Goethe replied that he should give no heed to it even then. Wagner refers to



RICHARD WAGNER AND SIGFRIED WAGNER.

From a photograph, 1880; in the possession of Frau C. Wagner.

this incident in a letter to a friend and adds, "Although I would not compare myself to Goethe, I am determined to act as he did;" but unfortunately his temper got the better of his judgment and overbore his resolution, and he began a conflict with those who

refused to recognise his claims, that was waged at first with extreme virulence and really ceased only with his life; but before he fell, victory had perched upon the standard he had raised and defended, and every year since his death has consolidated and extended his triumphs.

"In the midst of this bitterness against the existing condition of things," writes Wagner in an autobiographical sketch, "I found myself moved by the revolutionary spirit which was growing stronger and stronger all around me and which now enlisted my zealous sympathy." He believed that the degradation of art was due to the general and inveterate debasement of the social and political institutions of the time, and that the reformation which he had been vainly endeavoring to accomplish could be effected only by a radical change in the constitution of society and the state. The attempt made by Mr. William Ashton Ellis in his so-



WAGNER'S DOG *Marke*.

called "Vindication" to show that Wagner did not participate in the Saxon uprising of 1849, but that it was a journeyman baker of the same name who shouldered his musket and shouted sedition on the barricades is as foolish as it is futile. It is one of the penalties of his success and celebrity that the eminent composer now numbers among his adherents many persons of aristocratic tastes and severely conservative tendencies, who hold religiously to the doctrine of the divine rights of kings and regard all rebellion against the authority of the Lord's anointed as extremely wicked and, what is still worse, exceedingly vulgar. Wagner's biographers have uniformly passed over this characteristic and most instructive episode of his life in significant silence or with only the very slightest allusions to it. Glasenapp treats it as a mistake, not on the part of Wagner, but on the part of the Saxon government, whose issue of warrants for the capture of the fugitive was wholly un-

warrantable. Tappert has even the face to declare that "Wagner was never a revolutionist"; and, while admitting that he welcomed the movement because he hoped it would produce changes favorable to German art, adds: "Nowhere do I find any proofs of his participation in the insurrection, and all assertions of this kind bear the stamp of falsity." If Tappert had examined the records of the criminal court of Dresden instead of confining his investigations to the archives of the Royal Theatre, he would have found conclusive evidence of the truth of the statements which he so positively denies. There he would have discovered among other official documents bearing on the question the "Acts against the ex-musical conductor Richard Wagner, of this place, on account of participation in the insurrection of May 1849."¹ Doubtless some things done by other Wagners were naturally enough ascribed to the most famous man of this name. Thus Count Von Beust in

S t e c k b r i e f.

Der unten etwas näher bezeichnete Königl. Kapellmeister
Richard Wagner von hier

ist wegen wesentlicher Theilnahme an der in hiesiger Stadt stattgefundenen aufrührerischen Bewegung zur Untersuchung zu ziehen, zur Zeit aber nicht zu erlangen gewesen. Es werden daher alle Polizeibehörden auf denselben aufmerksam gemacht und ersucht, Wagnern im Betretungsfalle zu verhaften und davon uns schleunigst Nachricht zu ertheilen.

Dresden, den 16. Mai 1849.

Die Stadt-Polizei-Deputation.
von Dypell.

Wagner ist 37 bis 38 Jahre alt, mittler Statur, hat braunes Haar und trägt eine Brille.

REDUCED FACSIMILE OF THE WARRANT OF ARREST ISSUED AGAINST WAGNER AND
PUBLISHED IN THE *Dresdener Journal*. From Dresden Municipal Library.

his reminiscences entitled "Aus drei Viertel-Jahrhunderten" accuses Wagner of having set fire to the "Prince's Palace" and states that there is among the acts of accusation in the possession of the government a letter written by Wagner himself, in which he boasts of the deed. "Whether he sang: '*Frisch, Feuerflamme, fröhlich und furchtbar,*' as an accompaniment to this performance, I am unable to say." Von Beust's mistake arose from the fact that there was among the revolutionists a low and disreputable fellow named Woldemar Wagner, a confectioner, who by order of Bakunin did attempt to burn the palace and sent to the provisional government a written report on the subject signed "Wagner." As the confectioner was an utterly obscure person, the discovery of this paper would inevitably implicate the distinguished composer.

¹ Akta wider den vormaligen Kapellmeister Richard Wagner, hier, wegen Bethheiligung am hiesigen Mai-Aufstande im Jahre 1849.

It was unquestionably this brutal and blood-thirsty maker of com-fits who shot Lieutenant von Krug in front of the arsenal on the third of May, and who had to answer also to the charge of pillaging private dwellings.

According to a popular belief once widely spread and still lurking as a tradition in the minds of some credulous people, the destruction of the old Dresden opera house by fire on the sixth of May, 1849, was due to a conspiracy on the part of Richard Wagner and the eminent architect, Gottfried Semper. The origin of this story deserves mention as a striking illustration of the rise and growth of such quasi-historical fables. It was in the earliest stages of the revolutionary movement that Wagner one day met Semper on the street and referring to the projected representation of "Lohengrin," complained of the stage as not deep enough for an effective arrangement of the scenic decorations. The conversation was about the new opera house built by Semper, who somewhat irritated by this stricture on an edifice of which he was justly proud, replied sarcastically: "Yes, indeed, I should like to burn down the old booth at once." This remark uttered half testily and half jestingly was overheard by Wagner's envious colleague Reissiger and by the singer Chiarelli, who chanced to be in Meser's music store near the door of which the earnest colloquy took place. Rumors of this dreadful plot were whispered abroad, and when a short time afterwards the old opera house was actually devoured by flames, there could be no difficulty in determining who were the incendiaries.

There was also a third Wagner, a member of the municipal council of Schneeberg and delegate to the Saxon Diet, who took part in the insurrection and was finally forced to flee from Germany; and it is possible that public opinion may have held the already celebrated musician to some extent responsible for the words and actions of this comparatively unknown politician, which, however, appear to have been of an inconspicuous and rather harmless character.

But after making all due allowance for misapprehensions arising from the existence of these inconvenient and in part discreditable doubles, it is impossible for even the most subtle and sophisticated apologist to explain away stubborn facts and to reduce Wagner's rôle as a revolutionist to a mere "Comedy of errors." The long speech which he delivered in the *Vaterlandsverein*, June 14, 1848, and his contributions to the extremely radical sheet, Röckel's *Volksblätter*, which he has not seen fit to include in the

collected edition of his works, but which Dinger has printed in full, prove conclusively his ardent zeal for the cause and show clearly his conception of the aims and purposes of the revolutionary movement. "First of all," he says in his fiery and somewhat fantastic speech, "we must extinguish the last flicker of aristocracy." True, he adds, our nobles are no longer feudal lords, privileged to oppress and flay us according to their good pleasure; but in order to remove every cause of offence, they ought now to renounce all lingerings of class distinction and to lay aside betimes that robe of rank which on a hot day may easily become a shirt of Nessus and burn them to the bones. If ancestral pride and piety keep them from this renunciation of hereditary prerogatives, let them remember that the people too have forefathers, whose deeds are not recorded in family archives, but whose sufferings under all sorts of servitude are written with bloody ink in the history of the past thousand years. The abolition of the nobility would logically involve the abolition of the court with all its superfluous and expensive pomp and pageantry. Royalty was to be retained, the function of the sovereign being merely that of the chief public servant and first citizen of the state; while a disciplined militia, in the place of a standing army, provided for the national defense. It was also a part of his programme to eliminate the aristocratic element from the legislative body, which was to consist of a single homogeneous assembly of the representatives of the people elected by universal suffrage. There was to be no recognition of different estates of the realm and consequently no division of the parliament into an upper and a lower house.

Wagner's political ideal was a democratic and socialistic state, the head of which was to be an hereditary executive to be called king or president as the people might determine. On this point he was by no means strenuous, his own preference for a monarchy being due in a great measure to his personal love and esteem for Frederic Augustus, the king of Saxony. All talk of his deep ingratitude to this monarch is the sheerest nonsense. The one point, however, upon which he most earnestly insisted, was socialistic reform and the improvement of the condition of the working classes. In his eyes the worst of all tyrannies is a plutocracy, the tyranny of capital, the subjection of man to the soulless and heartless domination of "the pale metal." He wished to do away with an order of things which makes millions the slaves of a few, and these few the slaves of their own wealth, which causes labor to be a burden and enjoyment to be a vice, and renders one man wretched



FAFNER.

From the "Nibelung-Ring" (After a painting by Hermann Hendrich.)

through want and another wretched through superfluity. The curse attached to the treasure of the Nibelungen and the calamities it entailed upon its possessors even to the destruction of the gods symbolised to him the misery wrought among men by the inordinate greed of gold. The money power he declares to be the source of all discord and violence on earth, as the ring forged from the hoard of the Rhine was fatal to the peace and happiness of Valhalla and introduced hatred and contention into the abode of the immortals. In his speech he protests against any misinterpretation of his views: "Be not so foolish or malicious as to regard the necessary redemption of the human race from the coarsest and most demoralising servitude to filthy lucre as identical with the endeavor to carry out the silliest and absurdest of doctrines, namely that of communism." At the same time he prophecies that unless a serious effort shall be made to apply the principles of socialism, in the proper sense of the term, for the rectification of centuries of wrong, derided and despairing human nature will rise up in fierce conflict and with the wild battle-cry of communism succeed perhaps in overthrowing and obliterating all the highest achievements of civilisation for the last two thousand years. "This is not a threat," he adds, "but a warning."

The leading spirit of the Dresden insurrection was the Russian anarchist and nihilist, Michael Bakunin, who won Wagner's heart by declaring that in the coming cataclysm all existing institutions would be swept away and "everything perish except the Ninth Symphony." There is no reason to suppose that Bakunin felt any peculiar tenderness for this creation of Beethoven's genius or believed that it was endowed with imperishable qualities above many other musical masterpieces; but he had a keen eye for the crotchets and enthusiasms of those whom he wished to captivate, was quick to detect each individual's hobby-horse and had a charming way of praising it and gently patting it on the shoulder. He was without doubt a very strong and extremely fascinating character and possessed a rare gift of eloquence and almost irresistible powers of persuasion. Wagner was completely under his influence and firmly convinced that the realisation of his ideas would result not only in a most desirable political reconstruction of Europe, but also in the moral and social regeneration of mankind, which would of course bring with it as an inevitable sequence a marvellous revival and consummate evolution of art. It was to the coming of this golden age of superior enlightenment and culture that he looked forward with intense eagerness, regarding all other ac-

quisitions as mere means to this supreme end. In his subsequent utterances Bakunin spoke rather depreciatingly of Wagner, whom he regarded as a visionary. Nevertheless, as he admits, they often discussed political questions together and their intercourse remained cordial and intimate to the very last. Wagner was a regular attendant at the secret meetings held at Bakunin's rooms in the *Menageriegarten*, at which all the revolutionary plans were laid and arrangements made for the preparation of hand grenades, shrapnel shells, and other deadly explosives for insurrectionary uses. He also took an uncommonly lively interest in procuring these materials, which were stored on Bakunin's premises. Indeed, as we are informed by Röckel, at least one conference on this subject was held in Wagner's garden. After the movement had failed and Wagner was asked by his brother-in-law Wolfram at Chemnitz whether he had taken an active part in it, he replied: "No, only as a curious spectator!" A curious, in the sense of a queer sort of spectator, he certainly was.

Frau Minna Wagner recognised the great ability and energy of Bakunin, but feared him as the evil genius of her husband, whom she endeavored to keep out of the sphere of his influence, and, in fact, so far as possible out of the vortex of the revolution, predicting that it would end in public disaster and personal distress to themselves. It is difficult to determine to what extent Wagner was engaged in actual combat on the streets and behind the barricades. It is probable, however, that his valorous deeds of this kind were quite insignificant, and he once expressed to his wife his regret that he could not carry a gun,—a remark which, unless intended merely to deceive and pacify her, would imply that he did not bear arms during those stormy days of May. Perhaps he wished that she, too, should infer that he had nothing to do with the affair except as "a curious spectator." We have pretty conclusive evidence that the principal post of honor occupied by him at that turbulent time was a very high one, namely, the top of the tower of the Kreuzkirche, where he watched the progress of events and noted down his observations on slips of paper, which he wrapped in stones and threw to the soldiers below, who forwarded them to the head-quarters of the insurgents. From this lofty and responsible station he dispatched, on the morning of May 7, a messenger to his wife for a box of snuff and two bottles of wine. Somewhat distrustful she inquired whether her husband were alone, and on learning that Bakunin and a few other ultraists were with him, sent instead of the snuff and wine a brief and per-

empty note bidding him return home at once, or she would leave the house. He obeyed and did not get out again until the next day, Frau Minna having promptly locked the doors and purposely mislaid the keys. The uniformly sound judgment of this lady in all practical matters and the prudence and decision shown by her in effecting her husband's escape shortly after this quasi-comical incident indicate a person of unusual discernment and force of character, and not the mere goody portrayed by Wagner's ardent apologists. It was chiefly due to her timely and efficient intervention that Wagner was permitted to work out his musical theories and complete his musical dramas in his quiet retreat on Lake Zurich instead of spending the most fruitful years of his life gloomily meditating on the past in the penitentiary at Waldheim or in the fortress of Königstein.

In no other country is the individual course of life so completely and consciously governed and directed by strictly philosophical principles as in Germany. The key to every man's actions is his *Weltanschauung* or the peculiar color and curvature of the spherical lenses through which he contemplates the world. Conduct that cannot be brought into some definite correlation to the cosmic system is condemned as random and erratic; but no eccentricity is so extreme as not to be entitled to consideration and to command respect, provided it can answer the question: *Dic cur hic* by appealing to the nature of things and proving that it has reached its standpoint in obedience to the general laws and in harmony with the essential constitution of the universe.

While Hegel was still living his disciples were divided into three distinct sections, representing respectively supernaturalism, rationalism, and a sort of rationalistic mysticism, which claimed to have affinities with both the opposites and sought to mediate between them. If political terms may be used to express philosophical distinctions, these parties may be called the right, the left, and the centre of Hegelianism. The most radical and aggressive of these factions was known as the *Junghegelianer* or Neo-Hegelians, of whom Ludwig Feuerbach, Arnold Ruge, Daumer, and Echtermeyer were perhaps the most eminent and influential. Wagner belonged to this extreme left wing; and, indeed, the whole revolutionary movement of 1848 had its origin in Neo-Hegelianism and derived its inspiration and theoretical justification from this source. Notwithstanding the paternal care taken by the Emperor Nicholas to preserve his dear children from spiritual contamination through contact with the culture of Western Europe, the writings of this

advanced school were smuggled into Russia by Pavlov and Stan-kovitch, and Moscow soon became a seat of contagion for the entire empire. It was in this sacred city of the Muscovites that Granovski, Belinski, and Bakunin became first infected with this philosophy, from which they deduced the necessity of an European revolution and a Panslavonic confederation as the next stage in the evolution of human civilisation.

In his *Phenomenology of Mind* Hegel remarks that our age is clearly an age of transition to a new period; and this passage was evidently in Feuerbach's mind when he wrote, "our present time is the key-stone of a great epoch in the history of mankind, and therefore the starting-point of a new life." The postulation of a dawning era of radical reform and universal transformation was common to the whole school of Neo-Hegelians, who were eagerly looking forward to it and earnestly laboring to realise it each in his own sphere. Like speculators on the stock-exchange they all dealt in "futures." Friedrich Feuerbach and Daumer were interested in the religion of the future, Ludwig Feuerbach in the philosophy and ethics of the future, Ruge and Echtermeyer in the science of the future, Bakunin, Proudhon, and Röckel in the political, social, and industrial organisation of the future, while Wagner devoted all his powers to the development of the music of the future. During the latter half of the nineteenth century rapid progress has been made towards the realisation of these ideals at least in modified forms, except in cases where the advance of intelligence has set them aside as hopelessly Utopian; religion, philosophy, ethics, and science have passed through wonderful stages of evolution; the problem of the political and social constitution of the future is still a burning question constantly threatening to become incendiary; only in the province of art, which Wagner made it his mission to cultivate, has faith been turned into vision, and the goal of his aspirations actually attained both in the creation of the musical drama according to his conception of it and, what was perhaps still more difficult, in the growth of a national and international public capable of comprehending and appreciating it. It was for an ideal society of the future that he composed his works, which were to be rendered by dramatic singers existing as yet only in his mind's eye; and it is doubtful whether he ever expected to live to see them properly represented before sympathetic and enthusiastic audiences.

According to Dinger's tabulation of Wagner's views as a Neo-Hegelian, his philosophy was evolutionary materialism and sensual-

ism, his religion atheism, his ethics optimism and eudemonism, and his politics anarchism: a summary of isms sufficient to chill the marrow and curdle the blood of many a devout Wagnerite of to-day. The works, which derived their inspiration and took a more or less distinct tinge from these tenets, are the projected musical dramas, to which the text was written, but the music never composed: "Siegfried's Death" (afterwards embodied in the third part of the tetralogy), "Wieland the Smith," "Jesus of Nazareth," and the subsequently completed "Ring of the Nibelungen," although in this last-mentioned tragedy of the gods he has thrown a veil of symbolism over his ideas and presented them in a more artistic and therefore less aggressive form. His strong and cheerful optimism as to the glorious prospects of mankind here prevented him from looking beyond and seeking consolation in the magnified looming of human hopes on the bright sky of the hereafter. The expression of this feeling comes out very forcibly in his essays and especially in his personal correspondence. "The future generation," he writes, "will have no longer any need of God and immortality, since this life will satisfy all our hopes, so that we shall not have to direct our thoughts beyond the earth to an imaginary heaven." He characterises all such "religious presumptions" as "anthropomorphistic speculations, which are injurious and immoral, because they place the final purpose of man outside of himself," whereas he is only the supreme and crowning product of cosmic evolution and can "serve no other purposes than those of nature, which has produced him conformable to certain conditions of necessity." His spiritual superiority does not exempt him from the operation of the laws of development and dissolution which govern all other organisms.

In a volume entitled *The Destiny of Man* Mr. John Fiske endeavors to show the unreasonableness of supposing that "Man as the goal of Nature's creative work" should be only one of the many perishable forms of matter and destined to disappear with the rest, and asks: "Has all this work been done for nothing? Is it all ephemeral, all a bubble that bursts, a vision that fades?" To these indignant interrogatories Wagner would have replied: "No, indeed; man's immortality and eternal beatitude consists in the persistence and perfection of the spiritual element, not in the individual, but in the race; and there is no reason why the contemplation of this slow but unceasing process of evolution and its glorious consummation in the highest possible elevation of humanity, even though it be completed with the present life upon the

earth, should put any logical thinker to intellectual confusion." It is interesting to note how easily, in regions of speculation lying out of the range of scientific demonstration, diametrically opposite conclusions may be deduced from precisely the same premises. Liszt was greatly exercised at his friend's utter lack of faith and in his letters seeks to show him the error of his ways, quoting with a slight and suitable variation the exhortation in Elsa's song:

"Lass zu dem Glauben Dich neu bekehren:
Es giebt ein Glück,"

and beseeching him not to turn away contemptuously from this "only true and eternal bliss."

Wagner, however, was too much of a eudemonist, too thoroughly given up to the gratification of what he called his *Glückseligkeitstrieb*, to be greatly influenced by such admonitions. Ethically his philosophy of life might be summed up in Pope's exclamation.

"O happiness, our being's end and aim."

His bitter hostility to Christianity arose chiefly from its ascetic teachings, which put a barrier between man and the full exercise and enjoyment of the powers and passions with which nature has so lavishly endowed him and which are essential to his welfare and conservation. In "Jesus of Nazareth" he infers from the statement that "God is love," that love is supreme and absolute and knows no limitations. Indeed, the whole didactic purpose of the drama is to glorify love as the primal and universal law of the race in opposition to the restrictions imposed upon its manifestations by human enactments. In the crucible of this consuming and refining passion individual egotism is transformed into the altruism of domestic and social relations, thus fulfilling in the province of the emotions the alchemist's dream of transmuting base metals into gold. It endues Siegfried's sword with a magic power that shatters Wotan's spear, "the shaft of sovereignty" and symbol of conventional moral order, and urges the youthful hero onward through a sea of fire to the rescue and redemption of Brünnhilde.

Highly significant, too, is Wagner's enthusiasm for Hâfiz and Shelley. The former he declares to be not only "the most gifted poet," but also "the greatest and sublimest philosopher that ever lived." What attracted him so strongly to the Dîvân (known to him only in Daumer's fragmentary and rather imperfect translation) was the glowing sensuality that pervades all the ghazals, the warm erotic hues that color even the religious poems, and the unceasing denunciation of priestcraft and pietism. The motto of

Hâfiz: "Strive always after ready bliss," and his expressed preference of the tulip-cheeked beauties of Shîrâz to the promised houris of Paradise would commend themselves to Wagner as the quintessence of wisdom. As for Shelley, his admiration and also his knowledge of the English poet appear to have been confined to "Queen Mab," which charmed him by reason of its radically revolutionary spirit and atheistic tendencies.

About the year 1854 Wagner's *Weltanschauung* or mental attitude towards the universe underwent a rapid and fundamental change under the influence of Schopenhauer. It is reported of Professor Huxley that he once defined his philosophical position as that of "a materialist before dinner and an idealist afterward." Quite as sudden and extreme as this hypothetical transformation and originating in equally extraneous and accidental causes was Wagner's transition from the Neo-Hegelianism of Ludwig Feuerbach to the Post-Kantianism of Schopenhauer. So long as he was absorbed in setting forth his theories in literary essays and embodying them in musical compositions, he felt perfectly happy in dreams of future triumphs; but when he presented

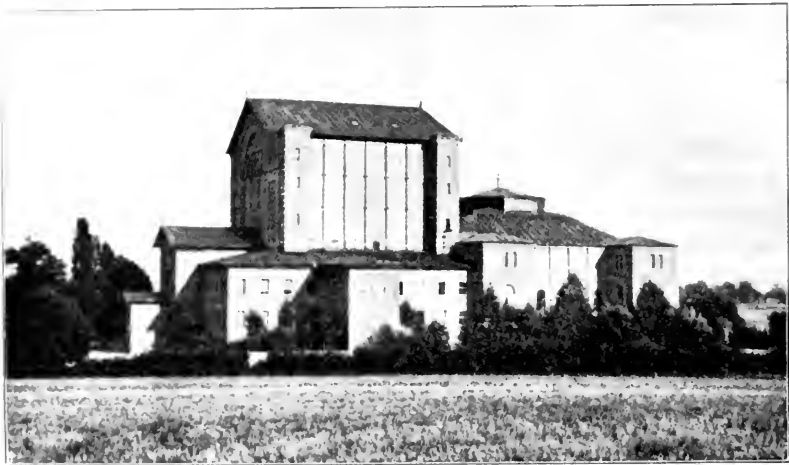
these achievements to the world and saw them treated with coldness by the public and contempt by the critics, he began to despair. As the beautiful vision vanished, his serene optimism was superseded by a sullen pessimism; in this despondent state of mind he heard the censorious voice of the misanthropic sage of Frankfort exclaiming: "Vain man, do you think your fate is exceptional? Solitude and disparagement are the penalties of genius; suffering is the universal lot of man; pessimism is not a transient mood, but



RICHARD WAGNER AT THE REHEARSAL.

Sketch by Adolph Menzel.

a deep-seated principle, rooted and grounded in the very nature of things, and the only true philosophy of life." Wagner listened to this voice, which seemed to come from heaven, and received its glad tidings with unspeakable joy. "This man," he writes in a letter to Liszt, "was to me in my loneliness a gift from on high. He is the greatest philosopher since Kant, whose ideas he has thought out to their logical conclusion. German professors have prudently ignored him for the last forty years, but recently, to the disgrace of Germany, he was discovered by an English critic. What charlatans all the Hegels are in comparison with him!" The world is all vanity and vexation, despicable and delusive, "bad, bad, thoroughly bad," and to renounce it is the highest



THE FESTIVAL PLAYHOUSE AT BAYREUTH.

Photograph by Anna Chamberlain.

wisdom. He even prizes Christian asceticism as an anodyne and "quietive of the will," and has ceased to regard religion either as priestly fraud and fanaticism or as a supernatural revelation, but recognises its necessity and validity as a natural product of the human mind. Its sublimest existing forms are "Brahmanism with its offshoot, Buddhism and Christianity," in which the doctrine is taught that the way to life is through the negation of the will, whereas the Hebrew and Hellenic religions inculcate the affirmation of the will as the only road to happiness. For this reason he thinks Christianity has been perverted and discredited by being interpreted as a continuation and completion of Judaism,

since the two systems are wholly antagonistic in spirit. "Every attempt to unite these opposing elements has been fatal to Christianity and demoralising to society. What has the imperious and irascible tribal god, Jehovah, in common with the all-loving and all-suffering meek and lowly Jesus?" His ideal of humanity is no longer the Grecian Apollo, the type of physical strength and beauty, but the Oriental bikshu; and he expresses the highest veneration for Francis of Assisi. The fact, too, that the *Glückseligkeitstrieb* or instinctive seeking after happiness is never fully gratified here justly demands that there should be an hereafter.

Wagner's philosophy is now idealistic transcendentalism, and his politics what he calls "ideal conservatism" with strong leanings to aristocracy. The nobility, which in 1848 was the special object of his abhorrence, he esteems the most important factor and chief pillar of the state and of society, and thinks it ought to be firmly established and strengthened. He is heartily ashamed of his former rabid democracy and would gladly erase all records of it, declaring that he can explain his aberrations only on the assumption that he was then "in an utterly abnormal condition." Indeed, the violence of his intellectual revolt seems at first to have stunned him and to have paralysed for a time his creative powers. He informs Liszt that "out of love to the youthful Siegfried, the most beautiful dream of my life, I shall probably go on and finish the Nibelungen," but evidently his heart is not in it. He then adds: "I have in my head the project of a Tristan and Isolde, the simplest and yet the most full-blooded musical conception; with the black flag that waves at the end I will cover myself as with a shroud and die." The red flag, which a few years before he would fain follow to liberty or death, has now been lowered and permanently furled. Instead of the joyous and triumphant tones of Siegfried's horn we hear the melancholy and plaintive pipings of the shepherd's reed in the final scenes of Tristan and Isolde, both of whom, like genuine disciples of Schopenhauer, find their highest bliss in drowning their sorrows in the fathomless sea of oblivion:

"In des Welt-Athem's
wehendem All—
ertrinken—
versinken—
unbewusst—
höchste Lust!"

"Die Meistersinger von Nürnberg," written soon after Wagner's return from exile when the future again seemed bright to

him, is pervaded by a correspondingly cheerful spirit. It is a quasi-historical comedy with a distinctly polemical purpose, in which the Minnesinger Walther von Stolzing and the Mastersinger



TOWER OF THE MAGICIAN KLINGSOR

From "Parzifal" (After a painting by Ferdinand Knab.)

Sixtus Beckmesser are opposed to each other as types of creative genius and dead traditionalism in art. In a satire of this sort, bearing a decidedly *pro domo* stamp, small scope could be given to

the illustration of philosophical principles lying beyond the immediate object in view; even the painful duty of renunciation is mitigated in the person of Hans Sachs by the humor of the general situation. In "Parsifal," on the other hand, the influence of Schopenhauer is plainly perceptible in the conception and execution of the drama, and his ideas would have doubtless found still fuller embodiment and expression in "Nirvâna," had Wagner lived to complete this projected work.

THE MITHRAIC LITURGY, CLERGY, AND DEVOTEES.¹

BY PROFESSOR FRANZ CUMONT.

IN all the religions of classical antiquity there is one feature which, formerly very conspicuous and perhaps the most important of all for the faithful, has to-day almost totally disappeared from our view. It is the liturgy. The Mysteries of Mithra form no exception to this unfortunate rule. The sacred books which contain the prayers recited or chanted during the services, the ritual of the initiations, and the ceremonials of the feasts, have vanished and left scarce a trace behind. A verse borrowed from one unknown hymn is almost all that has come down to us from the collections which anciently were so abundant. The old Gâthas composed in honor of the Mazdean gods were translated into Greek during the Alexandrian epoch, and Greek remained for a long time the language of the Mithraic cult, even in the Occident. Barbaric words, incomprehensible to the profane, were interspersed throughout the sacred texts and augmented the veneration of the worshippers for the ancient formulary, as well as their confidence in its efficacy. Such were the epithets like *Nabarze*, "victorious," which has been applied to Mithra, or of the obscure invocations like *Nama*, *Nama Sebesio*, engraved on our bas-reliefs, which have never yet been interpreted. A scrupulous respect for the traditional practices of their sect characterised the Magi of Asia Minor, and continued to be cherished with unabated ardor among their Latin successors. On the downfall of paganism, the latter still took pride in worshipping the gods according to the ancient Persian rites which Zoroaster was said to have instituted. These rites sharply distinguished their religion from all the others that were practiced at the same time in Rome, and prevented its Persian origin from ever being forgotten.

¹ Extracted by the author from his *Textes et Monuments figurés relatifs aux Mystères de Mithra* (Brussels: H. Lamertin). Translated by T. J. McCormack.

If some piece of good fortune should one day unearth for us a Mithraic missal, we should be able to study there these ancient usages and to participate in imagination in the celebration of the services. Deprived as we are of this indispensable guide, we are excluded utterly from the sanctuary and know the esoteric discipline of the Mysteries only from a few indiscretions. A text of St. Jerome, confirmed by a series of inscriptions, informs us that there were seven degrees of initiation and that the mystic (*μύστης*, *sacratus*) successively assumed the names of Raven (*corax*), Occult (*cryphius*), Soldier (*miles*), Lion (*leo*), Persian (*Perses*), Courier of the Sun (*heliodromus*), and Father (*pater*). These strange appellations were not empty epithets with no practical bearing. On certain occasions the celebrants donned garbs suited to the title that had been accorded them. On the bas-reliefs we see them carrying the counterfeit heads of animals, of soldiers, and of Persians (see Fig. 2, p. 675). "Some flap their wings like birds, imitating the cry of crows; others growl like lions," says a Christian writer of the fourth century;¹ "in such manner are they who are called wise shamefully travestied."

These sacred masks, of which the ecclesiastical writer exhibits the ridiculous side, were interpreted by pagan theologians as an allusion to the signs of the zodiac, and even to the doctrine of metempsychosis. Such divergences of interpretation simply prove that the real meaning of these animal disguises was no longer understood. They are in reality a survival of primitive practices which have left their traces in numerous cults. We find the titles of Bear, Ox, Colt, and other similar names borne by the initiates of the different Mysteries in Greece and Asia Minor. They go back to that prehistoric period where the divinities themselves were represented under the forms of animals; and when the worshipper, in taking the name and semblance of his god, believed that he identified himself with him. The lion-headed Kronos having become the incarnation of time, was substituted for the lions which the fore-runners of the Mithraists worshipped; and similarly the cloth and paper masks with which the Roman mystics covered their faces were substitutes for the animal skins with which their barbarous predecessors originally clothed themselves, be it that they believed they thus entered into communion with the monstrous idols which they worshipped, or that, enveloped in the pelts of their flayed victims, they attributed a purifying virtue to their bloody tunics.

To the primitive titles of Raven and Lion others were after-

¹Ps. Augustine, *Quaest. vet. et novi Test.*, (T. et M., t. II, p. 8).

wards added for the purpose of attaining the sacred number seven. The seven degrees of initiation through which the mystic was forced to pass in order to acquire perfect wisdom and purity, answered to the seven planetary spheres which the soul was forced to traverse



Fig. 1. MITHRAIC KRONOS, OR PERSONIFICATION OF INFINITE TIME.

Here represented without the head of a lion, which appears on the breast of the figure. This is a Roman beautification of the horrific features of the Oriental God. (Bas-Relief of Modena.)

in order to reach the abode of the blessed.¹ After having been Raven, the initiates were promoted to the rank of Occult (*κρύφιος*).

¹ See p. 608 of *The Open Court* for October, 1902.

The members of this class, hidden by some veil, probably remained invisible to the rest of the congregation. To exhibit them (*ostendere*) constituted a solemn act. The soldier (*miles*) formed part of the sacred militia of the invincible god and waged war under his directions on the powers of evil. The dignity of Persian recalled the first origin of the Mazdean religion, and he who obtained it assumed during the sacred ceremonies the Oriental custom of donning the Phrygian cap, which had also been bestowed on Mithra. The latter having been identified with the Sun, his servitors invested themselves with the name of Couriers of the Sun (*Ἡλιοδρόμοι*); lastly, the "Fathers" were borrowed from the Greek Thiasi, where this honorific appellation frequently designated the directors of the community.

In this septuple division of the deities, certain additional distinctions were established. We may conclude from a passage in Porphyry that the taking of the first three degrees did not authorise participation in the Mysteries. These initiates, comparable to the Christian catechumens, were the servants (*ὑπηρετοῦντες*). It was sufficient to enter this order to be admitted to the degree of Ravens, doubtless so called because mythology made the raven the servitor of the Sun. Only the mystics that had received the Leontics became Participants (*μετέχοντες*), and it is for this reason that the grade of *Leo* is mentioned more frequently in the inscriptions than any other. Finally, at the summit of the hierarchy were placed the Fathers, who appear to have presided over the sacred ceremonies (*pater sacrorum*) and to have commanded the other classes of the faithful. The head of the Fathers themselves bore the name of *Pater Patrum*, sometimes transformed into that of *Pater patratus*, for the purpose of introducing an official sacerdotal title into a naturalised Roman sect. These grand-masters of the adepts retained until their death the general direction of the cult. The reverence and affection which were entertained for these venerable dignitaries are indicated by their name of Father, and the mystics placed under their authority were called brethren among one another, because the fellow-initiates (*consacranei*) were expected to cherish mutual affection.¹

Admission (*acceptio*) to the lower orders could be accorded even to children. We do not know whether the initiates were obliged to remain in any one of the grades for a fixed length of time. The Fathers probably decided when the novice was suffi-

¹ See the next *Open Court*.

ciently prepared to receive the higher initiation, which they conferred in person (*tradere*).

This ceremony of initiation appears to have borne the name of sacrament (*sacramentum*), doubtless because of the oath which the neophyte took and which was compared to that made by the conscripts enrolled in the army. The candidate engaged above all things not to divulge the doctrines and the rites revealed to him, but other and more special vows were exacted of him. Thus, the mystic that aspired to the title of *Miles* was presented with a crown on a sword. He thrust it back with his hand and caused it to fall on his shoulder, saying that Mithra was his only crown. Thereafter, he never wore one, neither at banquets nor when it was awarded to him as a military honor, replying to the person who conferred it: "It belongs to my god," that is to say, to the invincible god.

We are as poorly acquainted with the liturgy of the seven Mithraic sacraments as we are with the dogmatic instructions that accompanied them. We know, however, that conformably to the ancient Iranian rites, repeated ablutions were prescribed to neophytes as a kind of baptism designed to wash away their guilty stains. As with a certain class of Gnostics, this lustration doubtless had different effects at each stage of initiation, and it might consist according to circumstances either in a simple sprinkling of holy water, or in an actual immersion as in the cult of Isis.

Tertullian also compared the confirmation of his co-religionists to the ceremony in which they "signed" the forehead of the soldier. It appears, however, that the sign or seal impressed was not, as in the Christian liturgy, an unction, but a mark burned with a red-hot iron like that applied in the army to recruits before being admitted to the oath. This indelible imprint perpetuated the memory of the solemn engagement by which the person under vow contracted to serve in that order of chivalry which Mithraism constituted. On reception among the Lions, there were new purifications. But this animal being the emblem of the principle of fire, the use of water, the element hostile to fire, was renounced; and, in order to preserve the initiate from the blemish of sin, honey was poured on his hands and applied to his tongue, as was the custom with new-born children. It was honey also that was presented to the Persian because of its preservative virtue, as Porphyry tells us;¹ in fact, marvellous properties appear to have been associated with this substance, which was believed to have been pro-

¹ Porph., *De antro Nymph.*, c. 15 (*T. et M.*, t. II., p. 40).

duced under the influence of the moon. According to the ancient ideas, it was the food of the blessed, and its absorption by the neophyte made him a peer of the gods.¹

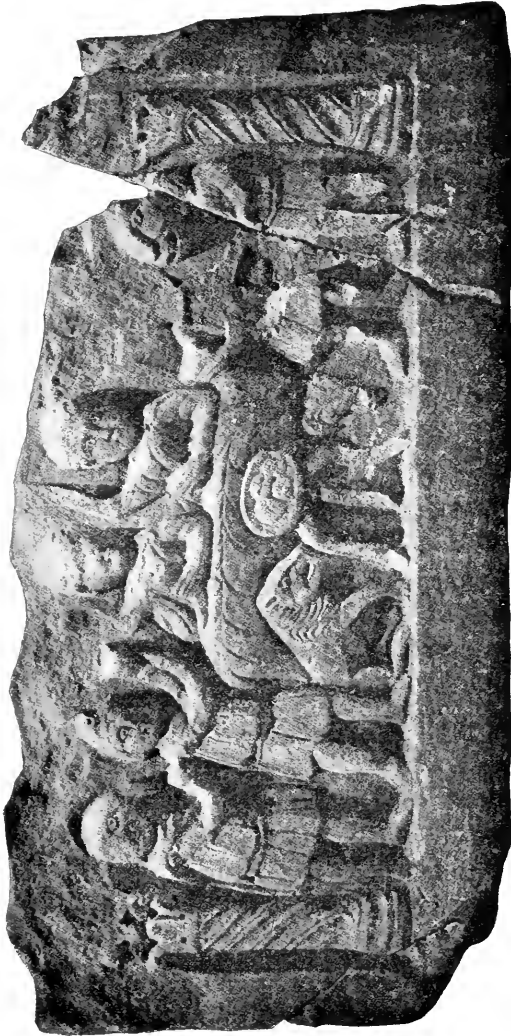


Fig. 2. MITHRAIC COMMUNION.

At the left the Raven and the Persian ; at the right, the Soldier and the Lion.
(Fragment of a bas-relief recently discovered in Konjiga, Bosnia.)

In the Mazdean service, the celebrant consecrated the bread and the water which he mingled with the intoxicating juice of the Haoma prepared by him, and he consumed these foods during the performance of his sacrifice. These ancient usages were preserved

¹ The liturgic use of honey has recently been elucidated by Usener, "Milch und Honig" (*Hermes*, LVII), 1902, p. 177 ff.

in the Mithraic initiations, save that for the Haoma, a plant unknown in the Occident, was substituted the juice of the vine. A loaf of bread and a goblet of water were placed before the mystic, over which the priest pronounced the sacred formula. This oblation of bread and water, with which undoubtedly wine was afterwards mixed, is compared by the apologists to the Christian sacrament of the Lord's Supper. Like the latter, it was not granted until after a long novitiate. It is probable that only those initiates who had attained the degree of Lions were admitted to it, and that this is the reason that the name of "Participants" was given to them. A curious bas-relief recently published shows us the spectacle of this sacred repast (Fig. 2). Before two persons stretched upon a couch covered with pillows is placed a tripod bearing four tiny loaves of bread, each marked with a cross. Around them are grouped the initiates of the different orders, and one of them, the Persian, presents to the two a drinking-horn; whilst a second vessel is held in the hands of one of the participants. These love feasts are evidently the ritual commemoration of the banquet which Mithra celebrated with the Sun before his ascension.¹ From this mystical banquet, and especially from the imbibing of the sacred wine, supernatural effects were expected. The intoxicating liquor gave not only vigor of body and material prosperity, but wisdom of mind; it communicated to the neophyte the power to combat the malignant spirits, and what is more, conferred upon him as upon his god, a glorious immortality.

The sacramental collation was accompanied, or rather preceded, by other rites of a different character. These were genuine trials imposed upon the candidate. To receive the sacred ablutions and the consecrated food, the participant was obliged to prepare for them by prolonged abstinence and numerous austerities; he played the rôle of sufferer in certain dramatic expiations of strange character and of which we know neither the number nor the succession. If we can believe a Christian writer of the fourth century,² the eyes of the neophyte were bandaged, his hands were bound with the entrails of chickens, and he was compelled to leap over a ditch filled with water; finally, a liberator approached with a sword and sundered his loathsome bonds. Sometimes, the terrified mystic took part, if not as an actor, at least as a spectator, in a simulated murder, which in its origin was undoubtedly real. In late periods, the officiants were contented with producing a sword dipped in the blood of a man who had met a violent death. The

¹ See *The Open Court* for October, 1902, p. 606.

² See above, p. 671.

cruelty of these ceremonies, which among the warlike tribes of the Taurus must have been downright savage orgies, was softened by contact with Western civilisation. In any event, they had become more fear-inspiring than fearful, and it was the moral courage of the initiate that was tried rather than his physical endurance. The idea which was sought to be attained was the stoic "apathy," the absence of every sensitive emotion. The atrocious tortures, the impossible emasculations, to which some too credulous or inventive authors have condemned the adepts of the Mysteries, must be relegated to the realm of fable, as must likewise the pretended human sacrifices which were said to have been perpetrated in the shades of the sacred crypts.

Nevertheless, it must not be supposed that Mithraism exhibited nothing more than the benignant phantasmagoria of a species

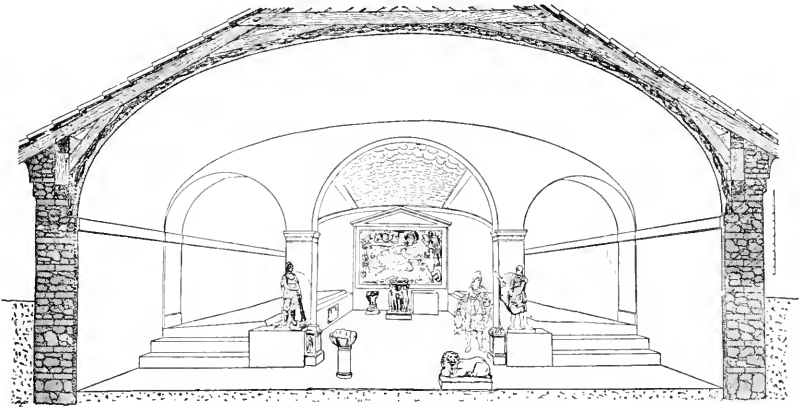


Fig. 3. MITHRÆUM OF CARNUNTUM, THE MODERN PETRONELL, NEAR VIENNA TO THE EAST.¹ (Restored by Mr. Tragau.)

of ancient free masonry. There had subsisted in its liturgic drama vestiges of its original barbarism, of the time when in the forests, in the depths of some dark cave, corybantes, enveloped in the skins of beasts, sprinkled the altars with their blood. In the Roman towns, the secluded caverns of the mountains were replaced by subterranean vaults (*spelæa*) of far less imposing aspect (Fig. 3). But even in these artificial grottos the scenes of initiation were

¹This Mithræum, like all others of the same style, is underground. Before the great bas-relief of Mithras slaying the bull are two altars, the one large and square in form, the other smaller and richly ornamented. The small statue on the left is Mithras being born from the rocks. At the entrance we see on the right the lion of Mithras and on the left a font for holy water. The two torch-bearers have their stand at the pillars which separate the aisles. The Mithræum is approached by a stairway and through a square hall (or pronaos), which is considerably larger than the sanctum itself.

calculated to produce on the neophyte a profound sensation. When, after having traversed the approaches of the temple, he descended the stairs of the crypt, he perceived before him in the brilliantly decorated and illuminated sanctuary the venerated image of the tauroctonous Mithra erected in the apse, then the monstrous statues of the leontocephalous Kronos, laden with attributes and mystic symbols, the meaning of which was still unknown to him. At the two sides, partly in the shadow, the assistants, kneeling on stone benches, were seen praying. Lamps ranged about the choir threw their bright rays on the images of the gods and the officiants, who, robed in strange costumes, received the new convert. Fitful flashes of light skilfully manipulated impressed his eyes and his mind. The sacred emotion with which he was seized lent to images which were really puerile a most formidable appearance; the vain allurements with which he was confronted appeared to him serious dangers over which his courage triumphed. The fermented beverage which he imbibed excited his senses and disturbed his reason to the utmost pitch; he murmured his efficient formulas, and they evoked before his distracted imagination divine apparitions. In his ecstasy, he believed himself transported beyond the limits of the world, and having issued from his trance he repeated, as did the mystic of Apuleius:¹ "I have transcended the boundaries of death, I have trodden the threshold of Proserpine, and having traversed all the elements I am returned to the earth. In the middle of the night I have seen the Sun scintillating with a pure light; I have approached the gods below and the gods above, and have worshipped them face to face."

The tradition of all this occult ceremonial was scrupulously observed by a priesthood instructed in the divine science and distinct from all classes of initiates. Its first founders were certainly the Oriental Magi, but we are almost entirely ignorant of the manner in which its ranks were later recruited and organised. Was it hereditary, named for life, or chosen for a fixed term? In the latter event, who had the right of choosing and what conditions did the candidates have to fulfil? None of these points is sufficiently elucidated. We can only state that the priest, who bore indifferently, as it seems, the title of *sacerdos* or that of *antistes*, was often, but not always, a member of the Fathers. We find one vicar, and sometimes several, in each temple. There is every ground for believing that a certain hierarchy existed in this "sacerdotal order."

¹ Apuleius, *Metam.*, XI, 23, à propos of the mystics of Isis.

Tertullian tells us that the chief pontiff (*summus pontifex*)¹ could marry but once; he doubtless designated by this Roman name the "Father of the Fathers," who appears to have exercised general jurisdiction over all the initiates residing in the city.² This is the only indication we possess regarding an organisation which was perhaps as solidly constituted as that of the Magi in the Sassanian kingdom, or that of the Manicheans of the Roman empire. The same apologist adds that the sectarians of the Persian god also had, like the Christians, their "virgins and their continents." The existence of this kind of Mithraic monachism appears to be all the more remarkable as the merit attached to celibacy is contrary to the spirit of Zoroastrianism.

The rôle of the clergy was certainly more extensive than in the ancient Greek and Roman religions. The priest was the intermediary between God and man. His functions evidently included the administration of the sacraments and the celebration of the services. The inscriptions tell us that in addition he presided at the formal dedications, or at least represented the faithful one on such an occasion along with the Fathers; but this was the least portion only of the duties he had to perform; the religious service which fell to his lot appears to have been very exacting. He doubtless was compelled to see that a perpetual fire burned upon the altars. Three times a day, at dawn, at noon, and at dusk, he addressed a prayer to the Sun, turning in the morning toward the East, at noon toward the South, at evening toward the West. The daily liturgy frequently embraced special sacrifices. The celebrant, garbed in sacerdotal robes resembling those of the Magi, sacrificed to the higher and lower gods divers victims, the blood of which was collected in a trench; or offered them libations, holding in his hands the bundle of sacred twigs which we know from the Avesta. Long psalmodies and chants accompanied with music, were interspersed among the ritual acts. A solemn moment in the service,—one very probably marked by the sounding of a bell,—was that in which the image of the tauroctonus Mithra, hitherto kept veiled, was uncovered before the eyes of the initiates. In some temples, the sculptured slab, like our tabernacles, revolved on a pivot, and alternately concealed and exposed the figures that adorned its two faces.

Every day in the week, the Planet to which it was sacred was

¹ Tertull., *De praescr. haeret.*, XL.

² Cf. *supra*, p. 130. I adopt here the suggestion of M. Wissowa, *Religion der Römer*, 1902, p. 309.

invoked in a fixed spot in the crypt; and Sunday, over which the Sun presided, was especially holy. Further, the liturgic calendar solemnised certain dates by festivals concerning which we are unfortunately very poorly informed. Possibly the sixteenth or middle day of the month continued (as in Persia) to have Mithra for its patron. On the other hand, there is never a word in the Occident concerning the celebration of the Mithrakana, which were so popular in Asia.¹ They were doubtless merged in the celebration of the 25th of December, for a very wide-spread custom required that the new birth of the Sun (*Natalis invicti*), which began to wax great again on the termination of the winter solstice, should be celebrated by sacred festivals. We have good reasons for believing that equinoxes were also days of rejoicing, the return of the deified seasons being inaugurated by some religious salutation. The initiations took place preferably at the beginning of spring, in March or in April, at the Paschal period, when Christians likewise admitted their catechumens to the rites of baptism. But concerning all these solemnities, as generally with everything connected with the heortology² of the Mysteries, our ignorance is almost absolute.

The Mithraic communities were not only brotherhoods united by spiritual bonds; they were also associations possessing juridic existence and enjoying the right of holding property. For the management of their affairs and the care of their temporal interests, they elected officers, who must not be confounded either with the initiates or the priests. The titles borne in the descriptions by the members of these boards of trustees prove to us that the organisation of the colleges of the worshippers of Mithra did not differ from that of the other religious *sodalicia*, which was based upon the constitutions of the municipalities or towns. These corporations published an official list of their members, an *album sacratorum*, in which the latter were ranked according to the importance of their office. They had at their head a council of decurions, a directing committee named most likely in a general assembly, a sort of miniature senate, of which the first ten (*decem primi*) possessed, as in the cities, special privileges. They had their masters (*magistri*) or presidents, elected annually, their curators (*curatores*), upon whom fell the task of managing the finances, their attorneys (*defensores*), charged with presenting their cause before the courts or public bureaux; and finally, their patrons (*patroni*), persons of consider-

¹ See *The Open Court*, for March, 1902, p. 171.

² The science of festivals. From ἑορτή, festival, holiday.—Tr.

ation, from whom they expected not only efficient protection but also pecuniary aid in replenishing their budget.

As the state granted them no subsidies, their well-being depended exclusively on private generosity. Voluntary contributions, the regular revenues of the college, scarcely covered the expenses of worship, and the least extraordinary expenditure was a heavy burden for the common purse. These associations of unmoneyed people could not, with their slender resources, construct sumptuous temples; ordinarily they acquired from some land-holder a piece of ground favorably situated, on which they erected, or rather dug, their chapel, some other benefactor defraying the cost of the construction. Or, some wealthy burgher placed at the disposal of the mystics a cellar, where they installed themselves as best they could. If the original donor had not the means to pay for the interior decoration of the crypt and the modelling of the sacred images, other Brothers supplied the necessary sum, and a honorific inscription perpetuated the memory of their munificence. Three dedicatory inscriptions found in Rome enable us to witness the founding of one of these Mithraic congregations.¹ A freedman and a freeman contributed a marble altar, two other initiates consecrated a second one, and a slave likewise made his modest offering. The generous protectors obtained in return for their liberality the highest dignities in the little church. Through their efforts it was gradually furnished, and in the end could allow itself certain luxuries. Marble succeeded common stone, sculpture replaced plaster, and mosaic was substituted for painting. Finally, when the first temple fell into decay, the enriched community frequently rebuilt it with new splendor.

The number of the gifts mentioned in the epigraphic texts bears witness to the attachment of the faithful to the brotherhoods into which they had been admitted. It was owing to the constant devotion of the thousands of zealous disciples that these societies, the organic cells of the great religious body, could live and flourish. The order was divided into a multitude of little circles, strongly knit together and practising the same rites in the same sanctuaries. The size of the temples in which they worshipped is proof that the number of members was always very limited. Even supposing that the participants only were allowed to enter the subterranean crypt and that the initiates of inferior rank were admitted only to the vestibule (*pronaos*), it is impossible that these societies should have counted more than one hundred members. When the

¹CIL, VI, 556, 717, 734 = 30822 (*T. et M.*, t. II, p. 101, nos 47-48bis).

number increased beyond measure, a new chapel was constructed and the group separated. In these compact churches, where every one knew and aided every one else, prevailed the intimacy of a large family. The clear-cut distinctions of an aristocratic society were here effaced; the adoption of the same faith had made the slave the equal, and sometimes the superior, of the decurion and the *clarissimus*. All bowed to the same rules, all were equally honored guests at the same festivals, and after their death they all doubtless reposed in one common sepulchre. Although no Mithraic cemetery has been discovered up to the present day, the special belief of the sect regarding the future life and its very definite rites render it quite probable that like the majority of the Roman *sodalicia* it formed not only religious colleges but also funerary associations. It certainly practised inhumation, and the liveliest and most ardent desire of its adepts must have been that of obtaining an interment that was at once honorable and religious, a "mansion eternal," where they could await in peace the day of the resurrection. If the name of brothers which the initiates gave themselves was not an empty term, they were bound to render to one another at least this last duty.

The very imperfect image that we can frame of the interior life of the Mithraic conventicles aids us nevertheless in fathoming the reasons of their rapid multiplication. The humble plebeians who first entered its vaults in great numbers found in the fraternity of these congregations succor and solace. In joining them, they passed from their isolation and abandonment to become part of a powerful organisation with a fully developed hierarchy and having ramifications that spread like a dense net over the entire empire. Besides, the titles which were conferred upon them satisfied the natural desire that dwells in every man of playing some part in the world and of enjoying some consideration in the eyes of his fellows.

With these purely secular reasons were associated the more powerful motives of faith. The members of these little societies imagined themselves in the privileged possession of a body of ancient wisdom derived from the far Orient. The secrecy with which these unfathomable arcana were surrounded increased the veneration that they inspired: *Omne ignotum pro magifico est*. The gradual initiations kept alive in the heart of the neophyte the hopes of truth still more sublime, and the strange rites which accompanied them left in his ingenuous soul an ineffaceable impression. The converts believed they found, and, the suggestion being transformed into reality, actually did find, in the mystic ceremonies a

stimulant and a consolation. They believed themselves purified of their guilt by the ritual ablutions, and this baptism lightened their conscience of the weight of their heavy responsibility. They came forth strengthened from these sacred banquets, which contained the promise of a better life, where the sufferings of this world would find their full compensation. The astonishing spread of Mithraism is due in large measure to these stupendous illusions, which would appear ludicrous were they not so profoundly and thoroughly human.

Nevertheless, in the competition between the rival churches that disputed under the Cæsars the empire of human souls, one cause of inferiority rendered the struggle unequal for the Persian sect. Whilst the majority of the Oriental cults accorded to women a considerable rôle in their churches, and sometimes even a preponderating one, finding in them ardent supporters of the faith, Mithra forbade their participation in his Mysteries and so deprived himself of the incalculable assistance of these propagandists. The rude discipline of the order did not permit them to take the degrees in the sacred cohorts, and, as among the Mazdeans of the Orient, they occupied only a secondary place in the society of the faithful. Among the hundred of inscriptions that have come down to us, not one mentions either a priestess, a woman initiate, or even a donatress. But a religion which aspired to become universal could not deny a knowledge of divine things to one half of the human race, and in order to afford some opportunity for feminine devotion it contracted at Rome an alliance which certainly contributed to its success. The history of Mithraism in the Occident would not be intelligible if we neglected to consider its policy toward the rest of paganism.

GOSPEL PARALLELS FROM PALI TEXTS.

Translated from the Originals by ALBERT J. EDMUNDS.

(Eighth Series.)

DECLINE OF THE FAITH.¹

WITH REMARKS ON MAITREYA.

Matthew xxiv. 11, 12. Many false prophets shall arise, and shall lead many astray. And because iniquity shall be multiplied, the love of the many shall wax cold.

Luke xviii. 8. When the Son of man cometh, shall he find faith on the earth?

NUMERICAL COLLECTION V. 79.

MONKS, the following five future dangers (or, fears for the future), though not arisen now, will hereafter arise. Ye must be awake thereto, and being awake, must struggle to avert them. What are the five?

Monks, there will be monks in the far future, wanting in physical, moral, emotional and intellectual control; and being so, they will confer Initiation upon others, and will not be able to train them in superior morals, emotions and intelligence. These, being also without the aforesaid control, will initiate others in their turn, who will keep up the same state of things. And so, monks, from corruption of doctrine [will come] corruption of discipline, and from corruption of discipline corruption of doctrine.

This, monks, is the first future danger which, though not arisen now, will hereafter arise. Ye must be awake thereto, and being awake, must struggle to avert it.

¹Translated from the *Anāgata-bhayāni* (Future Dangers), one of the texts among the selections of the Emperor Asoko, in his Edict at Bhāba, and found in the Numerical Collection, V. 77-80. Chapters 77 and 78 deal with the personal dangers for monks in any age, including Buddha's own. In Chapter 77 they practice religion for security against the dangers of the forest: snakes, scorpions, centipedes, etc. In Chapter 78 they practice it for security in old age or times of trial. We now translate Chapter 79 entire.

Again, monks, there will be monks in the far future, wanting in control as before, who being so will give asylum to others, and they will not be able to train them in superior morals, emotions and intelligence. These will give asylum to yet others, and so [there will be] more corruption of discipline from doctrine, and of doctrine from discipline.

This, monks, is the second future danger, which will come and must be guarded against.

Again, monks, there will be monks in the far future without physical, moral, emotional and intellectual control, and being so, when they discourse upon the Higher Doctrine (*Abhidhammo*) and the Exegesis (*Vedalla*) they will not be awake, descending into doctrine dark.¹ And so, monks, [there will be] corruption of discipline from corruption of doctrine, and corruption of doctrine from corruption of discipline.

This, monks, is the third future danger which, though not arisen now, will hereafter arise. Ye must be awake thereto, and being awake must struggle to avert it.

²[Again], monks, there will be monks in the far future, [wanting in physical, moral, emotional and intellectual control; and they being thus wanting in physical, moral, emotional and intellectual control], there are Dialogues (*Suttantā*) spoken by the Tathāgato,—deep, of deep meaning, transcendental, connected with the³ Void (or, classified under Void); and when these are recited they will not listen nor give ear nor present a heart of knowledge; and they will not study those doctrines, learn them, nor reflect thereon.

But there are Dialogues poet-made, poetical, thrilling the heart, suggestive to the heart, the utterances of disciples who are outsiders. When these are recited they will listen, give ear, and present a heart of knowledge; these doctrines they will study, learn by heart and reflect upon.

And so, monks, [there will be] corruption of discipline from corruption of doctrine, and corruption of doctrine from corruption of discipline.

¹*Awake* is the same root as *Buddha* and *Buddhist*, while *dark* is the same word as the Sanskrit *Krishna*. One might almost suspect a punning allusion to the later admixture of Buddhism with the Krishna cult; but our text is too ancient.

²This paragraph, except the words in square brackets, is found in the Classified Collection, xx. 7. The grammatical connection of the clause beginning, "there are Dialogues," etc., is as awkward in the Pāli as it is in the English, and seems to indicate a separateness for this passage.

³See, e. g., Majjhima 121 and 122, which were very popular dialogues. The Chinese, in the seventh century, considered them such thorough compendiums of Buddhism, that many cared for no other Scriptures. (*I-tsing*, p. 51. I take "nothingness" = *sunnatā*.)

This, monks, is the fourth future danger which, though not arisen now, will hereafter arise. Ye must be awake thereto, and being awake, must struggle to avert it.

Again, monks, there will be monks in the far future without physical, moral, emotional and intellectual control; and being so, the Presbyter monks' will be luxurious, loose-lived, taking precedence by their descent, in seclusion neglecting their charge. They will not strive with their will for attainment of the unattained, approach to the unapproached, realisation of the unrealised. The last generation of them will fall into heresy, and will be luxurious, loose-lived, taking precedence by descent, in seclusion neglecting their charge. And so, monks, [there will be] corruption of discipline from corruption of doctrine, and corruption of doctrine from corruption of discipline.

This, monks, is the fifth future danger which, though not arisen now, will hereafter arise, and which ye must be awake to, and so struggle to avert.

These, monks, are the Five Future Dangers which, though not arisen now, will hereafter arise, and which ye must be awake to, and so struggle to avert.

[Chapter 80 gives a detailed account of future luxuries, such as building monasteries in towns, villages, and capitals; wearing fine robes; associating with young nuns, etc.]

The *Buddhist Apocalypse* translated by Warren is a mediæval treatise, expanded from just such texts as our present one.]

MINOR SECTION ON DISCIPLINE (CULLAVAGGO)¹ X. 1.

Ânando, if women had not received permission to go forth from domestic life and enter the homeless one, under the Doctrine and Discipline made public by the Tathâgato, then, Ânando, would the religious life have lasted long: the Gospel (*Saddhammo*) would have lasted for a thousand years. But, Ânando, now that women have received that permission, the religious life will not last long: the Gospel, Ânando, will now last only five hundred years.

[This passage is important as a time-mark in the history of the Canon, a fact which was pointed out in our provisional preface to this series of Parallels. (*Open Court*, February, 1900, p. 115.)

¹ Translated in *S. B. E.*, XX., p. 325.

In patristic works written after the Christian era, such as Buddha-ghosha's commentaries and the Great Chronicle of Ceylon, the figures 500 have been altered to 5000. This was because the 500 years had expired, and still the faith flourished. Therefore the sacred text has not been materially altered, and goes back behind the time of Christ. The period of a thousand years in our text may perhaps be compared with those of the Mazdean Saviours or the millennium of the Apocalyptical Christ.

It is to be regretted that the period of decline has been confounded with that of the second Coming or advent of Metteyyo (Sanskrit, Maitreyas;¹ contracted into Maitreya). Thus, Eitel, in his *Handbook of Chinese Buddhism*, places this advent five thousand years after Gotamo, which, as we have seen, is a later exaggeration of the five hundred predicted in the Book of Discipline. Rhys Davids, in his *Manual*, probably following Eitel, says the same; for that learned scholar has never had the leisure to re-write his book and give full references in the light of his present knowledge. Pâli learning is still in its infancy. Even Kern, whose *Manual* is deemed the best by so exacting a critic as Barth, does not give the original Pâli authority on the Metteyyo prophecy, but a passage in the late patristic Milindo. This is because the Pâli text in question has not yet been edited in Roman letters, but must be painfully read in the character of Siam. The text, however, was briefly referred to by Oldenberg in 1881, in the first edition of his *Buddha*; but was never, I believe, given fully, at least in English, until its appearance in *The Open Court* in 1900.

Unfortunately Dr. Carus, in his *Gospel of Buddha*, p. 217, has made the mistake pointed out, of associating the coming of Metteyyo with the end of the period of purity.

Owing to the curious coincidence that 500 years is the period between Gotamo and Jesus, some writers who have accepted the confusion of Metteyyo with this period, have regarded him as a Buddhist prophecy of Christ. Were it so, it would be a more remarkable one than any oracle of Daniel or Isaiah; for nowhere do the prophets clearly state that, at the end of a definite, non-mystical, mundane term of years, a Saviour would arise named Love, for such is the meaning of Metteyyo. We have purposely kept separate, in our Pâli Parallels, these two doctrines of the Second Coming and the Declension of the Faith.

¹ The first Europeans to transcribe Sanskrit words were the Greeks, and they rightly transcribed them in the nominative case, thus bringing out the sameness of the s-ending in Sanskrit, Greek and Latin.

In June, 1900 (*Open Court*, Vol. XIV., pp. 362, 363), we translated the leading Pâli oracle upon the coming of Metteyyo, under the caption of *Second Coming*. I may be allowed to say that the Christian idea of the Holy Ghost was not adduced by me among the New Testament passages for this Parallel, but was added in the editor's office. However, as we know that the doctrine of the Comforter was the Johannine and spiritual form of the grosser Pauline Second Coming, I have no objection to its standing, though of course the cogent parallel is the Pauline and Apocalyptic one, i. e., of a physical re-appearance of Christ.]

MISCELLANEOUS.

THANKSGIVING.

Thanksgiving is a harvest festival, and the first crops of the pilgrims that had settled in New England having failed, the wild turkey was a welcome addition to the table of the half-starved little community. He has ever since remained the pride of Thanksgiving day, and many millions of turkeys fall victims to the traditional celebration of this typically American family festival.



THE TWO RIVALS.

It seems a pity that man sustains his life at the cost of lower life, but to anyone who has closely studied the subject this condition appears to be inevitable; and it is certain that if sheep and oxen and chickens and turkeys and other animals of the same class were not eaten, these creatures would not be much better off. Indeed the greater part of them would not exist at all, for they are specially raised for the butcher and have no other purpose of existence but to sustain human life. Thus, however, they acquire a significance which utterly transcends their own comprehension, and to some extent their fate is easier and better than that of any

other being, man himself not excepted. They live in perfect safety and without care, well tended, and their wants always satisfied, until one day with the least pain their thread of life is cut in the stockyards. And if they knew their fate they would gladly die in the assurance that their lives serve as a pedestal for mankind to stand on. They serve to raise the standard of living and contribute not a little toward the comfort and well-being of the highest race that has developed upon the earth.

There is a humorous old German student song called the lamentations of a goose written in condemnation of man's barbarous habit of feeding on flesh. In many parts of Europe the goose takes the place of the American turkey and is considered the best ornament of the fall festivals, especially Martini; substituting the word turkey for goose, the song begins thus:

Man is a cannibal by nature;
He does not mind his fellow creature.
Me, poor Turkey, they have also caught
And with cranberries on the table brought.

The poor Turkeys have had a hard time this year. The summer was too wet for them and many millions died before they could be dressed to grace the thanksgiving dinner-table.

P. C.

HISTORY OF CHRISTIANITY IN JAPAN.¹

The Rev. Hans Haas, a German Lutheran missionary to Japan, who through long residence is very familiar not only with the language but also with the customs and literature of the country, has been engaged for many years in studying and writing the history of Christianity in Japan. So far the first volume only lies before us, and the work promises to become very complete and at the same time reliable and impartial. Judging from the first installment, we may expect the entire book to become a classical work which will be the best authority on the subject.

The Rev. Haas is a German and a Protestant, and at the very beginning he meets with the difficulty that the apostle of Japanese Christianity is a Roman Catholic and a Jesuit, nay more, the arch-Jesuit and founder of Jesuitism, Francis Xavier; and Mr. Haas has done his task with remarkable fairness and justice toward the representative of Jesuitism so much hated by Protestants.

The first volume is adorned with the reproduction of Xavier's portrait taken from Tursellin's biography which appeared at Cologne in the year 1610, thirty-five years after Xavier's death. No better frontispiece could have been selected, for the first volume is practically devoted to Xavier's missionary work.

The introductory chapters contain a very vivid description of the first rumors that reached Europe of the existence of Zipangu, and of attempts to find those rich islands; then their discovery by the Portuguese, and the conversion and baptism of three Japanese gentlemen in Gao in the Molucca islands, through Francis Xavier, which is the beginning of the Christianising of Japan. The remainder of the book is a history of Xavier's sojourn in Japan.

The report concerning the first native Christian is literally quoted from Mendez Pinto, who says that when they were just weighing anchor in the Bay of Yama-

¹ *Geschichte des Christenthums in Japan.* Von Pfarrer Hans Haas. I. Erste Einführung des Christenthums in Japan durch Franz Xavier. 1902. Pages, xiv, 300.

gawa, Satsuma, two men on horseback came down the hill in great haste and signalled him with a kerchief. During the previous night four slaves, one of whom belonged to Pinto himself, had escaped from the ship. So Pinto, hoping that the horsemen would give them information concerning the runaways, went ashore with two comrades in a sloop, but when they reached the land one of the two men said: "I am persecuted and in great fear; any delay may be fatal. For the love of God take me at once to your ship!" Pinto hesitated but felt inclined to yield to the request, the more so as he had seen the gentleman repeatedly in Yamagawa in the society of respected merchants. But scarcely had they entered the sloop when fourteen horsemen arrived who cried; "Turn over to us the traitor or thou must die!" And soon nine other horsemen followed, whereupon Pinto left the shore, and being out of reach of their arrows, asked what they wanted. Then the pursuers said: "If you dare to take this Japanese man (he made no mention of his companion), you must know that thousands of your people will have to suffer for it." Pinto made no reply, but rowed over to the ship and went on board with the two Japanese fugitives, who were well received by the captain, George Alvarez, and other Portuguese gentlemen. They gladly gave them everything that was necessary for the long journey. One of these two Japanese men was Anjiro,¹ "an instrument chosen by the Lord," says Pinto, "for the glory and propagation of the holy faith."

This Anjiro met Francis Xavier and became the first convert to Christianity. Xavier baptised him and two other Japanese gentlemen at Gao, and gave him the name Paolo of Santa Fé.

It is a pity that Mr. Haas has to take away a good deal of the romanticism of Pinto's report. First he argues that it is very improbable that the fugitive should have returned after a few months to the very province of his native country from which he had just escaped, and appeared in public as a missionary of the new faith without being molested. From all the reports available concerning Anjiro, and presented by Mr. Haas, we come to the conclusion that he was of good family, knew some Portuguese before he left Japan in search of Xavier, and was somehow inclined to Christianity by his mental constitution as well as by a troubled conscience which he had in vain tried to assuage in Buddhist monasteries. Anjiro also speaks of personal enemies; but the dramatic incident of his flight to the ship seems to conflict with the scattered passages in Xavier's letters concerning Anjiro. Anjiro had an introduction to Captain Alvaros, but he happened to deliver the letter to George Alvarez, who, without informing him of his error, took him to Malacca, where after some adventures he finally met the famous Padre Francis Xavier, of whom Anjiro had heard so much. He knew enough Portuguese to talk with Xavier without an interpreter, and succeeded in inducing his saint and master to visit Japan. Under Xavier's direction Anjiro translated an exposition of the Apostolic Faith for his countrymen and served him generally as a spokesman and interpreter.

It would lead us too far to enter into the details of the main contents of the book, but we wish to say that Xavier's personality is delineated in strong and bold outlines, and we may be sure that our author has succeeded pretty well in giving us a true portrait of the founder of Jesuitism, and all statements are substantiated

¹ *Anjiro* is, according to Mr. Haas, probably the correct Japanese spelling of the name; according to other reports, the name might be Japanese *Kanjiro*; or, if Bartoff's spelling be reliable, *Angero*, or as he is commonly called, *Gagiro*, the name must be the Japanese *Hachirō*.

by facts, so as to make us acquainted with the zealous Jesuit through his very life-work at a period when he was at his best.

Anjiro remained Xavier's most important assistant. A congregation was founded in Hirado. Xavier then sojourned in Yamagata and visited the capital. Thence he went to the province of Bungo and founded another congregation at Yamaguchi. Having worked two years and three months in Japan, Xavier left the country on November 20, 1551, and returned to India. He died a year afterwards on the Island of Sanshan, December 20, 1552, at the age of forty-six years.

The last chapter of the volume before us is an appreciation of Xavier's work, and the appendix contains translations of some important documents, a catechetical circular to the inhabitants of the Malacca Islands, containing Xavier's explanation of the Christian confession of faith, extracts from the books of the captain Georg Alvarez concerning Japan, a description of the habits and customs of the island of Japan by Anjiro, viz., Paolo of Santa Fé, and his letter to the Society of Jesus in Latin.

We may expect that the next following volumes will deal with the defeat which Christianity met in Japan, and finally the more modest but more successful attempts of modern missions, both Catholic and Protestant, of the present day.

* * *

Having given a general review of the book, we wish to add a few comments concerning a subject that, though of special interest, is only incidentally mentioned by the author. There being many similarities between Christianity and Buddhism, Xavier tried to discover indications of the work of Christian missionaries previous to his apostolate; but he declares in a letter dated February 29, 1552, that after a diligent search he could find no trace of it, and, judging from native writings as well as from oral conversations, he had become convinced that the Japanese had never heard anything about Christ. He noticed, however, that at Kagoshima, the capital of Satsuma, the Shimazu princes wore a white cross in their coat-of-arms, yet of Christ they had no knowledge. The vice-provincial P. Caspar Coegles too declared that this coat-of-arms is quite similar to the Christian cross, and, added he, may God grant that the prince and his family would soon worship it as the coat-of-arms of Christ.

Now, this Satsuma coat-of-arms is the cross (not to mention a few other cruciform symbols of less significance) which made a Christian Japanese author¹ believe that some of his people had adopted Christian crosses as their coats-of-arms, but the Satsuma cross is called Kutsuwa, which means a horse-bit ring; and its similarity to the Christian cross, accordingly, is purely incidental.

The Rev. Haas adds in a footnote a few comments concerning the relation of Christianity to Buddhism, saying:

"Japanese historians have frequently tried to prove that centuries before Xavier Christianity must have been preached in Japan by Christian missionaries; but this cannot be seriously maintained. However, it would be interesting to investigate how much of Christianity had reached Japan indirectly through Buddhism; for the Buddhism that reached Japan has certainly assimilated in India and China many Christian ideas from the Nestorians. This would explain many co-incidences between the Catholic religion and Japanese Buddhism.

"I quote here a comment made by Hildreth in *Japan as it was and is*, page 59, who, calling attention to the fact that Buddha's religion in its organisation and

¹The Rev. Ernest W. Clement, editor of the *Japan Evangelist*, communicated the contents of this article to *The Open Court* where it appeared in Vol. XIII., p. 742 ff. (1899, No. 12).

customs, in spite of a difference in dogma, is a counterpart of the Catholic Church, speaks of it as a similarity which missionaries could only explain by the theory of diabolical imitation."

Hildreth says: "... a similarity which the missionaries could only explain by the theory of a diabolical imitation; and which some subsequent Catholic writers have been inclined to ascribe, upon very unsatisfactory grounds, to the ancient labors of Armenian and Nestorian missionaries, being extremely unwilling to admit what seems, however, very probable, if not, indeed, certain,—little attention has as yet been given to this interesting inquiry,—that some leading ideas of the Catholic Church have been derived from Buddhist sources, whose missionaries, while penetrating, as we know they did, to the East, and converting entire nations, may well be supposed not to have been without their influence also on the West."

Mr. Haas continues:

"Prof. Rudolf Seydel has treated this problem in several of his books. The possibility of an influence of the Christian Gospels can scarcely be denied, and in fact has never been objected to by any one who is able to judge. That which above all seems to speak against the probability of this hypothesis seems to me that in the Christian literature down to Clement of Alexandria every mention of Buddhism is missing. So far we do not know the bridge over which the Buddha legend may have reached the Christians at the time when the Gospels were written."

We have to add here that Mr. Edmunds's articles on the subject which have appeared from time to time in *The Open Court* are in so far of great importance, that he limits his parallels to passages of Páli literature which is nowhere later than the second century before the Christian era. Other interesting material concerning this important problem is contained in our article on the Widow's Two Mites, which will appear in a future number of *The Open Court*. P. C.

ANCIENT HISTORY FOR BEGINNERS.

Dr. Botsford's school-histories of Greece and Rome formed but very recently the subject of our encomiums, and we have now to call attention to a new volume by this author, which in our judgment is even more admirable from the point of view of mere utility than its predecessors. Its title is *An Ancient History for Beginners*.¹ It treats as a unit of the history of the Orient, Greece, and Rome down to the founding of the Holy Roman Empire by Charlemagne (800 A. D.). Time out of mind these periods have been taught in detached form and their continuity wilfully slurred; the time is lacking in our secondary schools to devote an entire volume to each period or country; the plan has been tried, and the results have been nothing short of woeful: isolated, ham strung views of the world's men and events. Not only a knowledge of history but a broad and clear bird's-eye view of all of history is necessary to a rational and unbiassed life; and three books of the type of Dr. Botsford's present *Ancient History* or of Duruy's old *Moyen Age* (with modernisations) would afford a firmer foundation for sound social and historical judgments than twice as many works devoted to *disconnected* fields of modern and ancient life. Benjamin Franklin learned languages backwards, beginning with French and Italian, and ending with Latin; possibly history also could be studied

¹ By George Willis Botsford, Ph. D., Lecturer in Ancient History, Columbia University. With Maps and Numerous Illustrations. New York and London: The Macmillan Co. 1902. Pp., 494.

backwards, starting with our Spanish War, or, perhaps better, the Anthracite Coal Strike, and concluding with the Reindeer, Palafitte, and Hallstattian epochs; advocates even of the "sidewise" method have not been wanting. But begun, it should be finished; and it seems odd that the Committee of Seven of the American Historical Association should have been destined to wait till 1899 to divulge the need of a study of the connecting links of history, so sadly neglected, for example, in the early Middle Ages, the Byzantine and late imperial epochs.

Dr. Botsford's work is "adapted to beginning classes in the high school, and furnishes material for a year's work"; it is "intended for pupils who have never studied history before," the story being simply told, all unfamiliar terms explained, and proper names syllabified and accented on their first occurrence. "Myth. . . . receives due attention. . . . and the effects of geographical conditions and the causal relation of events are explained in an elementary way." Prehistoric conditions are briefly—perhaps too briefly—indicated; Egypt and the Asiatic nations (including China) receive rather scant treatment in some 37 pages; Greece gets 213 pages; and Rome from Romulus to Charlemagne, 216 pages. In all the external aids that modern photographic and cartographic art can supply the book is extremely rich and reflects great credit on author and publisher. The maps have been specially made for their purposes, and are themselves distinct contributions to the educational side of the subject, whilst the photographs of ancient art and architecture, of ancient landscapes, etc., etc., lend a life and charm to the book that cannot be underrated. We can, in fine, unqualifiedly recommend Dr. Botsford's work, both for school and home instruction. We only regret that several pages could not have been devoted to prehistory, on which even the bibliographies, otherwise excellent, give no references.

T. J. McC.

TWO PHILOSOPHICAL POEMS OF GOETHE.

TRANSLATED BY P. C.

(Under the title "God and World," Goethe published several philosophical poems from which Prof. T. B. Wakeman, President of the Liberal University of Silverton, Oregon, and editor of *The Torch of Reason*, has selected two for publication, adding thereto a literal translation. Mr. Wakeman, we ought to add, is an admirer of Goethe, whose poems he suggests should be studied in the original as a religious and ethical school-book, and the transliteration of the two poems in question is a chip from his workshop. At his suggestion, the writer has ventured to translate in verse the two poems entitled: "One and All" and "Bequest." The original texts are easily found in every German edition of Goethe's poems under the collective heading: *Gott und Welt*.)

It will be noticed that the first poem, "One and All," ends with the lines:

"And into naught we all must fall
If e'er in life we shall remain;"

while the poem "Bequest" makes the opposite statement, saying:

"No being into naught can fall;
The eternal liveth in them all."

This contrast is intentional on Goethe's part; he had written the poem "One and All" in a mood which Mr. Wakeman appropriately calls "Goethe's Nirvâna." But Goethe found himself misunderstood. A German naturalist association took the

lines as a motto in a connection which seemed to interpret the idea that death ends all; so Goethe found himself urged to show the reverse to his statement of self-surrender and therefore wrote the poem "Bequest" to prove that while the individual must identify itself with the All, his very individuality is preserved in the evolution of soul.

We have further to add that the lines offer some difficulties in interpretation, especially verse two, line four, of "Bequest," where "the Wise One" has been differently construed by different interpreters of Goethe's works. Some believe they find in the passage an endorsement of Kant's subjective notions that it is the astronomer who prescribes to the planets their orbits, and in that case "the Wise One" would be Copernicus; otherwise, we ought to understand by "Wise One" the Omniscient Architect of the world,—a masonic idea;¹ and the meaning in that case would be that truth comes from God who prescribes their courses to the celestial bodies.

Verse three of the same poem contains indeed an echo of Kant's doctrine of the *a priori*, including the categorical imperative, viz., that the soul contains *a priori* all the rules and laws of purely formal thought, and also the standard of the moral ought. It is (as verse four declares) pure reason which enables us to utilise all sense-material; the senses are reliable if regulated by reason.

Our translation is as literal as possible, while preserving also the run of the original.)

ONE AND ALL.

" Into the limitless to sink,
No one, I trow, will ever blink,
For there all sorrow we dismiss.
Instead of cravings and wants untold,
Fatiguing demands and duties cold,
Surrender of one's self is bliss.

" O, World-soul, come to fill our lives,
For he who with thy spirit strives
Attains the height of his vocation.
Then, sympathetic spirits, speed us;
Great masters, gently higher lead us
To the Creator of creation.

" In re-creating the created,
Lest fossilise the animated,
Aye, active power, is manifest;
The non-existent actualising,
In younger worlds and suns is rising,
But never, nowhere, can be rest.

" In active deeds life proves unfolding;
It must be moulded and keep moulding;
Sometimes but seeming rest 'twill gain.
The eternal stirreth in us all,
And into naught we all must fall;
If e'er in life we shall remain."

¹ Goethe was a Mason and used to write poems for Masonic festivals.

BEQUEST.

" No being into naught can fall,
 The eternal liveth in them all ;
 In being, therefore, be thou blessed,
 Being is eternal, for fixed measures
 Preserve its ever-living treasures,
 In which the world is nobly dressed.

" The Truth of yore has been decried,
 And noble spirits has allied.
 To dear old Truth we must adhere !
 'Tis to the Wise One Truth we owe :
 To Him who did their orbits show
 To earth and to her brother-sphere.

" First, friend, within thyself thou enter,
 For 'tis within that lies the center ;
 No noble thinker will gainsay.
 No rule there's missing. So rejoice,
 That conscience' independent voice
 Serves duty as its solar ray.

" We on our senses must rely,
 And if our reason we apply,
 Sensation never error yields ;
 With open eyes do all observing,
 And roam with confidence unswerving
 Through this world's rich and wondrous fields.

" Temper your joys with moderation,
 With reason keep in consultation,
 When life is beaming with life's glee.
 The past will thus become enduring,
 E'en now the future life-securing ;
 The moment gains eternity.

" Born, as of old, of patient love,
 Whenever may the spirit move,
 Are bard's and thinker's great creations ;
 With highest favors they are fraught.
 Forefeel of noble souls the thought ;
 'Tis the most enviable of vocations."

 THE DISCOVERY OF NEPTUNE.

The appearance of a new edition of Miss Clerke's well-known *Popular History of Astronomy*¹ affords us a welcome opportunity of calling to the attention

¹ Fourth Edition, Revised and Corrected. New York : The Macmillan Co.; London : Adam and Charles Black. 1902. Pp., 489. Cloth, \$4.00.

of our readers a work of sterling merit in perhaps the most delightful province of natural inquiry. The story of the heavens is of entrancing interest, and in the present case it has been told with an authority and self-restraint that the natural flights of fancy and pietism in which writers on these topics are tempted to indulge have only in rare instances transcended. Miss Clerke, it may be mentioned in passing, is the author of astronomical articles in the *Encyclopædia Britannica* as well as of independent works on the history of astronomy. We quote below from her *Popular History*, as a specimen of the reading Miss Clerke offers, the story of the discovery of Neptune,—one of the greatest achievements in the annals of astronomical science. The English side of the discovery naturally receives here strong emphasis.

THE STORY OF NEPTUNE.

“We have now to recount an event unique in scientific history. The discovery of Neptune has been characterised as the result of a ‘movement of the age,’ and with some justice. It had become necessary to the integrity of planetary theory. Until it was accomplished, the phantom of an unexplained anomaly in the orderly movements of the solar system must have continued to haunt astronomical consciousness. Moreover, it was prepared by many, suggested as possible by not a few, and actually achieved, simultaneously, independently, and completely, by two investigators.

“The position of the planet Uranus was recorded as that of a fixed star no less than twenty times between 1690 and the epoch of its final detection by Herschel. But these early observations, far from affording the expected facilities for the calculation of its orbit, proved a source of grievous perplexity. The utmost ingenuity of geometers failed to combine them satisfactorily with the later Uranian places, and it became evident, either that they were widely erroneous, or that the revolving body was wandering from its ancient track. The simplest course was to reject them altogether, and this was done in the new Tables published in 1821 by Alexis Bouvard, the indefatigable computing partner of Laplace. But the trouble was not thus to be got rid of. After a few years fresh irregularities began to appear, and continued to increase until absolutely ‘intolerable.’ It may be stated as illustrative of the perfection to which astronomy had been brought, that divergencies regarded as menacing the very foundation of its theories never entered the range of unaided vision. In other words, if the theoretical and the real Uranus had been placed side by side in the sky, they would have seemed, to the sharpest eye, to form a single body.

“The idea that these enigmatical disturbances were due to the attraction of an unknown exterior body was a tolerably obvious one; and we accordingly find it suggested in many different quarters. Bouvard himself was perhaps the first to conceive it. He kept the possibility continually in view, and bequeathed to his nephew’s diligence the inquiry into its reality when he felt that his own span was drawing to a close; but before any progress had been made with it, he had already (June 7, 1843) ‘ceased to breathe and to calculate.’ The Rev. T. J. Hussey actually entertained in 1834 the notion, but found his powers inadequate to the task, of assigning an approximate place to the disturbing body; and Bessel, in 1840, laid his plans for an assault in form upon the Uranian difficulty, the triumphant exit from which fatal illness frustrated his hopes of effecting or even witnessing.

“The problem was practically untouched when, in 1841, an undergraduate of St. John’s College, Cambridge, formed the resolution of grappling with it. The

projected task was an arduous one. There were no guiding precedents for its conduct. Analytical obstacles had to be encountered so formidable as to appear invincible even to such a mathematician as Airy. John Couch Adams, however, had no sooner taken his degree, which he did as senior wrangler in January, 1843, than he set resolutely to work, and on October 21, 1845, was able to communicate to the Astronomer Royal numerical estimates of the elements and mass of the unknown planet, together with an indication of its actual place in the heavens. These results, it has been well said, gave 'the final and inexorable proof' of the validity of Newton's Law. The date October 21, 1845, 'may therefore be regarded as marking a distinct epoch in the history of gravitational astronomy.'

"Sir George Biddell Airy had begun in 1835 his long and energetic administration of the Royal Observatory, and was already in possession of data vitally important to the momentous inquiry then on foot. At his suggestion, and under his superintendence, the reduction of all the planetary observations made at Greenwich from 1750 onwards had been undertaken in 1833. The results, published in 1846, constituted a permanent and universal stock of materials for the correction of planetary theory. But in the meantime, investigators, both native and foreign, were freely supplied with the 'places and errors,' which, clearly exhibiting the discrepancies between observation and calculation—between what *was* and what was *expected*—formed the very groundwork of future improvements.

"Mr. Adams had no reason to complain of official discourtesy. His labors received due and indispensable aid; but their purpose was regarded as chimerical. 'I have always,' Sir George Airy wrote, 'considered the correctness of a distant mathematical result to be a subject rather of moral than of mathematical evidence.' And that actually before him seemed, from its very novelty, to incur a suspicion of unlikelihood. No problem in planetary disturbance had heretofore been attacked, so to speak, from the rear. The inverse method was untried, and might well be deemed impracticable. For the difficulty of determining the perturbations produced by a given planet is small compared with the difficulty of finding a planet by its resulting perturbations. Laplace might have quailed before it; yet it was now grappled with as a first essay in celestial dynamics. Moreover, Adams unaccountably neglected to answer until too late a question regarded by Airy in the light of an *experimentum crucis* as to the soundness of the new theory. Nor did he himself take any steps to obtain a publicity which he was more anxious to merit than to secure. The investigation consequently remained buried in obscurity. It is now known that had a search been instituted in the autumn of 1845 for the remote body whose existence had been so marvellously foretold, it would have been found within *three and a half lunar diameters* ($1^{\circ} 49'$) of the spot assigned to it by Adams.

"A competitor, however, equally daring and more fortunate—*audax fortunatus adjutus*, as Gauss said of him—was even then entering the field. Urbain Jean Joseph Leverrier, the son of a small Government employé in Normandy, was born at Saint-Lô, March 11, 1811. He studied with brilliant success at the École Polytechnique, accepted the post of astronomical teacher there in 1837, and, 'docile to circumstance,' immediately concentrated the whole of his vast, though as yet undeveloped powers upon the formidable problems of celestial mechanics. He lost no time in proving to the mathematical world that the race of giants was not extinct. Two papers on the stability of the solar system, presented to the Academy of Sciences, September 16 and October 14, 1839, showed him to be the worthy successor of Lagrange and Laplace, and encouraged hopes destined to be abun-

dantly realised. His attention was directed by Arago to the Uranian difficulty in 1845, when he cheerfully put aside certain intricate cometary researches upon which he happened to be engaged, in order to obey with dutiful promptitude the summons of the astronomical chief of France. In his first memoir on the subject (communicated to the Academy, November 10, 1845), he proved the inadequacy of all known causes of disturbance to account for the vagaries of Uranus; in a second (June 1, 1848), he demonstrated that only an exterior body, occupying at a certain date a determinate position in the zodiac, could produce the observed effects; in a third (August 31, 1846), he assigned the orbit of the disturbing body, and announced its visibility as an object with a sensible disc about as bright as a star of the eighth magnitude.

"The question was now visibly approaching an issue. On September 10, Sir John Herschel declared to the British Association respecting the hypothetical new planet: 'We see it as Columbus saw America from the coast of Spain. Its movements have been felt, trembling along the far-reaching line of our analysis with a certainty hardly inferior to that of ocular demonstration.' Less than a fortnight later, September 23, Professor Galle, of the Berlin Observatory, received a letter from Leverrier requesting his aid in the telescopic part of the inquiry already analytically completed. He directed his refractor to the heavens that same night, and perceived, within less than a degree of the spot indicated, an object with a measurable disc, nearly three seconds in diameter. Its absence from Bremiker's recently-completed map of that region of the sky showed it to be no star, and its movement in the predicted direction confirmed without delay the strong persuasion of its planetary nature.

"In this remarkable manner the existence of the remote member of our system known as 'Neptune' was ascertained. But the discovery, which faithfully reflected the duplicate character of the investigation which led to it, had been already secured at Cambridge before it was announced from Berlin. Sir George Airy's incredulity vanished in the face of the striking coincidence between the position assigned by Leverrier to the unknown planet in June, and that laid down by Adams in the previous October; and on the 9th of July he wrote to Professor Challis, director of the Cambridge Observatory, recommending a search with the great Northumberland equatoreal. Had a good star-map been at hand, the process would have been a simple one; but of Bremiker's 'Hora XXI.' no news had yet reached England, and there was no other sufficiently comprehensive to be available for an inquiry which, in the absence of such aid, promised to be both long and laborious. As the event proved, it might have been neither. 'After four days of observing,' Challis wrote, October 12, 1846, to Airy, 'the planet was in my grasp if only I had examined or mapped the observations.' Had he done so, the first honors in the discovery, both theoretical and optical, would have fallen to the University of Cambridge. But Professor Challis had other astronomical avocations to attend to, and, moreover, his faith in the precision of the indications furnished to him was, by his own confession, a very feeble one. For both reasons he postponed to a later stage of the proceedings the discussion and comparison of the data nightly furnished to him by his telescope, and thus allowed to lie, as it were, latent in his observations the momentous result which his diligence had insured, but which his delay suffered to be anticipated.

"Nevertheless, it should not be forgotten that the Berlin astronomer had two circumstances in his favor apart from which his swift success could hardly have been achieved. The first was the possession of a good star-map; the second was

the clear and confident nature of Leverrier's instructions. 'Look where I tell you,' he seemed authoritatively to say, 'and you will see an object such as I describe.' And in fact, not only Galle on the 23d of September, but also Challis on the 29th, immediately after reading the French geometer's lucid and impressive treatise, picked out from among the stellar points strewing the zodiac, a small planetary disc, which eventually proved to be that of the precise body he had been in search of during two months.

"The controversy that ensued had its ignominious side; but it was entered into by neither of the parties principally concerned. Adams bore the disappointment, which the dilatory proceedings at Greenwich and Cambridge had inflicted upon him, with quiet heroism. His silence on the subject of what another man would have called his wrongs remained unbroken to the end of his life; and he took every opportunity of testifying his admiration for the genius of Leverrier.

"Personal questions, however, vanish in the magnitude of the event they relate to. By it the last lingering doubts as to the absolute exactness of the Newtonian Law were dissipated. Recondite analytical methods received a confirmation brilliant and intelligible even to the minds of the vulgar, and emerged from the patient solitude of the study to enjoy an hour of clamorous triumph. For ever invisible to the unaided eye of man, a sister-globe to our earth was shown to circulate, in perpetual frozen exile, at thirty times its distance from the sun. Nay, the possibility was made apparent that the limits of our system were not even thus reached, but that yet profounder abysses of space might shelter obedient, though little favored, members of the solar family, by future astronomers to be recognised through the sympathetic thrillings of Neptune, even as Neptune himself was recognised through the tell-tale deviations of Uranus.

"It is curious to find that the fruit of Adams's and Leverrier's laborious investigations had been accidentally all but snatched half a century before it was ripe to be gathered. On the 8th, and again on the 10th of May, 1795, Lalande noted the position of Neptune as that of a fixed star, but perceiving that the two observations did not agree, he suppressed the first as erroneous, and pursued the inquiry no further. An immortality which he would have been the last to despise hung in the balance; the feather-weight of his carelessness, however, kicked the beam, and the discovery was reserved to be more hardly won by later comers." μ .

BOOK REVIEWS.

THE CHILDREN OF THE NATIONS; A Study of Colonisation and Its Problems. By Poultney Bigelow, M. A., F. R. G. S. New York: McClure, Philips & Co. 1901. Pages, xiii, 365.

Poultney Bigelow, well-known as the author of a book on *The German Emperor and His Neighbors*, a man of broad education acquired both at home (viz., at Harvard) and abroad in France and Germany, has published an instructive book under the title: *The Children of the Nations*. The book discusses in thirty-five chapters the several methods of colonisation among the different civilised peoples. First the Spanish colonies and their final doom in South America, Cuba, the Philippines, etc. (Chapters I-VII). Here follows (Chapter VIII) a discussion of the Negro as an element in colonial expansion both in America and South Africa. Then the author descants on official German civilisation in Kiao Chow and East Africa (Chapter IX), which ought to be very instructive to the German Emperor,

though there is little probability that he will heed the author's advice. Next in importance are Portugal, the rise and decay of her colonies, including an appreciation of Francis Xavier's work and the establishment as well as failure of Jesuit missions (Chapters X-XIII); a discussion of the Dutch, and especially of the Boer, fills three most interesting Chapters (XIV-XVI). As much as Mr. Bigelow appreciates Dutch culture, he is hard on the Boer whom he compares to the Texas cowboy. Of no less interest are the several chapters on Scandinavian, Danish, Chinese, French, and Russian colonisation (Chapters XVII-XXIV). But the most important information may be drawn from the chapters on the English colonies in America, and the rise of American independence (Chapters XXV-XXVI); Chapter XXVII gives the reason why England lost her American colonies; Chapters XXVIII-XXX discuss the English possessions in the West Indies and British Guiana; Chapter XXXI, those in Australasia; Chapter XXXII discusses the dangers and sanitation of the tropics; Chapter XXXIII, the white invasion of China; Chapter XXXIV, the philosophy of colonisation, which may be regarded as the summary of Mr. Bigelow's experiences; and finally, in Chapter XXXV our author applies his maxims to the prospects of American colonisation.

The book is interesting wherever one may happen to open it, and it goes far to prove the wisdom of giving liberty to colonies and of encouraging home government everywhere. To select one drastic instance only, we quote from page 293: "Although the Great Wall of China was built by forced labor, it is more than probable that to-day an American contractor would undertake to build it over again with free labor for less money than it originally cost. The reason for this is, that only high-priced mechanics can be trusted with high-priced machinery,—and a good machine can underbid the best of slaves."

P. C.

PROJET D'ORGANISATION DU MOUVEMENT SCIENTIFIQUE UNIVERSEL EN ANGLAIS, ESPAGNOL, FRANÇAIS, ALLEMAND, ITALIEN; Dedié à Mr. Andrew Carnegie. Par *Dr. E. M. Cavazzutti*. Buenos Ayres: Cooperativa Tipográfica, Reconquista 414. 1902.

This pamphlet contains some excellent ideas on the unification and economisation of the World's Research, in both its active positive aspect (as investigation) and its passive negative aspect (as the dead storing up of knowledge). "In each capital of the European states and in the principal cities of both Americas, Australia, and the civilised nations of Asia, there shall be established a scientific institution called an Emporium, which shall be divided into three Divisions: one Bibliographical, one Experimental, and one for Scientific Congresses." We cannot go into details; suffice it to say that it is the object of these Emporiums to promote coöperation, unity, and parsimony, both intellectual and material, in the scientific world, and to focus the dispersed thought and spiritual energies of the world. Dr. Cavazzutti's ideas have found partial but very meagre realisation in some existing institutions, and though they are not entirely novel, they are systematic and consistent. They should receive, the author thinks, the attention of Mr. Carnegie.

It is refreshing to observe that the work comes from South America and was inspired partly by the utterances of Mr. Bonney (not Bouney, as the author has it). The text is in five languages: English, Spanish, French, German, and Italian. Barring a few slips, such as "World's Scientific *Movre*" for "World's Scientific *Movement*," the English is clear reading.

u.

AN INTRODUCTION TO CELESTIAL MECHANICS. By *F. R. Moulton, Ph. D.*, Instructor in Astronomy in the University of Chicago. New York: The Macmillan Co. 1902. Pp. 384.

Mr. Moulton has endeavored to give in this volume "a somewhat satisfactory account of many parts of Celestial Mechanics rather than an exhaustive treatment of any special part. The aim has been to present the work so as to attain logical sequence, to make it progressively more difficult, and to give the various subjects the relative prominence which their scientific and educational importance deserves. In short, the aim has been to prepare such a book that one who has had the necessary mathematical training may obtain from it in a relatively short time and by the easiest steps a sufficiently broad and just view of the whole subject to enable him to stop with much of real value in his possession, or to pursue to the best advantage any particular portion he may choose."

Considerable knowledge of the calculus is requisite to the enjoyment of Mr. Moulton's treatise, which is in every respect an excellent survey of this most interesting field of mechanics. The discussions are elegant and concise, having been selected from the masters of this department of inquiry, and give, indeed, "an idea of the methods of investigation and the results attained in Celestial Mechanics." The interest and value of the treatise have been heightened by the addition of pertinent historical and bibliographical remarks: while too much praise cannot be bestowed on the publishers for the excellence of the typography. μ.

The Hibbert Journal is the title of a new "quarterly magazine of religion, theology, and philosophy." It is supported and sanctioned by the Hibbert Trustees, institutors of the well-known foundation made from funds left by Robert Hibbert, a West India Merchant who died in 1849. The object of the *Journal* like that of the foundation is the honest, critical, and unpartisan discussion of all unsettled problems of religion and theology. The *Journal* is edited by L. P. Jacks and G. Dawes Hicks, and has as its "editorial advisors" some of the most prominent religious thinkers of Great Britain. The contributors to the first number are Prof. Percy Gardner ("The Basis of Christian Doctrine"), Prof. Josiah Royce ("The Concept of the Infinite"), Sir Oliver Lodge ("The Controversy Between Science and Faith"), Rev. Stopford Brooke ("Matthew Arnold"), Principal James Drummond ("'Righteousness of God' in St Paul's Theology"), and F. C. Conybeare ("Early Doctrinal Modifications of the Gospels"). The *Journal* has a becomingly solid and dignified appearance. (London and Oxford: Williams & Norgate. Price, 2s. 6d. net.)

Mr. William Morton Payne has collected into two tasteful little volumes, recently published by A. C. McClurg, of Chicago, the editorial articles on literary and educational topics which he has supplied in past years to the pages of *The Dial*. Mr. Morton's essays have always been one of the most attractive features of *The Dial*; he has ever striven to make them more than ephemeral comments on the objects of which they treat; and the care with which they have been written, the soberness and self-restraint with which they have been conceived, the wide culture which their contents bespeak, amply justify their author in the hope that there is due them some meed of permanency. The readers of these little volumes will have their memories pleasantly refreshed on nearly all the important movements in literature and the related arts that recent years have chronicled. (*Little Leaders. Editorial Echoes.* Two volumes. 1902.)

The Temple Classics, under the critical and discerning editorship of Mr. Israel Gollancz, are fast augmenting in number and elegance. They include now the greater part of what is best in English and the world's literature; they meet the most fastidious tastes; and a careful selection from their wealth would form a rare adornment to the tables of any household. The *Temple Dramatists* (English) and the *Temple Cyclopedic Primers* (general science and literature) form appropriate complements to the series. Especial attention is to be directed to the *Temple Classics for Young People* which now include *The Arabian Nights*, Fouqué's *Sintram*, Kingsley's *Heroes*, Lamb's *Tales from Shakespeare*, Scott's *Ivanhoe*, etc. Mr. E. Lucas, whose work in rendering good literature accessible we noticed in a former number of *The Open Court*, has given us in the same group an admirable rendering of some of *Andersen's Fairy Tales*. The illustrations of these little works are quaint and appropriate: the books are of pocket size and cost, bound, from forty to sixty-five cents. The publishers will doubtless be glad to send a full list of titles on application. (New York: The Macmillan Co., 66 Fifth Ave. London: J. M. Dent & Co.)

Paul Elder and Morgan Shepard have published a series of baby pictures under the name of *Baby Roland*, by George Hansen,—one called "Lima Beans," another "Vespers," and the third "The Ascent of Man." The contents are three sets of photographs: the first of a baby dining on lima beans; the second greeting the setting sun and bidding good night; and the third the gradual climbing of the stairs and the final triumph, followed by a "declaration of independence." The photographs are a trifle dilettantic, but the price (50 cents for each little fascicle) is reasonable, considering the handmade make-up; each series is ornamented with pressed algae.

The August and September issues of *The Bibelot*, "A Reprint of Poetry and Prose for Book Lovers, chosen in part from scarce editions and sources not generally known," are: (1) "In Praise of Old Houses," by Vernon Lee (Miss Violet Paget), and (2) "An Address on William Morris," by J. W. Mackail, delivered at Kelmescott House, Hammersmith, before the Hammersmith Socialist Society, Nov. 11, 1900. Mr. Mackail's address gives an admirable review of Morris's life and career. The October *Bibelot* is "Rossetti and the Religion of Beauty" by F. W. B. Myers. (Portland, Me.: Thomas B. Mosher. Price each, 5 cents.)

Watts & Co. of London have just issued a cheap edition (six pence) of Matthew Arnold's famous book *Literature and Dogma: An Essay Towards a Better Apprehension of the Bible*,—a work as justly noted for its literary qualities as for its criticism of an unreasoning and false theology. It was originally published in the early seventies, and its object was, as its author stated, "to reassure those who feel attachment to Christianity, to the Bible, but who recognise the growing discredit befalling miracles and the supernatural."

Echoes from the Solitudes is the title of the latest volume of aphorisms and poems from the pen of Mary Morgan (Gowan Lea), a former contributor to *The Open Court*, the earlier readers of which will remember her graceful sonnets. The little book contains many pretty sentiments. (London: George Allen.)

The First Principles of Herbert Spencer has been translated into French from the sixth English edition by M. Guymiot. The proofs of this French edition have been read and thoroughly revised by the author, and the publishers have supplied a very handsome photogravure reproduction of the best bust of Herbert Spencer that we have seen. While this work will not be largely used by English readers, save possibly by English students of French who are desirous of acquiring by comparison a knowledge of French philosophical terminology, for which purpose it would be admirable, the translation will serve the purpose of introducing to circles knowing French but not conversant with English, the chief work of one of the most popular English philosophers of the last decades. (Paris: Librairie C. Reinwald; Schleicher Frères, Éditeurs. 1902. Pages, xvii, 508. Price, 10 Francs)

NOTES.

The proposed Hindu-Buddhistic Religious Conference at Kioto, Japan, mentioned in the last *Open Court* as taking place in October of this year, has been postponed until April and May of 1903. An industrial exhibition will be held about the same time at Okasa, Japan. It is expected that a large number of Indian visitors will attend the Conference and Exhibition, the latter of which is to be supplemented by a special Indian Arts Exposition. Japan owes a large debt to India, and the forthcoming gatherings are in the nature of a friendly return for the intellectual advantages which Japan has derived from Indian civilisation in the past.

Mathematics, Mechanics, Physics

A Brief History of Mathematics

By the late DR. KARL FINK, Tübingen, Germany. Translated by WOOSTER WOODRUFF BEMAN, Professor of Mathematics in the University of Michigan, and DAVID EUGENE SMITH, Professor of Mathematics in Teachers College, Columbia University, New York City. With Biographical notes and full index. Pp. 345. Cloth, \$1.50 net (5s. 6d. net).



Not a book of anecdotes, nor one of biography; but a clear and brief statement of the FACTS of mathematical history. An invaluable work for teachers of mathematics.

“Dr. Fink’s work is the most systematic attempt yet made to present a compendious history of mathematics.”—The Outlook.

“This book is the best that has appeared in English. It should find a place in the library of every teacher of mathematics.”—The Inland Educator.

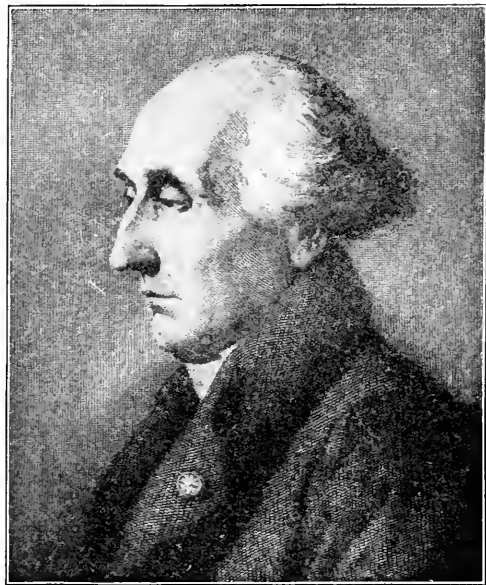
On the Study and Difficulties of Mathematics

By AUGUSTUS DE MORGAN. With portrait of De Morgan, Index and Bibliographies of Modern Works on Algebra, the Philosophy of Mathematics, Pangeometry, etc. Pp. viii, 288. Cloth, \$1.25 net (4s. 6d. net).

“The point of view is unusual; we are confronted by a genius, who, like his kind, shows little heed for customary conventions. The ‘shaking up’ which this little work will give to the young teacher, the stimulus and implied criticism it can furnish to the more experienced, make its possession most desirable. This ‘Mathematical Series’ must be held one of the most notable achievements of THE OPEN COURT.”—Michigan Alumnus, April '99.

Lectures on Elementary Mathematics

By JOSEPH LOUIS LAGRANGE. With portrait and biography of LaGrange. From the French by T. J. MCCORMACK. Pp., 172. Cloth, \$1.00 net (4s. 6d. net).



JOSEPH LOUIS LAGRANGE, 1736-1813.

“Historical and methodological remarks abound, and are so woven together with the mathematical material proper, and the whole is so vivified by the clear and almost chatty style of the author as to give the lectures a charm for the readers not often to be found in mathematical works.”—Bulletin American Mathematical Society.

The Foundations of Geometry. By DANIEL HILBERT, Ph. D., Professor of Mathematics in the University of Göttingen. With many new additions still unpublished in German. Translated by E. J. TOWNSEND, Ph. D., Professor of Mathematics in the University of Illinois. (In preparation.)

Mathematics, Mechanics, Physics—Continued



AUGUSTUS DE MORGAN, 1806-1871.

Elementary Illustrations of the Differential and Integral Calculus

By AUGUSTUS DE MORGAN. New reprint edition. With sub-headings and bibliography of English and foreign works on the Calculus. Price, cloth, \$1.00 net (4s. 6d. net).

"It aims not at helping students to cram for examinations, but to give a scientific explanation of the rationale of these branches of mathematics. Like all that De Morgan wrote, it is accurate, clear and philosophic."—*Literary World*, London.

Mathematical Essays and Recreations

By HERMANN SCHUBERT, Professor of Mathematics in Hamburg. From the German by T. J. McCORMACK. Pp., 149. Cuts, 37. Cloth, 75c. net (3s. net).

"Professor Schubert's Essays make delightful reading. They deal, not with the dry side of mathematics, but with the philosophical side of that science on the one hand and its romantic side on the other. They are admirably lucid and simple and answer questions in which every intelligent man is interested."—*Chicago Evening Post*.

Geometric Exercises in Paper-Folding

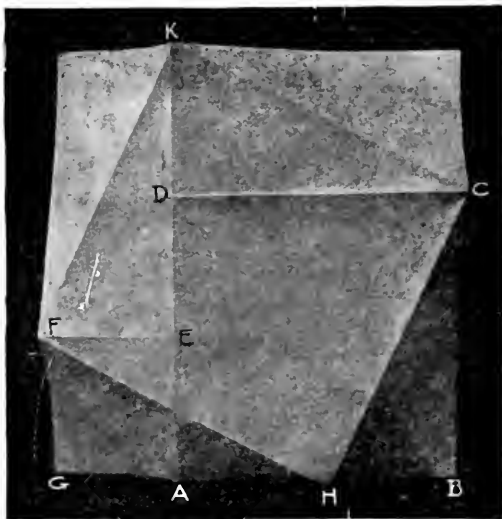
By T. SUNDARA ROW. Edited and revised by W. W. BEMAN and D. E. SMITH. With many half-tone engravings from photographs of actual exercises, and a package of papers for folding. Pages, x-148. Cloth, \$1.00 net (4s. 6d. net).

A unique work. Highly recommended by the eminent European mathematician, Professor Klein, of Göttingen, it should be in the hands, not only of every special teacher of mathematics, but of every independent student, and of every one who gives instruction in the lower grades.

Essays on the Theory of Numbers

(1) Continuity and Irrational Numbers;
 (2) The Nature and Meaning of Numbers. By RICHARD DEDEKIND. From the German by W. W. BEMAN. Pp. 115. Cloth, 75c. net (3s. net).

These essays mark one of the distinct stages in the development of the theory of numbers. They give the foundation upon which the whole science of numbers may be established. The first can be read without any technical, philosophic or mathematical knowledge; the second requires more power of abstraction for its perusal, but power of a logical nature only.



Proof of the Pythagorean Proposition by Paper-Folding
 (From Sundara Row's GEOMETRIC EXERCISES.)

Mathematics, Mechanics, Physics—Continued



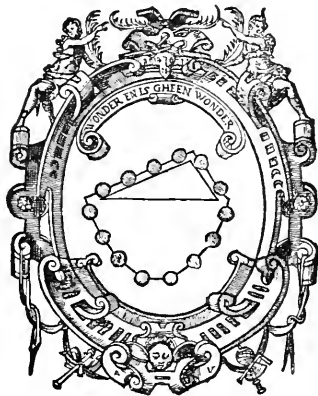
DR. ERNST MACH.
(Born February 18, 1838)

The Science of Mechanics

A Critical and Historical Account of Its Development. By DR. ERNST MACH, Professor of the History and Theory of Inductive Science in the University of Vienna. Translated from the German by THOMAS J. McCORMACK. Second enlarged edition. 250 cuts. Pp. xx+605. Cloth, gilt top, marginal analyses. Exhaustive index. Price, \$2.00 net (9s. 6d. net).

This book is as much a work on philosophy as science. It takes up the subject of the development of mechanics as a specimen of scientific development in general and shows both the psychology and the logic of the onward movement of human thought. The mechanism of the growth of our ideas, the nature of the structure of science and of truth in general are here exhibited in the plainest light.

“A remarkable work.”
—Nature.



Vignette to a Work by Stevinus (1605).
From Mach's MECHANICS.

“A masterly book.”—Engineering News.

“The book as a whole is unique and a valuable addition to any library of science or philosophy.”—Prof. D. W. Hering in Science.

“Sets forth the elements of the subject with a clearness, lucidity and force unknown in the mathematical text-books.”
—Canadian Mining and Eng. Review.

Popular Scientific Lectures

A Portrayal of the Methods and Spirit of Science. By ERNST MACH, Professor in the University of Vienna. Translated from the German by T. J. McCORMACK. Third edition. Pages, 415. In cloth, gilt top, \$1.50 net (7s. 6d.)

Lectures on Mechanics, Sound, Light, Electricity, the Conservation of Energy, Philosophy and Education. The thoughts of the master-minds of science are here presented in popular form by one of its foremost living representatives.

“A most fascinating volume, . . . has scarcely a rival in the whole realm of popular scientific writing.”—Boston Traveller.

“Truly remarkable. . . . May be fairly called rare.”—Professor Henry Crew, N. W. University.

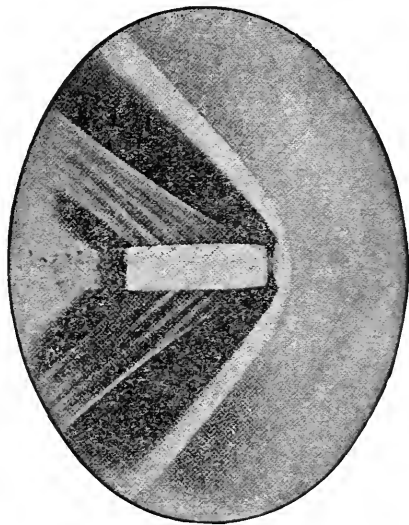
“A very delightful and useful book.”—Daily Picayune, New Orleans.

“Have all the interest of lively fiction.”—Commercial Advertiser.

“Its literary and philosophical suggestiveness is very rich.”—Hartford Seminary Record.

“A masterly exposition.”—Scotsman, Edinburgh.

“Will please those who find the fairy tales of science more absorbing than fiction.”—Pilot, Boston.



PHOTOGRAPH OF A FLYING BULLET.
(From Mach's POPULAR SCIENTIFIC LECTURES.)

Mathematics, Mechanics, Physics—Continued

Articles Published in The Monist and The Open Court on Subjects Related to Mathematics, Physics, Etc.

Copies of "The Monist" and "The Open Court" containing the articles here listed will be supplied by the publishers at the prices stated.

Are the Dimensions of the Physical World Absolute? By the LATE PROF. B. J. DELBŒUF, Brussels. "The Monist," Vol. IV, No. 2. 50 cents.



SIR ISAAC NEWTON. (1642-1727.)

The Present State of Mathematics. By PROF. FELIX KLEIN, Goettingen. "The Monist," Vol. IV, No. 1. 50 cents.

The Non-Euclidean Geometry Inevitable. By DR. GEORGE BRUCE HALSTED, University of Texas. "The Monist," Vol. IV, No. 4. 50 cents.

On the Nature of Motion. By MAJOR J. W. POWELL, Smithsonian Institution, Washington, D. C. "The Monist," Vol. V, No. 1. 50c.

The Unseen Universe. By SIR ROBERT STAWELL BALL, LL. D., F. R. S., University of Cambridge, England. "The Monist," Vol. V, No. 4. 50 cents.

On the Nature of Roentgen's Rays. By PROF. HERMANN SCHUBERT, Hamburg, Germany. "The Monist," Vol. VI, No. 3. 50 cents.

On the Stereoscopic Application of Roentgen's Rays. By DR. ERNST MACH, University of Vienna. "The Monist," Vol. VI, No. 3. 50 cents.

Subconscious Pangeometry. By DR. GEORGE BRUCE HALSTED, University of Texas. "The Monist," Vol. VII, No. 1. 50 cents.

The Logic of Relatives. By CHARLES S. PEIRCE, Milford, Pa. "The Monist," Vol. VII, No. 2. 50 cents.

The Regenerated Logic. By CHARLES S. PEIRCE, Milford, Pa. "The Monist," Vol. VII, No. 1. 50 cents.

On the Foundations of Geometry. By PROF. H. POINCARÉ, The Sorbonne, Paris. "The Monist," Vol. IX, No. 1. 50 cents.

On Pasigraphy. Its Present State and the Pasigraphic Movement in Italy. By PROF. ERNST SCHROEDER, Carlsruhe. "The Monist," Vol. IX, No. 1. 50 cents.

De Morgan to Sylvester. By DR. GEORGE BRUCE HALSTED, University of Texas. "The Monist," Vol. X, No. 2. 50 cents.

On the Nature of Scientific Law and Scientific Explanation. By THOMAS J. McCORMACK. "The Monist," Vol. X, No. 4. 50 cents.

Philosophical Fragments. By BERNARD RIEMANN. "The Monist," Vol. X, No. 2. 50c.

Mathematical Principles of Esthetic Forms. By DR. ARNOLD EMCH, University of Colorado. "The Monist," Vol. XI, No. 1. 50 cents.

On the Recent Development of Method in Theoretical Physics. By PROF. LUDWIG BOLTZMANN, University of Leipsic. "The Monist," Vol. XI, No. 2. 50 cents.

Mathematics, Mechanics, Physics—Continued

- On Physiological, as Distinguished From Geometrical, Space.** By DR. ERNST MACH, University of Vienna. "The Monist," Vol. XI, No. 3. 50 cents.
- A Flaw in the Foundation of Geometry.** Translated from the "Ausdehnungslehre" of HERMANN GRASSMANN. "The Open Court," No. 77. O. P. In volumes only.
- Electrical Waves and Rays.** The Experiments of Prof. H. Hertz. By THOMAS J. McCORMACK. "The Open Court," Nos. 95 and 97. 20 cents.
- The Rings of Saturn.** By DR. M. WILHELM MEYER. "The Open Court," No. 168. 5c



GOTTFRIED WILHELM VON LEIBNITZ. (1646-1716.)

- Signs and Symbols.** By PROF. ERNST SCHROEDER, Karlsruhe. "The Open Court," Nos. 270, 271, and 274. 15 cents.
- Waves and Rays.** By DR. PAUL SPIES. "The Open Court," Nos. 246 and 247. 10 cents.
- Large Numbers.** By PROF. HERMANN SCHUBERT, Hamburg, Germany. "The Open Court," Nos. 329 and 330. 10 cents.
- The New X-Rays in Photography.** Professor Roentgen's Discovery. By T. J. McCORMACK. "The Open Court," Nos. 441 and 446. 10c.
- Euler, Lagrange, Laplace, Monge, Descartes, Pascal, DeMorgan.** Biographical Sketches. By THOMAS J. McCORMACK. "The Open Court," Nos. 498, 499, 500, 501, 507, 509, and 511 respectively. Price, 10 cents each.
- The Life of Pythagoras.** By PROF. MORITZ CANTOR, Heidelberg, Germany. "The Open Court," No. 493. 10 cents.
- Lobachévski.** By DR. GEORGE BRUCE HALSTED, University of Texas. "The Open Court," No. 506. 10 cents.
- The Concept.** By PROF. ERNST MACH, University of Vienna. "The Open Court," No. 529. 10 cents.
- Copernicus, Tycho Brahe, and Kepler.** By DR. ERNST KRAUSE (Carus Sterne), Berlin. "The Open Court," No. 530. 10 cents.
- Notion of a Continuum.** An Essay in the Theory of Science. By DR. ERNST MACH, University of Vienna. "The Open Court," No. 530. 10 cents.
- The Struggle Regarding the Position of the Earth.** By DR. ERNST KRAUSE (Carus Sterne), Berlin. "The Open Court," No. 531. 10 cents.
- The Curbing of the Spirit of Inquiry.** A Sketch of the History of the Conflict Between Theology and Science. By DR. ERNST KRAUSE (Carus Sterne), Berlin. "The Open Court," Nos. 533 and 534. 20 cents.
- The Year Zero.** A Brief Study in Chronology. By THOMAS J. McCORMACK. "The Open Court," No. 524. 10 cents.
- Names and Numbers.** By DR. ERNST MACH, University of Vienna. "The Open Court," No. 524. 10 cents.

Biology, Evolution, Etc.



CHARLES DARWIN, 1809-1882.

From a private photograph taken in Darwin's prime.

"Contains the ripest results of deep study of the evolutionary problem. . . . No student of the subject can afford to neglect this last volume of Romanes."—*Bibliotheca Sacra*.

Part III. Post-Darwinian Questions Isolation and Physiological Selection

Pp. 181. With portrait of Mr. Gulick. Cloth, \$1.00.

The three volumes of "Darwin and After Darwin" supplied to one order \$4.00 net.

Darwinism Illustrated

(Reprint of illustrations from Darwin and After Darwin, Part I.)

Wood engravings explanatory of the Theory of Evolution, selected by and drawn under the direction of Prof. G. J. Romanes. Designed for use in class and home instruction. Pp. 94. Paper, \$1.00.

An Examination of Weismannism

By GEORGE JOHN ROMANES. With Portrait of Weismann, and a Glossary of Scientific Terms. Thoroughly indexed. Pp. ix., 221. Cloth, \$1.00 net.

"The best criticism of the subject in our language."—*The Outlook*, N. Y.

"The reader of this work will appreciate from this discussion, better than from the writings of Weismann himself, the significance of the final position adopted by Weismann."—*Science*.

Darwin and After Darwin

An Exposition of the Darwinian Theory and a Discussion of Post-Darwinian Questions. By GEORGE JOHN ROMANES, LL. D., F. R. S.

Part I. The Darwinian Theory

Pp. xiv., 460. 125 illustrations. Second Edition. With portrait of Darwin. Cloth, \$2.00.

"A brilliantly written work."—*Review of Reviews*.

"The best single volume on the general subject since Darwin's time."—*American Naturalist*.

"The most lucid and masterly presentation of the Darwinian theory yet written."—*Public Opinion*.

"The best modern handbook of evolution."—*The Nation*.

Part II. Post-Darwinian Questions. Heredity and Utility

Pp. xii., 344. With portrait of Romanes. Cloth, \$1.50.

"The clearest and simplest book that has appeared in the sphere of the problems it discusses."—*Chicago Dial*.



AUGUST WEISMANN
Professor in the University of Freiburg in Breisgau.
(Born January 17, 1834.)

Biology, Evolution, Etc.—Continued

The Primary Factors of Organic Evolution

By E. D. COPE. 121 illustrations. Pp. 550. Tables, bibliography and index. Cloth, net, \$2.00. (10s.).

A comprehensive handbook of the Neo-Lamarckian theory of Evolution, drawing its main evidence from paleontology, as distinguished from œcology (Darwin) and embryology (Weismann). Discusses the "Energy of Evolution," and lays special emphasis on the function of consciousness in organic development.

"Will stand as the most concise and complete exposition of the doctrines of the Neo-Lamarckian school hitherto published. A most valuable text-book for teachers and students."—Science, N Y.

"A work of unusual originality. No one can read the book without admiring the intimate knowledge of facts and the great power of generalization which it discloses."—Prof. J. McK. Cattell.

On Germinal Selection

As a Source of Definitely Directed Variation. By AUGUST WEISMANN. Translated by THOMAS J. McCORMACK. Pp., xii, 61. Paper, 25c. (1s. 6d.).

"Professor Weismann considers this one of the most important of all his contributions on the evolution problem . . . important as marking some fundamental changes in Weismann's position."—Science, New York.

"Forms the crown and capshaf of Weismann's theory of heredity."—Exchange.

On Orthogenesis (Definite Evolution)

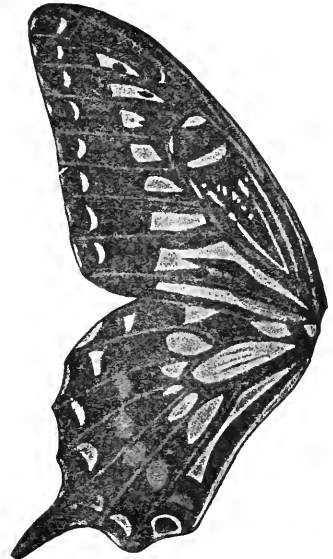
Or the Impotence of Darwinian Selection in the Formation of Species. By TH. EIMER, Professor of Zoology in the University of Tuebingen. Translated by THOMAS J. McCORMACK. 19 cuts. Pp., 56. Paper 25c. (1s. 6d.).

This little brochure was written in reply to Weismann's "Germinal Selection." Prof. Eimer argues upon the same lines as the American Neo-Lamarckians, Cope, Hyatt, etc. His doctrine of orthogenesis, which he declares to be a universally valid law, has been framed to show that organisms develop in definite directions, without regard for utility, through purely physiological causes, through the transmission of acquired characters, through the combined agency of the constitution of the animal and the effects of outward influences.

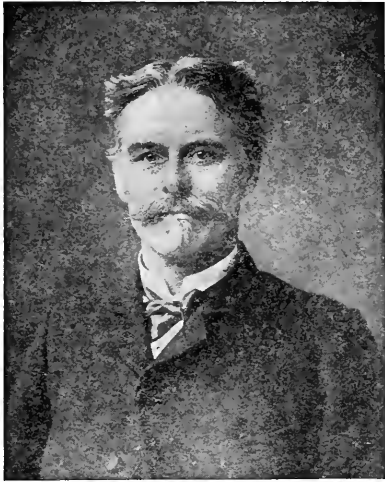
A Mechanico-Physiological Theory of Organic Evolution

Summary. By CARL VON NÆGELI. Translated by V. A. CLARK and F. A. WAUGH, of the University of Vermont. The only original account of Naegeli's theories in English. Pp., 52. Price, paper, 15 cents. (9d.)

Naegeli was the first to propose the general theory of cell-formation accepted to-day. The present little brochure, which is a synopsis of his great work on evolution, will render his difficult theories accessible to English-speaking students, to whom they have hitherto been almost a sealed book.



Butterfly's Wing from Eimer's ORTHOGENESIS. Illustrating the Definite Character of Evolution.



E. D. COPE. 1840-1897.

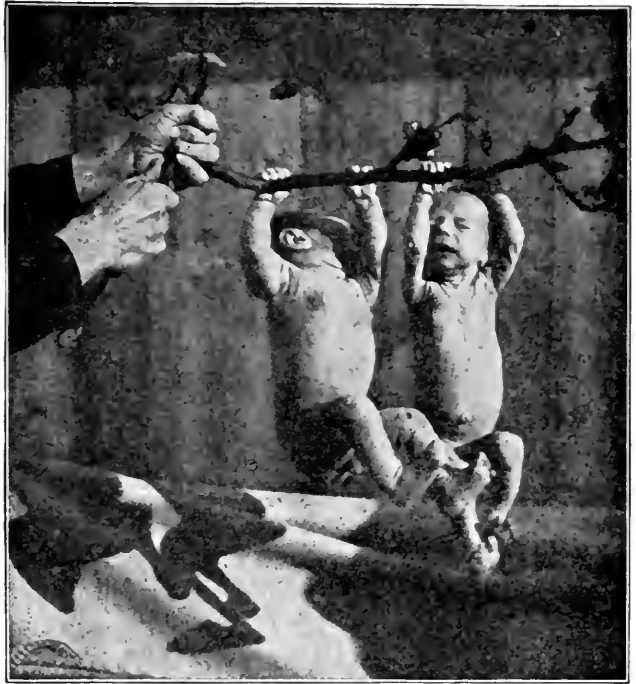
"One of the Great Men of Science of the World."
—Science, New York, Sept., 1896.

Biology, Evolution, Etc.—Continued

A First Book in Organic Evolution

An Introduction to the Study of the Development Theory by D. KERFOOT SHUTE, M.D., Professor of Anatomy in the Medical Department of the Columbian University, Member of the Association of American Anatomists, Member of the Washington Microscopical Society, etc. Pages, xvi—285, 39 illustrations—9 in natural colors. Price, cloth, \$2.00 net (7s. 6d. net).

"It is a presentation of the subject for the general reader which is masterly, clear, and entertaining. A profound subject is thoroughly grasped; a technical subject is made plain; and a complex subject is made simple. I am especially delighted with it as a book for auxiliary reading in the High Schools and Colleges of the country."—Major J. W. Powell, Smithsonian Institution, Washington, D. C.



THE GRASPING POWER OF INFANTS. (From Shute's ORGANIC EVOLUTION.)

The Principles of Bacteriology

By DR. FERDINAND HUEPPE, Professor of Hygiene in the University of Prague. Translated from the German and annotated by EDWIN O. JORDAN, Ph.D., Professor in the University of Chicago. 28 cuts. Five colored plates. Pages, 465—x. Price, \$1.75 net (9s.). Invaluable to the physician, the scientist, the student of hygiene, and practical people in all walks of life.

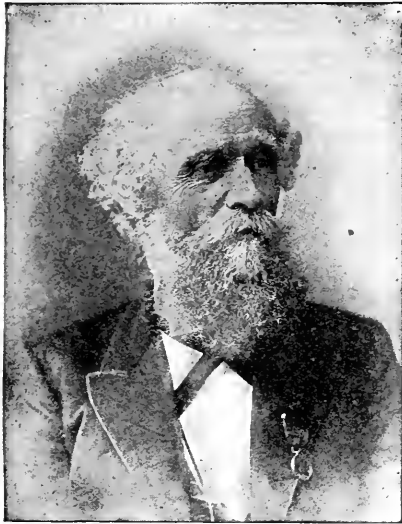
"It affords more ground for serious thought and reflection than perhaps any of the works on bacteriology hitherto published. The original and able manner in which the author attacks biological problems of great difficulty and complexity deserves all praise, and we can cordially recommend the book, not only to bacteriologists pure and simple, but also to those physicians who recognize the limitations of medical science."—Nature.

Articles Published in The Monist and The Open Court on Subjects Related to Biology and Evolution

Copies of "The Monist" and "The Open Court" containing the articles here listed will be supplied by the publishers at the prices stated.

- A. R. Wallace on Physiological Selection.** By PROF. GEORGE J. ROMANES. "The Monist," Vol. 1, No. 1. 50 cents.
- On the Material Relations of Sex in Human Society.** By PROF. E. D. COPE. "The Monist," Vol. 1, No. 1. 50 cents.
- The Immortality of Infusoria.** By DR. ALFRED BINET. "The Monist," Vol. 1, No. 1. 50 cents.

Biology, Evolution, Etc.—Continued



JOSEPH LE CONTE.
(1823-1901.)

The Factors of Evolution. By JOSEPH LE CONTE. "The Monist," Vol. I, No. 3. 50 cents.

The Continuity of Evolution. The Science of Language versus The Science of Life, as represented by Prof. F. Max Mueller and Prof. G. J. Romanes. By DR. PAUL CARUS. "The Monist," Vol. II, No. 1. 50 cents.

Mental Evolution. An Old Speculation in a New Light. By PROF. C. LLOYD MORGAN. "The Monist," Vol. II, No. 2. 50 cents.

The Nervous Ganglia of Insects. By DR. ALFRED BINET. "The Monist," Vol. III, No. 1. 50c.

Panpsychism and Panbiotism. By DR. PAUL CARUS. "The Monist," Vol. III, No. 2. 50 cents.

Automatism and Spontaneity. By DR. EDMUND MONTGOMERY. "The Monist," Vol. IV, No. 1. 50 cents.

Dr. Weismann on Heredity and Progress. By PROF. C. LLOYD MORGAN. "The Monist," Vol. IV, No. 1. 50 cents. Regarded by Prof. Weismann as one of the most powerful criticisms of his doctrine.

The Nervous Centre of Flight in Coleoptera. By ALFRED BINET. "The Monist," Vol. IV, No. 1. 50 cents.

The Problem of Woman From a Bio-Sociological Point of View. By DR. G. FERRERO. "The Monist," Vol. IV, No. 2. 50 cents.

Modern Physiology. By DR. MAX VERWORN, Professor of Physiology in the University of Jena. "The Monist," Vol. IV, No. 3. 50 cents.

Longevity and Death. (A Posthumous Essay.) By the late PROF. GEORGE J. ROMANES. "The Monist," Vol. V, No. 2. 50 cents.

To Be Alive, What Is It? By DR. EDMUND MONTGOMERY. "The Monist," Vol. V, No. 2. 50 cents.

Bonnet's Theory of Evolution. By PROF. C. O. WHITMAN. "The Monist," Vol. V, No. 3. 50 cents.

The Theory of Evolution and Social Progress. By PROF. JOSEPH LE CONTE. "The Monist," Vol. V, No. 4. 50 cents.

Naturalism. By PROF. C. LLOYD MORGAN. "The Monist," Vol. VI, No. 1. 50 cents.

From Animal to Man. By PROF. JOSEPH LE CONTE. "The Monist," Vol. VI, No. 3. 50 cents.

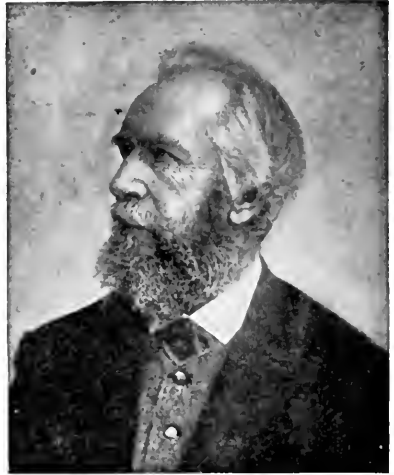
Some Points in Intracranial Physics. By DR. JAMES CAPPIE. "The Monist," Vol. VII, No. 3. 50 cents.



PROF. C. LLOYD MORGAN.
(Born February 6, 1852.)

Biology, Evolution, Etc.—Continued

- Illustrative Studies in Criminal Anthropology.** (1) "La Bête Humaine" and Criminal Anthropology. (2) Psychiatry and Criminal Anthropology. By PROF. CESARE LOMBROSO. "The Monist," Vol. I, No. 2. 50 cents.
- On Egg-Structure and the Heredity of Instincts.** By PROF. JACQUES LOEB, of the University of Chicago. "The Monist," Vol. VII, No. 4. 50 cents.
- The Aryans and the Ancient Italians.** A Page of Primitive History. By G. SERGI. "The Monist," Vol. VIII, No. 2. 50 cents.
- Regressive Phenomena in Evolution.** By PROF. CESARE LOMBROSO. "The Monist," Vol. VIII, No. 3. 50 cents.
- Assimilation and Heredity.** By PROF. JACQUES LOEB, University of Chicago. "The Monist," Vol. VIII, No. 4. 50 cents.
- Evolution Evolved.** A Philosophical Criticism. By PROF. ALFRED H. LLOYD, University of Michigan. "The Monist," Vol. IX, No. 2. 50 cents.
- The Primitive Inhabitants of Europe.** By PROF. GIUSEPPE SERGI, University of Rome, Italy. "The Monist," Vol. IX, No. 3. 50 cents.
- Vitalism.** By PROF. C. LLOYD MORGAN. "The Monist," Vol. IX, No. 2. 50 cents.
- Biology and Metaphysics.** By PROF. C. LLOYD MORGAN. "The Monist," Vol. IX, No. 4. 50 cents.
- The Man of Genius.** By PROF. GIUSEPPE SERGI, University of Rome, Italy. "The Monist," Vol. X, No. 1. 50 cents.
- The Psychic Life of Micro-Organisms.** A Controversy Between DR. ALFRED BINET and PROF. G. J. ROMANES. "The Open Court," Nos. 98, 116 and 127. Out of print.
- On Retrogression in Animal and Vegetable Life.** By PROF. AUGUST WEISMANN. "The Open Court," Nos. 105, 107, 108, 109. 40 cents.
- Evolution and Human Progress.** By PROF. JOSEPH LE CONTE. "The Open Court," No. 191. 5 cents.
- Phylogeny and Ontogeny.** By PROF. ERNST HAECKEL. From the "Phylogenic." "The Open Court," No. 214. 5 cents.
- Instinct and Intelligence in Chicks and Ducklings.** By PROF. C. LLOYD MORGAN. "The Open Court," No. 348. 5 cents.
- The General Phylogeny of the Protista.** By PROF. ERNST HAECKEL. "The Open Court," No. 391. 5 cents.
- The Kingdom of Protista.** By PROF. ERNST HAECKEL. "The Open Court," No. 394. 5c.
- The Cellular Soul.** By PROF. ERNST HAECKEL. From Haeckel's "Phylogenic." "The Open Court," No. 396. 5 cents.
- The Phylogeny of the Plant-Soul.** By PROF. ERNST HAECKEL. From the "Phylogenic." "The Open Court," No. 398. 5 cents.
- Epigenesis or Preformation.** By PROF. ERNST HAECKEL. "The Open Court," No. 405. 5c.



PROF. ERNST HAECKEL.
(Born February 16, 1834.)


THE POPULAR SCIENCE MONTHLY

CONTENTS OF THE SEPTEMBER NUMBER.

Aerography. PERCIVAL LOWELL.
University Control. PROF. J. J. STEVENSON.
The World-view of a Scientist: Ernst Haeckel's Philosophy. PROF. FRANK THILLY.
Eels and the Eel-Question. M. C. MARSH.
The Story of a Word—Mammal. DR. THEO. GILL.
A Year of Weather and Trade in the United States. PROF. R. DE C. WARD.
Mental and Moral Heredity in Royalty. DR. FREDERICK ADAMS WOODS.
A New Theory of Light and Colors. SIR ISAAC NEWTON.
Discussion and Correspondence:
Are Fellowships Almsgiving or Investments? MRS. W. A. KELLERMAN.
The Progress of Science:
The Carnegie Institution and the Marine Biological Laboratory; Science in American Journals; A Graduate School of Agriculture; Biographies of Eminent Chemists; The Comparative Growth of Bacteria in Milk; Scientific Items.

CONTENTS OF THE OCTOBER NUMBER.

Rudolf Virchow. Frontispiece.
A Study in Plant Adaptation. PROF. J. W. TOUMEY.
The American Origin of Agriculture. O. F. COOK.
Mental and Moral Heredity in Royalty. DR. FREDERICK ADAMS WOODS.
The Competition of the United States with the United Kingdom. DR. JOHN WADDELL.
Scientific Reading in a Public Library. ARTHUR E. BOSTWICK.
An Ascent of Mt. Orizaba. PROF. ALJA ROBINSON CROOK.
Origin of the Fins of Fishes. PRESIDENT DAVID STARR JORDAN.
Domestic and Intercollegiate Athletics. PROF. CALVIN M. WOODWARD.
Recent Advances in Science and their Bearing on Medicine and Surgery. PROF. RUDOLF VIRCHOW.
Discussion and Correspondence:
Are Fellowships Almsgiving or Investments? PRESIDENT DAVID STARR JORDAN.
College Professors: PRESIDENT C. W. SUPER.
The Progress of Science:
Rudolf Virchow; Scientific Eminence; The New British Order and Academy; The President's Address before the British Association; The International Council for the Study of the Sea; Scientific Items.
Index to Volume LXI.

 The MONTHLY will be sent to new subscribers for six months for One Dollar.

SUBSCRIPTION ORDER

To THE SCIENCE PRESS,
Publishers of THE POPULAR SCIENCE MONTHLY,
Sub-Station 84, New York City.

Please find enclosed check or money order for three dollars, subscription to THE POPULAR SCIENCE MONTHLY for one year, beginning

.....1902.
Please find enclosed from a new subscriber one dollar (sent at your risk), subscription for six months to THE POPULAR SCIENCE MONTHLY, beginning.....1902.

Name.....

Address.....

Single Numbers, 30 Cents.

Yearly Subscription, \$3.00.

THE SCIENCE PRESS

GARRISON-ON-HUDSON, N. Y.

41 NORTH QUEEN ST., LANCASTER, PA.

SUB-STATION 84: NEW YORK.

"A Weekly Feast to Nourish Hungry Minds."—*N. Y. Evangelist.*

FOUNDED BY E. LITTELL IN 1844.

THE LIVING AGE

THE LIVING AGE, one of the oldest and most widely known of American literary magazines, was founded by E. LITTELL in 1844, and has been published without interruption for fifty-seven years.

It presents the cream of foreign periodical literature, and reprints without abridgement the most noteworthy essays, travel sketches, fiction, social and political papers, and discussions of literary, artistic and scientific subjects from the leading quarterlies, monthly magazines and reviews, and literary and scientific weekly journals.

To these long-established and distinctive features, it has added an editorial department, devoted to "Books and Authors," in which are published, weekly, paragraphs of literary news and comment, and careful, honest and discriminating notices of the more important new publications.

THE LIVING AGE

Holds a unique position in the periodical world as a weekly eclectic magazine. Intelligent Americans who want presented to them from week to week the most important and timely articles from foreign periodicals find what they want in THE LIVING AGE, *and can find it nowhere else.*

THE LIVING AGE

Is a weekly sixty-four page magazine, which prints in the course of a year twice as much matter as most of the monthly magazines, and is able, by reason of its wide field of selection, to publish articles by a *larger number of writers of the first rank* than any other magazine.

TO INTRODUCE THE MAGAZINE

To readers who are not now familiar with it, the publishers of THE LIVING AGE will send it by mail, postpaid, to any name not already on the subscription lists, for

Three Months, Thirteen Weeks, For One Dollar

These thirteen issues will aggregate about eight hundred and fifty octavo pages of the World's Best Current Literature. Subscriptions may begin with any desired date.

THE LIVING AGE COMPANY

P. O. BOX 5206.

BOSTON, MASS.

A UNIQUE MATHEMATICAL WORK

Geometric Exercises in Paper-Folding

By T. SUNDARA ROW. Edited and revised by W. W. BEMAN and D. E. SMITH. With many half-tone engravings from photographs of actual exercises, and a package of papers for folding. Pages, x, 148. Price, cloth, \$1.00 net (4s. 6d. net.).

"I have sought not only to aid the teaching of geometry in schools and colleges, but also to afford mathematical recreation to young and old, in an attractive and cheap form. 'Old boys' like myself may find the book useful to revive their old lessons, and to have a peep into modern developments which, although very interesting and instructive, have been ignored by university teachers."—From the author's *Preface*.

THE OPEN COURT PUBLISHING CO., CHICAGO,
324 Dearborn St.

LONDON: Kegan Paul, Trench, Trübner & Co.

INTERESTING BOOK ON EGYPT

THE

BOOK OF THE DEAD

An English Translation of the Chapters, Hymns, etc., of the Theban Recension, with Introduction, Notes, etc. By E. A. WALLIS BUDGE, M. A., Litt. D., D. Lit., Keeper of the Egyptian and Assyrian Antiquities in the British Museum. With four hundred and twenty vignettes, which do not appear in the larger edition published in 1897. Three vols. Crown 8vo. Price, \$3.75 net. Just Published.

The Open Court Publishing Company, Chicago
Monon Building - - 324 Dearborn Street.

Attractive Combined Offers

Asiatic Russia (postpaid) - - -	\$7.95
Records of the Past - - - -	2.00
The Open Court - - - -	1.00
Bibliotheca Sacra - - - -	3.00
	<hr/>
	\$13.95

All four for \$10.75.

Asiatic Russia (postpaid) - - -	\$7.95
The Open Court - - - -	1.00
Bibliotheca Sacra - - - -	3.00
	<hr/>
	\$11.95

All three for \$9.75.

Records of the Past - - - -	\$2.00
The Open Court - - - -	1.00
Bibliotheca Sacra - - - -	3.00
	<hr/>
	\$6.00

All three for \$4.75.

Asiatic Russia.—“A work of highest authority, presented with literary grace and skill. . . . The result of prodigious scholarship and wide observation presented in easy, readable style.”—*The Critic*.

Records of the Past.—A new monthly periodical published at Washington, D. C., under the editorship of Rev. Henry Mason Baum, D. C. L., with Mr. Frederick Wright as assistant. Each number contains thirty-two quarto pages, accompanied with numerous elegant illustrations.

Remittances, strictly in advance, may be made by Money Order, New York Draft, or Registered Letter to

Bibliotheca Sacra Co., Oberlin, Ohio, U. S. A.

REPRINTS OF SCIENCE CLASSICS.

No. 1.

THE ANALYSIS OF AIR AND WATER, being selections from LAVOISIER'S ELEMENTARY TREATISE OF CHEMISTRY. Translated and annotated by C. E. Linebarger. Double number. Ten cents.

The laboratory method of science teaching, at first applied to supplement the text-book, has proved so valuable that the text-book work has in a measure become subordinate to the laboratory work. In the laboratory the student comes in direct contact with the facts of science, and uses his text-book mainly to supplement and correlate what he has learned in the laboratory. The text-book, however, too often proves inadequate. From his experience in getting knowledge at first hand in the laboratory, the student comes to feel a desire to get his knowledge of matters which from lack of time and facilities he cannot study by laboratory methods, also at first hand; he wants to consult the original sources of the knowledge of the facts given in the text. The value of "supplementary reading," as it is called, is universally recognized in the study of history and literature. It gives the student a breadth and power impossible otherwise. And so it would be in the study of science, if the original sources of information were readily accessible.

To meet this want is the object of the series of "Reprints of Science Classics." These consist of selections from the writings of the pioneers of science, so edited as to be within the comprehension of the beginner in science. They embrace the sciences of **Biology (Botany, Zoology and Physiology)**, **Chemistry, Physics, Astronomy, Physiography**, etc., and are accompanied with copious notes, reproductions of cuts and plates, biographical sketches and other matter calculated to arouse interest and bold attention. Each "Reprint" is edited by a man who is a teacher as well as a scientist. It is believed that the study of such "Reprints" cannot fail to inculcate more of the true scientific spirit into science education and to make it more and more of a training for power.

(In Preparation.)

THE MECHANICAL EQUIVALENT OF HEAT. A Literal Transcript from the Original Papers, by James Prescott Joule. Edited by F. A. Osborn, Professor of Physics in Olivet College.

The School Science Press, Ravenswood, Chicago, Ill.

TOUT LE MONDE LIT la revue internationale illustrée

L'Humanité Nouvelle

La moins couteuse, la mieux faite, la plus complète de toutes les revues de langue française. Organe libre des tendances les plus larges en matières scientifiques et artistiques.

L'Humanité Nouvelle

paraît mensuellement en un volume illustré in-8° rasain de 128 pages.

La revue ne publie que de l'inédit.

Sciences sociologiques (politique, histoire, socialisme), géographiques, biologiques, etc.; Philosophie; Contes; Vers; Théâtre; Critique littéraire et artistique, etc. Revue des livres et revues de toutes les langues et sur tous sujets.

Directeurs: A. Hamon et V. Emile-Michelet

Aucune revue ne peut rivaliser avec *L'Humanité Nouvelle*.

Abonne-ments	} France et Belgique	Un an Six mois Un numéro		
		15	8	1 75
	} Union postale	20	10	2 "

Envoi d'un numéro spécimen franco sur demande

3 bis, Cours de Rohan, Paris, 6e
62, Rue Montagne de la Cour, Bruxelles



To the West

The North-Western Line is the only double track railway from Chicago to the Missouri River.

The double track is now completed between Chicago and Council Bluffs. Four fast trains each way daily between Chicago and Omaha, three trains daily to the Pacific Coast and two to Denver.

A double track railway across the western prairies means a great deal of history-making, empire-building, American energy.

The story of the western country and of the Pioneer Line that has played so great a part in its progress is interestingly told in a booklet which will be sent on receipt of a two-cent stamp to pay postage.

W. B. KNISKERN, GEN'L PASS'R & TKT AGT.
CHICAGO

ESSAYS ON NUMBER

- I. CONTINUITY AND IRRATIONAL NUMBERS.
II. THE NATURE AND MEANING OF NUMBERS.

By *Richard Dedekind*, Professor in Brunswick, Germany. Authorised Translation by *Wooster Woodruff Beman*. Pages, 115. Red Cloth, 75 cents.

CONTENTS

I. Continuity and Irrational Numbers: Properties of Rational Numbers; Comparison of the Rational Numbers with the Points of a Straight Line; Continuity of the Straight Line; Creation of Irrational Numbers; Continuity of the Domain of Real Numbers; Operations with Real Numbers; Infinitesimal Analysis.

II. The Nature and Meaning of Numbers: Systems of Elements; Transformation of a System; Similarity of a Transformation. Similar Systems; Transformation of a System in Itself; The Finite and Infinite; Simply Infinite Systems. Series of Natural Numbers; Greater and Less Numbers; Finite and Infinite Parts of the Number-Series; Definition of a Transformation of the Number-Series by Induction; The Class of Simply Infinite Systems; Addition of Numbers; Multiplication of Numbers; Involution of Numbers; Number of the Elements of a Finite System.

"The work of Dedekind is very fundamental, and I am glad to have it in this carefully-wrought English version. I think the book should be of much service to American mathematicians and teachers."—*Prof. E. H. Moore*, University of Chicago.

"It is to be hoped that the translation will make the essays better known to English mathematicians; they are of the very first importance, and rank with the work of Weierstrass, Kronecker, and Cantor in the same field."—*Nature*.

THE OPEN COURT PUBLISHING CO., CHICAGO

LONDON: KEGAN PAUL, TRENCH, TRÜBNER & Co., LTD.



French Lick Springs

In the Indiana Highlands

On the Monon Route

New hotel, of brick and stone. Golf links, saddle horses, etc.

Pluto spring, sulphur-saline, similar to Karlsbad, but stronger.

Send for booklet.

Frank J. Reed, G. P. A.

CHICAGO.



BETWEEN

CHICAGO AND KANSAS CITY,
CHICAGO AND ST. LOUIS,
CHICAGO AND PEORIA,
ST. LOUIS AND KANSAS CITY.

THROUGH FULLEMAN SERVICE
BETWEEN CHICAGO AND

HOT SPRINGS, ARK., DENVER, Colo.,
TEXAS, FLORIDA, UTAH,
CALIFORNIA AND OREGON.

IF YOU ARE CONTEMPLATING A TRIP, ANY PORTION OF WHICH CAN BE MADE OVER THE CHICAGO & ALTON, IT WILL PAY YOU TO WRITE TO THE UNDERSIGNED FOR RATES, MAPS, TIME-TABLES, ETC.

GEO. J. CHARLTON,
GENERAL PASSENGER AGENT,
CHICAGO, ILL.

RECENTLY PUBLISHED!

HYMNS OF THE FAITH

(DHAMMAPADA)

Being an Ancient Anthology Preserved in the Short Collection of the Sacred Scriptures of the Buddhists. Translated from the Páli by ALBERT J. EDMUNDS. Cloth binding, gilt top. Printed on India tint paper. Pages, xiv, 110. Price, \$1.00.

"This celebrated ancient anthology of Buddhist devotional poetry was compiled from the utterances of Gotamo and his disciples; from early hymns by monks; and from the popular poetic proverbs of India. . . .

"If ever an immortal classic was produced upon the continent of Asia, it is this. Its sonorous rolls of rhythm are nothing short of inspired. No trite ephemeral songs are here, but red-hot lava from the abysses of the human soul, in one out of the two of its most historic eruptions."—*Translator's Preface.*

THE OPEN COURT PUBLISHING CO., CHICAGO, ILL.

LONDON: KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.

Foundations of Geometry

A systematic discussion of the axioms upon which the Euclidean Geometry is based. By DAVID HILBERT, Professor of Mathematics, University of Göttingen. Translated from the German by E. J. TOWNSEND, University of Illinois. Pages, 140. Price, Cloth, \$1.00 net (4s. 6d. net).

Recently Published!

Defining the elements of geometry, points, straight lines, and planes, as abstract things, Professor Hilbert sets up in this book a simple and complete set of independent axioms defining the mutual relations of these elements in accordance with the principles of geometry; that is, in accordance with our intuitions of space. The purpose and importance of the work is his systematic discussion of the relations of these axioms to one another and the bearing of each upon the logical development of the Euclidean geometry. The most important propositions of geometry are also demonstrated and in such a manner as to show exactly what axioms underlie and make possible the demonstration. The work is therefore not only of mathematical importance as a contribution to the purifying of mathematics from philosophical speculation, but it is of pedagogical importance in showing the simplest and most logical development of our analysis of space relations.

THE OPEN COURT PUBLISHING CO., CHICAGO,
324 Dearborn St.

LONDON: Kegan Paul, Trench, Trübner & Co., Ltd.

New Books on the Old Testament

BABEL AND BIBLE.

A Lecture on the Significance of Assyriological Research for Religion Twice Delivered Before the German Emperor. By **Dr. Friedrich Delitzsch**, Professor of Assyriology in the University of Berlin. Translated from the German by **Thomas J. McCormack**. Profusely illustrated from the best sources on Assyriology. Fifty-nine half-tone and photo-zinc engravings depicting every phase of Assyrio-Babylonian life and art. Pp. 66. Price, boards, 50 cents net (2s. 6d. net).

This lecture is by one of the foremost Assyriologists and theologians of the world. It gives in brief compass the history of Babylon and its civilisation and portrays the immense influence it exerted on all early antiquity, and especially on the religious conceptions of the Jews and hence on us their spiritual descendants. This lecture aroused much discussion in Germany, and is creating no little comment in its present English translation.

THE CREATION-STORY OF GENESIS I.

A Sumerian Theogony and Cosmogony. By **Dr. Hugo Radau**. Pages, 70, vi. Price, boards, 75 cents net (3s. 6d. net).

This work is an exhaustive and erudite investigation, on the ground of Sumerian sources accessible only to a few scholars, of the creation-story of the Bible, which is proved, in part, to be the redaction of a Sumerian theogony and cosmogony. The booklet offers something entirely new in this direction and sheds a new and unexpected light on the most discussed chapter of the Bible.

BIBLICAL LOVE-DITTIES.

A Critical Interpretation, and Translation, of the Song of Solomon. By **Paul Haupt**, Professor in the Johns Hopkins University, Baltimore. Price, paper pamphlet, 5 cents (3d.).

The great Biblical scholar of Johns Hopkins University here offers a new translation and interpretation of the famous Song of Solomon. He says: "The late Professor Franz Delitzsch, of Leipzig, one of the foremost Biblical scholars of the nineteenth century and one of the most devout Christians I ever met in my life, stated in the introduction to his commentary on the Song of Solomon, that this Book was the most difficult book in the Old Testament, but the meaning becomes perfectly plain, in fact too plain, as soon as we know that it is not an allegorical dramatic poem but a collection of popular love-ditties which must be interpreted on the basis of the erotic imagery in the Talmud and modern Palestinian and other Mohammedan poetry."

The Open Court Publishing Company

324 DEARBORN STREET., CHICAGO

London: KEGAN PAUL, TRENCH, TRÜBNER & CO., Ltd.