SCIENCE

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DEVOTED TO THE ADVANCEMENT OF SCIENCE.

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CONTENTS AND INDEX.

N. S. VOL. I.—JANUARY TO JUNE, 1895.

The Names of Contributors are Printed in Small Capitals.

ERRATA:—p. 144, col. 2, line 34: for these, read three. p. 153, col. 2, line 59: for Maupertius, read Maupertuis. p. 212, col. 1, line 11: for plan, read phase. p. 213, col. 1, line 13: for cooking, read working. p. 334, col. 1, line 23: for Styles, read Stiles. p. 457, col. 2, line 23: for cinipidæ, read Cynipidæ.

SCIENCE.

FRIDAY, JANUARY 4, 1895.

CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison on Hudson, N. Y.
Subscriptions (five dollars annually) and advertisements should be sent to the Publisher of SCIENCE, 41 East 49th St., New York.

TO OUR READERS.

AFTER a brief period of suspension this journal again appears, greeting its readers with the compliments of the season. The interest in its future which has been shown in various quarters during the past few months, convinces its editorial staff that there is room for a journal devoted to the promotion of intercourse among those interested in the study of nature. The separation of our investigators around many widely separated centres, and the consequent lack of communication between them, increases the necessity of such a journal, as well as the difficulty of adapting it to the wants of all classes of subscribers. The experience of centuries shows that great success in advancing scientific knowledge cannot be expected even from the most gifted men, so long as they remain isolated. The attrition of like minds is almost as necessary to intellectual production as companionship is to conversation. In saying this I am not unmindful that such men as Copernicus, Kepler and Leibnitz were little stimulated by the companionship of other minds while thinking out their great works. But if the age for discoveries of the kind which these men made is not past, it is certain that work of the kind they did can be repeated only once in many generations. What other and less fortunate investigators have to do is to develop ideas, investigate facts, and discover laws. The commencement of this work of development on a large scale, and with brilliant success, was coeval with the formation of the Royal Society of London and the Academy of Sciences of France. When these bodies came together their members began to talk and to think. How imperfectly they thought, and how little they knew the way to learn, is shown more fully by the history of their debates and by the questions discussed at their meetings than by anything contained in the ponderous volumes of their transactions.

At the present day one of the aspects of American science which most strikes us is the comparative deficiency of the social element. We have indeed numerous local scientific societies, many of which are meeting with marked success. But these bodies cannot supply the want of national coöperation and communication. The field of each is necessarily limited, and its activities confined to its own neighborhood. We need a broader sympathy and easier communication between widely separated men in every part of the country. Our journal aims to supply the want of such a medium, and asks the aid of all concerned in making its efforts successful. It will have little space for technicalities which interest only the specialist of each class, and will occupy itself mostly with those broader aspects of thought and culture which are of interest not only to scientific investigators, but to educated men of every profession. A specialist of one department may know little more of the work of a specialist in another department than does the general reader. Hence, by appealing to the interests of the latter, we do not neglect those of the scientific profession. At the same time, it is intended that the journal shall be much more than a medium for the popularization of science. Underlying the process of specialization which is so prominent a feature of all the knowledge of our time there is now to be seen a tendency toward unification, a development of principles which connect a constantly increasing number of special branches. The meeting of all students of nature in a single field thus becomes more and more feasible, and in promoting intercourse among all such students SCIENCE hopes to find a field for its energies, in which it may invite the support of all who sympathize with its aim. S. NEWCOMB.

WASHINGTON.

SCRIPTORIBUS ET LECTORIBUS, SALUTEM.

EVERYBODY interested in SCIENCE knows what it ought to be, bright, varied, accurate, fresh, comprehensive, adapted to many men of many minds; a newspaper, in fact, planned for those who wish to follow a readable record of what is in progress throughout the world, in many departments of knowledge. It is not the place for 'memoirs,' but for 'pointers;' not for that which is so technical that none but a specialist can read it; not for controversies, nor for the advancement of personal interests, nor for the riding of hobbies. It should not be maintained for the dominant advantage of any profession, institution or place. Wordiness is inappropriate; so, on the other hand, are figures and symbols, unless they are indispensable. Reviews, summaries, preliminary announcements, descriptions, extracts, correspondence, reports of meetings, biographies, should all find a place; but they must be put in the right sort of phrases and paragraphs. 'There's the rub.' Who is to collect, prepare, revise and set forth these accounts of what is going on in the wide domains of investigation? Money helps to secure such articles, but the work must be done 'for love and not for money.' Altruism is called for, the willingness, if not the desire, on the part of scientific workers, even in the very highest classes, to contribute prompt, brief, readable, trustworthy reports of what is going on, with fitting comments.

Scientific men have rarely the editorial instincts or aptitudes, like those of the editors of *Nature*, the *Popular Science Monthly*, the *Journal of Science*. Caution, close attention to details, precise expressions, are indeed theirs, but readiness to collect and impart news, and ability to make use of the phraseology of common life, are often wanting. There are noteworthy exceptions among men of the first rank. Dr. Asa Gray, the botanist, could say what he had to say in a clear and interesting manner, and Clerk Maxwell, the mathematical physicist, could write paragraphs and verses racy enough for *Punch*. No better writers of instructive and agreeable English can be wished for than Darwin, Tyndall, Huxley and Spencer. SCIENCE hopes to be so fortunate as to discover and awaken the desired talent among the American students of nature. Its experience is worth something. Its managers know the rocks and shoals that must be avoided. They will welcome aid, suggestions, contributions, news, from every quarter. They ask cooperation. They believe that the art of writing can be acquired. One of the fundamental canons of success is to write so clearly that the rapid reader can perceive what is meant.

Such will be the aims of the new management of SCIENCE.

Finally,—

"If to do were as easy as to know what were good to do, chapels had been churches and poor men's cottages princes' palaces. It is a good divine that follows his own instructions: I can easier teach twenty what were good to be done, than to be one of the twenty to follow mine own teaching."

D. C. GILMAN.

JOHNS HOPKINS UNIVERSITY.

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*THE CHARACTER AND AIMS OF SCIENTIFIC INVESTIGATION.**

THE influence of this Association is in the highest and best sense of the word *educational*. Its discussions are aimed to present the correct methods of scientific investigation and to be guided by the true spirit of scientific inquiry. Permit me to explain this statement a little, for in it lies more than anywhere else the right to existence of our organization and the best effects it can exert upon its own members or upon a community where it convenes.

The goal which we endeavor to attain is *scientific truth*, the one test of which is that it will bear untrammelled and unlimited investigation. Such truth must be not only verified, but always verifiable. It must welcome every test; it must recoil from no criticism, higher or lower, from no analysis and no skepticism. It challenges them all. It asks for no aid from faith; it appeals to no authority; it relies on the dictum of no master.

The evidence, and the only evidence, to which it appeals or which it admits, is that which is in the power of every one to judge —that which is furnished directly by the senses. It deals with the actual world about us, its objective realities and present activities, and does not relegate the inquirer to dusty precedents or the mouldy maxims of commentators. The only conditions which it enjoins are that the imperfections of the senses shall be corrected as far as possible, and that their observations shall be interpreted by the laws of logical induction.

Its aims are distinctly beneficent. Its spirit is that of charity and human kindness. From its peaceful victories it returns laden with richer spoils than ever did warrior of old. Through its discoveries the hungry are fed and the naked are clothed by an improved agriculture and an increased food supply; the dark hours are deprived of their gloom through methods of ampler illumination; man is brought into friendly contact with man through means of rapid transportation; sickness is diminished and pain relieved by the conquests of chemistry and biology; the winter wind is shorn of its sharpness by the geologist's discovery of a mineral fuel; and so on, in a thousand ways, the comfort of our daily lives and the pleasurable employment of

*From the introductory address of Dr. Daniel G. Brinton, President of the American Association for the Advancement of Science, at the annual meeting in Brooklyn, August, 1894.

our faculties are increased by the administrations of science.

Scientific truth has likewise this trait of its own; it is absolutely open to the world; it is as free as air, as visible as light. There is no such thing about it as an inner secret, a mysterious gnosis, shared by the favored few, the select illuminati, concealed from the vulgar horde, or masked to them under ambiguous terms. Wherever you find mystery, concealment, occultism, you may be sure that the spirit of science does not dwell and, what is more, that it would be an unwelcome intruder. Such pretensions belong to pseudo-science, to science falsely so called, shutting itself out of the light because it is afraid of the light.

Again, that spirit of science which we cultivate and represent is at once modest in its own claims and liberal to the claims of others. The first lesson which every sound student learns is to follow his facts and not to lead them. New facts teach him new conclusions. His opinions of today must be modified by the learning of the morrow. He is at all times ready and willing to abandon a position when further investigation shows that it is probably incorrectly taken. He is in this the reverse of the opinionated man, the hobby rider and the dogmatist. The despair of a scientific assemblage is the member with a pet theory, with a fixed idea, which he is bound to obtrude and defend in the face of facts. Yet even toward him we are called upon to exercise our toleration and our charity; for the history of learning has repeatedly shown that from just such wayward enthusiasts solid knowledge has derived some of its richest contributions. So supreme, after all, is energy, that error itself, pursued with fervid devotion, yields a more bountiful harvest than truth languidly cultivated.

But, perhaps, the picture I have thus drawn of the spirit of scientific inquiry excites in the minds of some a certain antipathy, or, at least, a sense of dissatisfaction and incompleteness. To such this description may sound narrow and materialistic; the results of scientific study thus rehearsed may appear vague, indefinite, incompetent to satisfy the loftier yearnings of the soul of man for something utterly true, immutably real.

Vain, indeed, were the life work of our Association; bereft, indeed, were we of just claim on your consideration, did we appear before you with such a thankless and futile confession of the ultimate aim of our labor. But it is far, very far, otherwise.

All this prying into the objective, external aspect of things; this minute, painstaking study of phenomena; this reiterated revision and rejection of results, are with the single aim of discovering those absolute laws of motion and life and mind which are ubiquitous and eternal; which bear unimpeachable witness to the unity and the simplicity of the plan of the universe, and which reveal with sun-clear distinctness that unchangeable order which presides over all natural processes.

This is the mission of science—noble, inspiring, consolatory; lifting the mind above the gross contacts of life; presenting aims which are at once practical, humanitarian and spiritually elevating.

DANIEL G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

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*AMERICA'S RELATION TO THE ADVANCE OF SCIENCE.**

"IN art and science there is no such thing as nationalism: these, like all things great and good belong, to the entire world, and are promoted only by free interchange of ideas among contemporaries, with constant reference to the heritage of the past." So wrote

* From *What has been done in America for Science*—an Address delivered before the Philosophical Society of Washington, November 24, 1894, by G. BROWN GOODE, retiring President.

Goethe in his *Sprüche in Prosa.* In the present address I have spoken, not of "*American* Science," but of what has been done in America for science. I have summarized the work accomplished in the study of the physical conditions and biological statistics of two great continents. I have shown that our countrymen have made important contributions to exact knowledge in every one of its departments from astronomy to anthropology, and that, contrary to general belief, these have been chiefly in pure science rather than in the application of science. Most of our American advances in economic science, with the exception of those in the field of electricity, have consisted in multifarious adaptation and bold application of principles and methods first made known in Europe. Except in ingenious mechanical inventions, Americans have done little in connection with applied science that is strikingly new or great.

It is not, however, by determinate contributions to the aggregate of human knowledge that America has aided most largely the advance of science. It has been in a manner vastly more subtle and far-reaching, through the action of an intellectual leaven which has imbued the thought of all mankind.

America has always afforded to scientific workers a most sympathetic and appreciative audience—even at periods in her history when she has been producing the least at home. When Auguste Comte was young he intended, it is said, to seek a career on this side of the sea, but was dissuaded by a friend, who assured him that if Lagrange himself were to come to the United States he could only earn his livelihood by turning land surveyor. This was absurdly false, for in that very year Laplace's *Mécanique Céleste* was being translated, for the first and only time into English, by Nathaniel Bowditch, whose service to science, which was more important through his commentaries than his translation, was fully appreciated even during his own lifetime, and who has ever since been esteemed one of the most distinguished of our countrymen.

European science has always been more warmly appreciated by our people than contemporary European literature, and men like Lyell, Huxley Wallace and Tyndall, when they have come among us, have received the most enthusiastic welcome, and their books have been consumed in much larger editions than at home, and not without becoming royalties to their authors.

Many others have come to us, not in prosperity but through necessity, and were none the less heartily welcomed—Gallatin, Hassler, Priestly, Cooper, Bernard, Duponceau, Cupont de Nemours, Nicollet, Rau and others.

Humboldt wrote in 1807 :

"During five years passed in the Spanish colonies of America a few French emigrants we found at Nueva Valencia, in Guatemala, were the only ones we saw. Beyond the Atlantic the United States of America afford the only asylum to misfortune. A government, strong because it is free, confiding because it is just, has nothing to fear from giving refuge to the proscribed."*

Priestly, who had been forced to withdraw from the Royal Society, called America 'The Land of the future,' and Richard Price, in the midst of the Revolution, one of the most popular men in England, in declining the invitation of Congress to remove to this country wrote : "The United States is now the hope and likely soon to become the refuge of mankind."

There is even more to be said concerning the influence of our people upon the thought and practice of the Old World.

The liberal policy of our State and National governments toward many branches of scientific work is well understood abroad, and has had an influence, especially in en-

Personal Narrative, Vol. ii., Chapter I.

couraging the publication of dignified and well illustrated reports upon the results of scientific exploration and research.

An illustration of the popular appreciation of knowledge in this country is to be found in the growth of libraries, and in the increasing volume of the stream of books, new and old, which pass constantly to the westward across the Atlantic.

Augustine Birrell, M. P., in an address at Dumfermline, Scotland, has presented some most astounding statistics in regard to books and libraries. He said that in the public libraries of Europe there are twenty-one million printed volumes; in those of Australia, one million more, while those of America contain fifty millions—more than twice as many as in all the rest of the world.*

The mere possession of books does not in itself count for much, but the eagerness to acquire the means of research, not books only, but all other instruments and appliances for intellectual progress, is very significant. It should be remarked also that this tendency, so far as the public at large is concerned, has not become very evident until within the last third of the present century.

There is a relationship still more fundamental between America and the advance of science, to which only a passing allusion is proper here.

I refer to the reflex action of democratic institutions upon those of the Old World—to the influence of human freedom, practically demonstrated upon American soil, upon the freedom of the people in our parent lands.

It was one thing for men like Priestley to fly hither for personal liberty. It was quite another for Coleridge and Southey to plan for the founding of a pantisocracy on the banks of the Susquehanna, and then to remain at home with Wordsworth and promote human freedom by their writings, or for Price to denounce the oppression of the American colonies as an outrage against liberty, and thus to secure from the people of London, who presented him with the freedom of their city, an assurance of sympathy among their English kinsmen, which encouraged the colonists to declare their independence. If, at the time of the Great Exodus, the men who organized the Royal Society of London had carried out their purpose of removing in a body to Connecticut, there to found an academy of sciences, the higher learning would have been retarded, not advanced.

It is almost impossible for us to understand the manner in which even now freedom of thought and action is burdened in the Old World by the weight of feudal traditions and by the existence of class distinctions and privileges. Americans surely do not understand, but that quick-witted race of Orientals, the Japanese, have done so from the very time when they applied themselves seriously to the task of making their own what is best in the civilization of the circum-Atlantic peoples. To England they went for ideas about a navy and for lighthouses, to Germany for a system of government, for military instruction and for medicine, and to France for a code of laws. In matters of education, however, they have chosen from the very start to be guided by Americans;* their keen perception teaching them that, whatever may be its defects in detail, the American educational plan is that which in some form or other is certain

* *Pall Mall Gazette*, September, 1891. The estimate is perhaps somewhat extreme, though the official return of public libraries in the United States (excluding the other American republics and the colonies) show nearly 32,000,000 books in public libraries of over one thousand volumes.

* Their postal system, their telegraphic code and their meteorological service are also purely American in origin, as well as such foreign agricultural methods as they may have adopted.

to be adopted by every free people, and to work mighty changes in traditional, social and governmental systems. Not less significant, perhaps, in the same connection is the present attitude of Pope Leo XIII. and his counsellors in regard to educational movements in the United States.

The condition of affairs in Germany up to quite a recent day, as shown in Virchow's address to the Congress of German Naturalists in 1872, seems almost incredible.

Describing the organization of that society, fifty years before, he said:

"Not perhaps at the dead of night, but still beneath the veil of secrecy, a handful of savants assembled for the first time at Leipsic, at the invitation of Oken. In fact, in 1822, no considerable body of men could come together in Germany in answer to a public invitation, without the permission of the civil authority. They could not discuss among themselves scientific questions, no matter how unconnected with the political and national questions of the day. Add to this the other fact that, if I am not mistaken, it was only in 1861, at the Congress of Naturalists at Spires, that the names of the Austrian members could be made public, and then we can appreciate the tremendous change that has been brought about in the Vaterland."

In England personal liberty, though not consciously retarded by law, is severely trammeled by the nature of existing social organizations. Distinction in science and letters is, even to-day, practically, subordinated to social distinction. As an illustration one need only notice the position of the President of the Royal Society upon any list in which the names of influential Britons are arrayed in order of social precedence. It is next to impossible for a man of moderate means, however learned, to become president of one of the great English scientific societies, and the honor most highly esteemed by the masses in England, as well as throughout Europe, that of a decoration, is rarely given, except to men who are prosperous in some material way.

"I know in London," writes Leland, "a very great man of science, *nemini secundus*, who has never been knighted, although the tradesman who makes for him his implements and instruments has received the title and the *accolade*." *

The changes which the last four centuries have wrought are by no means to be all attributed to the influence of the inhabitants of the New World, but in a large degree, no doubt, to the social and political modifications which the discovery of America rendered possible in the Old World.

It is, after all, very difficult to realize the exact relation of this discovery to the intellectual history of mankind, and it may be impossible, unless we were endowed with the gift of omniscience.

A few months ago, standing within the great red fortress of the Alhambra, looking down on the plain of Granada, still green with the orchards and vineyards planted by the former Moorish rulers of Spain, I understood, as I had never done before, that the final expulsion of the Orientals from Europe was almost simultaneous with the discovery of America. Six months before he sailed westward, Columbus stood with Ferdinand and Isabella upon that very tower, and saw the last cavalcade of exiled Moors disappear over the mountains toward Africa. For many centuries the military strength of our European ancestors had been chiefly devoted to repelling the invasions of these restless men of the East. Feudal government held universal domain, and all the learning of Europe was hoarded up within monastic walls.

"The discovery of the New World not only offered new productions to the curiosity of man. It also extended the then existing work of knowledge respecting physical geography, the varieties of the human species, and the migrations of nations. It is impossible to read the narratives of the early Spanish travelers, especially that of Acosta, without perceiving the influence which the aspect of a great continent, the study of extraordinary appearance of nature, and intercourse with men of different races must have exercised on the progress of knowledge in Europe. The germ of a great number of physical truths is found in the works of the sixteenth century; and

* Memoirs, 1893, p. 127.

that germ would have fructified had it not been crushed by ignorance and superstition."

So wrote Humboldt at the end of the last century. He must have felt, although he did not say so then, that ignorance and superstition were also to be dissipated in the new and expanded intellectual atmosphere. The passage already quoted from his writings shows this clearly.

The establishment of the supremacy of Western civilization, and the finding of a New World were, after all, less important than the discovery which the men of both hemispheres made on this side of the sea—that they might become free and their own masters. It was the opening of a new period in human history. Men were awaking from the slumber of ages. Europe began to emerge from abject intellectual slavery. In political life the traditions of the age of despots were broken, and the development of free institutions begun. In religion a reformation was inaugurated, wider in scope than the movement led by Luther, which is commonly associated with that name. In art, soulless and awkward formalities were replaced by enthusiastic culture of the ideals of classical days, which in time grew broader, more spontaneous and more inspired. In the field of letters, scholastic traditions were cast aside, and each nation in Europe developed a new language and a new literature. In science, similar scholastic and traditional usages were discarded. The students who compiled uncritically and generalized upon the worthless results of their own antiquarian researches, gave place to the restless, skeptical, critical inquirers of modern times.

We have just ended our celebration of the discovery of America, the end of the Dark Ages, the birth of individual freedom and of proper government. We celebrated at the same time the beginning of a new epoch. The Mediæval Renascence was limited to Europe; ours will embrace all the nations of the earth. It may be that this should be considered the outgrowth and fulfillment of that which marked the end of the Middle Ages, but whether we are at the beginning of a new movement, or at the culmination of an old one, the last forty years have undoubtedly witnessed greater changes in the spirit of men's thoughts than the four centuries which had gone before.

The earlier Renascence gave to man the right and liberty to think and act as he, in his own judgment, saw fit. The Renascence of to-day is leading men to think; not only with personal freedom, but accurately and rightly. Far be it from me to say that I believe that mankind in general are very much nearer to accurate and just standards of judgment than they were four hundred years ago, but the spirit of to-day favors untrammeled and searching investigation of every question in which man is concerned, a critical comparison of the results of such investigation, and a frank intolerance of all illogical or unsound theory and application.

This is the spirit of science—the spirit of unprejudiced search for truth—and this, emphatically, is the spirit of thinking men of to-day in America, in every department of activity.

Who can say what is to be the part of America in the future intellectual life of the world? It cannot be less important than in the past, and in all likelihood the influence of America will be more comprehensive and deep-seated as the years go by. Is it not possible that it may hereafter become the chief of the conservative forces in civilization rather than, as in the past, be exerted mainly in the direction of change and reform?

Brain of the New World, what a task is thine,
To formulate the Modern—out of the peerless grandeur of the Modern,
Out of thyself. * * *

Thou mental moral orb, thou new, indeed new, spiritual world,
The Present holds thee not—for such vast growth as thine,
For such unparalleled flight as thine, such brood as thine,
The Future only holds thee and can hold thee.*

G. BROWN GOODE.

U. S. NATIONAL MUSEUM.

LEGAL UNITS OF ELECTRIC MEASURE.

IT will, doubtless, be interesting to all physicists, as well as to many in other departments of science, to know of the legalization by Act of Congress, within the last six months, of units of electrical measure. It is not necessary in these columns to go into an exposition of the necessity for such action on the part of the Government, nor to refer to the enormous amount of capital invested in the manufacture of instruments, devices and machinery, the sole object of which is the conversion of some form of energy into electricity and the reconversion of electricity into some form of energy. The measurement of the enormous quantities of electricity that have within the last decade been produced and thus converted has, up to a recent date, in all cases depended upon the conventional acceptance of units of measure which have for many years been in use among scientific men, and which originated in the necessity for such units of measure in scientific investigations. It is always worth while to note, however, that the great simplicity and perfection of electrical measurement is due to the fact that the science of electricity preceded the art of its utilization. In this respect electrical engineering has a very decided advantage over all other branches of engineering, for in all others the art preceded the science, and the science, therefore, was obliged to build itself upon the crude and mostly unphilosophical principles that developed in the art.

*Whitman, *Leaves of Grass.*

The fundamental units of electrical measure, namely, the ohm, the ampere and the volt, have been in use among scientific men, to the exclusion of all others, for more than a decade, related as they are to the fundamental units—length, mass and time, which are admirably adapted for use as the basis of all electrical metrology. It has, however, long been recognized that much inconvenience was caused in electrical discussion by the lack of a few additional units, the use of which would greatly facilitate mathematical calculations and numerical statements. The literature of the subject has abounded, during the past ten years, with suggestions as to these additional and desirable units of measure, and various writers have, from time to time, adopted such as seemed to be necessary for their own use, even giving them such values and such names as were best in their judgment. It was evident, therefore, that to prevent confusion in electrical nomenclature it was desirable to have an international agreement as to these units, their value, their number and their names; the demands for this have grown very extensive in the last few years, the result having now been reached in the passage, by Congress, of a law which seems to define and settle these questions as far as the United States Government is concerned.

All readers of this journal are, doubtless, familiar with the fact that as early as 1881 an electrical convention, or congress, was held in Paris for the purpose of trying to agree upon definitions of the fundamental units of electrical measure and their material representations, in cases where material representations were possible. After much discussion, and not without very considerable opposition, there was proposed at that time a material representation of the ohm which was known to be somewhat in error. The real ohm must always be that defined by the Committee of the British Association for the Advancement of Science, and any material representation which may be adopted should only be considered as an approximation to this. It was first agreed that this theoretical ohm should be represented by the resistance offered to an unvarying current of electricity by a column of mercury one square millimetre in cross section, and one hundred and six centimetres in length, at a definite temperature. Even at the time of the acceptance of this ohm it was well known that the length of this column was nearly three millimetres too small to correctly represent the ohm of the British Association Committee. This result had been established by investigations by Rowland in this country, and by other experimentalists in Europe. In consequence of the inaccuracy of this first material representation of the ohm it did not meet with much favor, although it was quickly taken up among practical men, and resistance coils in great numbers were wound in accordance with this definition, being generally, but incorrectly, known as the 'Legal Ohm.' I do not know that this unit was ever adopted by any government, or even by any municipal corporation.

During the last ten years there has been a continual agitation of this question, resulting in the determination to go over the whole subject again, with a view to defining the fundamental units and adding such other units as might be desirable and necessary, at an International Congress to be held at Chicago in 1893, in connection with the World's Fair. The inception and organization of this Congress was largely due to the American Institute of Electrical Engineers and to local societies in the city of Chicago. Its history is so well known that it is only necessary to refer to it very briefly. In order to avoid errors which are likely to arise in the consideration of a very important subject by a very large assemblage, it was agreed that the question of units should be referred to a body which was within, and formed a part of, the general International Congress, and which was known as the Chamber of Delegates. In this Chamber of Delegates the number of representatives from the different nations was limited; five each were allotted to the United States, Great Britain, France and Germany, three to Italy, and to the other nations a smaller number. Most of the principal delegations were full on the assembling of the Chamber, and the total number of persons was about thirty. Daily sessions were held during the week of the International Congress, and many hours aside from these sessions were occupied by special committees in the discussion and development of the various subjects which came before the Chamber to be acted upon.

In reference to the personnel of this Chamber, it may be well to say that the delegates from foreign countries were appointed by their respective governments and presented regular authenticated commissions, and that the representatives of the United States received their authority from the Secretary of State in a commission which he prepared after the names of the five persons selected had been recommended to him by a vote of about sixty or seventy of the leading electricians of the country, who had been invited to join in this ballot by the Chairman of the Executive Committee for the organization of an International Congress. The five names receiving the greatest number of votes were recommended to the Secretary of State for appointment as representatives of the United States. A list of the delegates present and taking an active part in the deliberation of the Chamber is given herewith:

Representing the United States.

Professor H. A. Rowland, Johns Hopkins University, Baltimore, Md.

Dr. T. C. Mendenhall, Superintendent United States Coast and Geodetic Survey, and of Standard Weights and Measures, Washington, D. C.

Professor H. S. Carhart, University of Michigan, Ann Arbor, Mich.

Professor Elihu Thomson, Lynn, Mass.

Dr. E. L. Nichols, Cornell University, Ithaca, N. Y.

Representing Great Britain.

W. H. Preece, F. R. S., Engineer in Chief and Electrician, Post-office, England; President of the Institution of Electrical Engineers, London.

W. E. Ayrton, City and Guilds of London Central Institution, Exhibition Road, London.

Professor Silvanus P. Thompson, D. Sc., F. R. S., Principal of the City and Guilds Technical College, Finsbury, London.

Alex. Siemens, 12 Queen Anne's Gate, Westminster, London, S. W.

Representing France.

E. Mascart, Membre de l'Institut, 176 rue de l'Université, Paris.

T. Violle, Professeur au Conservatoire des Arts et Metiers, 89 Boulevard St. Michel, Paris.

De la Touanne, Telegraph Engineer of the French Government, 13 rue Soufflot, Paris.

Edouard Hospitalier, Professor a l'École de physique et de chimie industrielle de la ville de Paris; Vice-President de la Societe internationale des Electriciens, 6 rue de Clichy, Paris.

Dr. S. Leduc, 5 quai Fosse, Nantes.

Representing Italy.

Comm. Galileo Ferraris, Professor of Technical Physics and Electro-technics in the R. Museo Industriale, Turin, Via Venti Settembre, 46.

Representing Germany.

H. E. Hermann von Helmholtz, Präsident der Physikalisch-technischen Reichsanstalt, Professor, a. d. Universität, Berlin, Charlottenburg bei Berlin.

Dr. Emil Budde, Berlin N. W. Klopstockstrasse 53.

A. Schrader, Regierungsrath, Mitglied des Kaiserl. Patentamts, Berlin.

Dr. Ernst Voit, Professor an der technischen Hochschule, München, Schwanthalerstrasse, 73–3.

Dr. Otto Lummer, Mitglied der Physikalisch-technischenReichsanstalt, Charlottenburg, Berlin.

Representing Mexico.

Augustin W. Chavez, City of Mexico.

Representing Austria.

Dr. Johann Sahulka, Technische Hochschule, Wien.

Representing Switzerland.

A. Palaz, Professeur, Lausanne.

René Thury, ingenieur, Florissant, Genève.

Representing Sweden.

M. Wennman, Byrachef i Rougle Telegrafstyrelsen, Stockholm.

Representing British North America.

Ormond Higman, Electrician, Standards Branch, Inland Revenue Department, Ottawa.

As a result of the deliberation of this Chamber, it was agreed to recommend to the several governments represented by the various delegations the adoption of eight units of electrical measure, namely: the ohm, the ampere, the volt, the coulomb, the farad, the joule, the watt and the henry. The Chamber also prescribed definitions for these several units, but as they are essentially the same as those adopted by Congress, and which will be found in detail below, it is not necessary to refer to them here.

Shortly after the adjournment of the Congress a report of its proceedings was made to the Secretary of State by the United States delegates, and this report was distributed by the Department of State among the various nations represented, and also among those not represented, with the request that they should coöperate with the United States in the legalization of the units of electrical measure thus carefully selected and defined. In order to secure action on the part of our own Government, a bill was prepared and introduced into the House of Representatives by Mr. Charles W. Stone, of Pennsylvania, early in 1894, defining these units substantially in agreement with the definitions adopted by the Chamber of Delegates at Chicago, and declaring them to be the legal units of electrical measure for the whole of the United States. Through the active interest of Mr. Stone, and by the assistance of the American Institute of Electrical Engineers or a few individual members thereof who interested themselves in the passage of the measure, this bill became a law by the approval of the President on the 12th of July last.

The differences between the definitions adopted by the International Congress at Chicago and those found in this law are very slight, and consist entirely of verbal changes that were thought to be desirable and necessary by the Senate Committee to which this bill was referred after its passage by the House of Representatives. It may be well to remark that a subcommittee of the Chamber of Delegates, consisting of von Helmholtz, Professor Ayrton and Professor Carhart, had been appointed to prepare specifications for the better realization of the adopted material representation of the volt. The continued illness of von Helmholtz, from the time of his leaving this country, at the close of this Congress, up to the day of his lamented death, about a year later, prevented the completion of the labors of this committee at an earlier date; however, correspondence had been begun, and many points had been defined and settled among its members. The specifications for the better representation of the ampere to which the Chamber of Delegates had agreed will be found in the report of the American delegates to the Secretary of State. As this subcommittee had not yet been able to formulate a report, and as it was necessary for Congress to make some reference to these specifications in the Act adopting the units, it was agreed that the matter should be referred to the National Academy of Science, as is provided in the last section of the Act. This Act, as it finally became a law, is as follows:

(PUBLIC No. 105.)

An Act to define and establish the units of electrical measure.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the passage of this Act the legal units of electrical measure in the United States shall be as follows:

First. The unit of resistance shall be what is known as the international ohm, which is substantially equal to one thousand million units of resistance of the centimetre-gramme-second system of electro-magnetic units, and represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice fourteen and four thousand five hundred and twenty-one ten thousandths grammes in mass, of a constant cross sectional area, and of the length of one hundred and six and three tenths centimetres.

Second. The unit of current shall be what is known as the international ampere, which is one-tenth of the unit of current of the centimetre-gramme-second system of electro-magnetic units, and is the practical equivalent of the unvarying current, which, when passed through a solution of nitrate of silver in water in accordance with standard specifications, deposits silver at the rate of one thousand one hundred and eighteen millionths of a gramme per second.

Third. The unit of electro-motive force shall be what is known as the international volt, which is the electro-motive force that, steadily applied to a conductor whose resistance is one international ohm, will produce a current of an international ampere, and is practically equivalent to one thousand fourteen hundred and thirty-fourths of the electro-motive force between the poles or electrodes of the voltaic cell known as Clark's cell, at a temperature of fifteen degrees centigrade, and prepared in the manner described in the standard specifications.

Fourth. The unit of quantity shall be what is known as the international coulomb, which is the quantity of electricity transferred by a current of one international ampere in one second.

Fifth. The unit of capacity shall be what is known as the international farad, which is the capacity of a condenser charged to a potential of one international volt by one international coulomb of electricity.

Sixth. The unit of work shall be the joule, which is equal to ten million units of work in the centimetre-gramme-second system, and which is practically equivalent to the energy expended in one second by an international ampere in an international ohm.

Seventh. The unit of power shall be the watt, which is equal to ten million units of power in the centimetre-gramme-second system, and which is practically equivalent to the work done at the rate of one joule per second.

Eighth. The unit of induction shall be the henry, which is the induction in a circuit when the electromotive force induced in this circuit is one international volt while the inducing current varies at the rate of one ampere per second.

SEC. 2. That it shall be the duty of the National Academy of Sciences to prescribe and publish, as soon as possible after the passage of this Act, such specifications of details as shall be necessary for the practical application of the definitions of the ampere and the volt hereinbefore given, and such specifications shall be the standard specifications herein mentioned.

Approved July 12, 1894.

It will be desirable to add some remarks upon the steps which have been taken in the same direction by the English Government since the adjournment of the International Congress. All who are familiar with the legislation in the United States on the subject of Weights and Measures will recognize the passage of the Act given above as the first general legislation establishing units of measure for the whole country, on the part of the American Congress.

Although the Constitution provides that Congress shall have the power to establish systems of weights and measures, it is well known that Congress has never exercised this power except in the Act of 1866, which involves the semi-establishment of such a system by making the use of the Metric System permissive throughout the United States. Aside from this, systems of weights and measures in this country have been uniformly and universally the result of State legislation until the passage of the above Act defining units of electrical measure.

In England a committee has for some time been in existence whose object was the recommendation of suitable units of electrical measure, that they might be legalized, as is the practice in Great Britain, by means of an 'Order in Council' signed by the Queen. Among the members of this committee are such well known names as Lord Kelvin, Preece, Glazebrook and Ayrton. This committee made a report on the 2d of August, 1894, and this report was approved by the Queen on the 23d of the same month, so that in this country we were a little more than a month in advance of Great Britain in the legalization of units of electrical measure. The English committee, however, did not feel prepared to go as far as we have gone in the recommendation for the adoption of the whole list of eight units approved at Chicago. Some members of this committee have explained this in personal conference by the statement that the three primary units, the ohm, the ampere and the volt, were found to be not difficult of material representation, while most of the others were very decidedly so, and, as most of the others are derived from these three, it was thought best, at the present time, to restrict authoritative adoption to the ohm, the ampere and the volt. In defining these units the English committee has also departed slightly from the definitions as adopted at Chicago, the changes being mostly verbal, but, in one or two instances, of such a character as to quite alter the fundamental relation of the materialized unit to its theoretical representative. In order that this may be clearly seen, it may be well to quote the definitions of these three units, as found in the 'Order in Council' of August 23d. The following is quoted directly from said 'Order':

"And whereas it has been made to appear to the Board of Trade that new denominations of standards are required for use in trade based upon the following units of electrical measurement, viz.:

"*First.* The Ohm, which has the value of 10^9 in terms of the centimetre and the second of time and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14.4521 grammes in a mass of a constant cross sectional area and of a length of 106.3 centimetres.

"*Second.* The Ampere, which has the value $\frac{1}{10}$ in terms of the centimetre, the gramme and the second of time, and which is represented by the unvarying electric current which, when passed through a solution of nitrate of silver in water, in accordance with the specification appended hereto and marked A, deposits silver at the rate of 0.001118 of a gramme per second.

"*Third.* The Volt, which has the value of 10^8 in terms of the centimetre, the gramme and the second of time, being the electrical pressure that if steadily applied to a conductor whose resistance is one ohm will produce a current of one ampere, and which is represented by .6974 ($\frac{1000}{1434}$) of the electrical pressure at a temperature of fifteen degrees C. between the poles of the voltaic cell known as Clark's cell, set up in accordance with the specification appended hereto and marked B."

The specifications referred to in the above as marked A are those that were adopted at the Chicago Congress, together with some additional suggestions as to the methods of procedure.

The specification marked B refers to the method of preparation of Clark's cell, including a detailed statement as to materials and as to the method of setting up the cells. These specifications are made so as to include several different kinds of cells, so that the Lord Rayleigh modification of the Clark cell, and also a modification devised and used by the Germans, may be used at will. There is certainly a decided advantage in this. Attached to the 'Order in Council' is a schedule which is declared to set forth the several denominations of electrical standards as approved by the Queen. In this schedule the standard of electrical resistance is described as being the resistance between the copper terminals of a particular coil of wire under standard conditions. The standard of current is described as being the current which when passed through the coils forming a part of a particular instrument under specific conditions gives rise to forces which are exactly balanced by the force of gravity at Westminster upon a particular mass of matter forming a part of said instrument. The standard of electro-motive force, or, as it is termed in the 'Order in Council,' 'electrical pressure,' which is denominated as one volt, is described as being $\frac{1}{100}$ part of the pressure which when applied between the terminals of a particular instrument causes the rotation of a certain portion of said instrument to the extent which is measured by the coincidence of a certain wire with the image in the eyepiece of the telescope and with certain fiducial marks.

A careful examination of the above definitions, together with the schedule following, and a comparison of the same with the units as defined by Act of Congress, which are essentially those of the Chicago Chamber of Delegates, will give rise to many interesting and important reflections to which space cannot now be given. It may be suggested, however, that there is room for uncertainty under the provisions of the English regulations as to what is the standard of resistance, or of current, or of electro-motive force. Of course this will all turn upon what would be the action of the English authorities in case of a suspected error in the material representation of these standards as provided for in the schedule. The 'Order in Council' makes no provision for a course of procedure in such an event, and it is but natural to assume that standards of a very complicated character, and so composite in material as those thus adopted, must be continually liable to changes, and the reintroduction of errors of considerable magnitude.

The actual material representations of these three electrical units, it will be observed, are by this 'Order' removed at a considerable distance from the fundamental definitions adopted by the English committee, as well as by the Chicago Chamber of Delegates, thus, although the ohm is defined primarily by reference to the C. G. S. system of units, and secondarily by reference to the column of mercury, in actual practice it is neither the one nor the other of these, but is the resistance of a solid metallic conductor.

The ampere, while defined primarily in terms of the C. G. S. system, and secondarily in reference to the silver voltameter, is in practice determined by the dynamic action of one current upon another. In the same way, the volt is not in practice referred to the C. G. S. system of units, nor is it determined by comparison with the Clark cell, but by the measurement of the rotation effect upon a part of a certain instrument when the electro-motive force is applied between certain points in that instrument.

One cannot refrain from the opinion that, from an absolutely metrological standpoint, the regulations of the 'Order in Council' should be condemned rather than approved; however, personal conference with the representatives of the English Board of Trade and Standardizing Laboratory reveals the fact that the material representations of electrical units, thus provided, are to be considered as but tentative in character, adopted on account of greater convenience in actual practice, and to be continually revised and corrected by reference to the fundamental definitions, which are essentially the same as those approved by the representatives of Great Britain at the Chicago Congress, and where they do differ from those are, it will be generally admitted, I think, on the whole, more sound.

It is very important for the United States that, when the time shall come, as it must before long, for the preparation of material representations of as many of the electrical units that have been legalized as can conveniently be represented, the greatest effort shall be made to see that there be no hasty action, and that, as far as possible, already well established principles of metrology shall be strictly applied.

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THE HUMANITIES.

THE study of the history of mankind is logically developed into five great branches, viz.: industries, pleasures, languages, institutions and opinions. These are the *Humanities.* Into all of these realms modern scientific research penetrates and seeks to discover their origin and development from the beginning of primeval human life to the present time. In following the course of humanity from the earliest savagery to the highest enlightenment it is found that man has traveled by five parallel roads from the starting place of ignorance toward the goal of wisdom. Now he travels on one road, now on another, parceling out his activities and dividing his time between all. On wings of thought he passes from way to way. When he travels by one road he seems to have one end in view, by another road another end in view, and yet as often as he may change his goal and the road by which he travels he is pursuing the route to wisdom. He may travel by false charts, or he may lose his way, and yet the end in view may remain the same. He engages in the arts of industry and the purpose is welfare; he engages in the arts of pleasure and the purpose is happiness; he engages in the arts of speech and the purpose is expression; he engages in institutional arts and the purpose is justice; he engages in the arts of learning and the purpose is knowledge. In the way by labor, the way by pleasure, the way by speech, the way by institutions and the way by learning—in all ways—he runs to the goal of wisdom.

In all the research prosecuted during the present century, and especially during the later decades, one great generalization is reached from the multitudinous facts gathered from the world; this is the intellectual unity of the human race. The history of the lower animals, from primeval geologic time to the present, exhibits a constant differentiation of species, genera, orders and higher groups. The evolution of animal life is the unfolding of new forms. In the study of mankind this evolution is replaced by an involution which tends toward unification. In his early history biotic forms and varieties were developed, with more or less differentiation of functions. Some men were high of stature, others were low of stature; some men were blondes, others were brunettes; some men had long skulls, others short skulls; some men had their eyes placed obliquely, others horizontally; some men had round hair, others had flat hair. The tendency in the beginning was toward the differentiation of varieties, which, had man continued in his lowly estate on a plane with the lower animals, might have resulted in the differentiation of species not interfertile with one another; but with mankind interfertility was preserved.

Man was endowed with superior intellect. He had outrun the lower animals in the race of culture and began to develop the five great activities: industry, pleasure, speech, government and learning. With these evolving powers the evolution of varieties was checked. The evolution of activities superseded the evolution of biotic varieties, and man's course of development was by involution and seriation; men became more and more interdependent, and this is involution. Some men made more progress in the five great activities than others, but all progress resulted in serial development. So some peoples have a higher culture than others. All of the human activities are interrelated and ever become more and more interrelated. Not only are the activities interrelated, but the peoples themselves become more and more interrelated through them in the progress of activital development.

Let us now take a hasty view of mankind in his early estate, moving along the highways of progress toward the present time. Early man was scattered over all the earth in kinship tribes, each one knit together by bonds of kindred blood and cords of marriage ties. All tribal society was thus organized. These little tribes, in vast numbers, each contained but a few individuals who inhabited the Eden between the walls of ice. Their arts of welfare sprung from conditions of local environment. Where the waters were abundant they became fishermen; where the beasts of the wold and prairie were plenty they became hunters, where the fruits of the forest and plain were rich they became gleaners, and where all of these sources of supply existed their food industries were diversified. In frigid lands they built their houses of snow and ice; in forest lands they built their homes of shards of trees, boughs and bark; in the savannahs they built their homes of reeds and mats; in arid lands of naked rock and cliff they built their homes of stone—everywhere they adapted the materials of the local environment to their use. Where the beasts were plenty they made their clothing of pelts; where animals yielded wool they made their clothing of woolen fibers; where fibrous plants were abundant they made their clothing of vegetable tapestries, and they decorated homes and clothing with the pigments and stains which they found where they lived. So man started on the way of welfare.

The children of these little tribes had their youthful sports. They kept playhouse as their mothers kept house; they played with dolls as their mothers played with babies; they played at hunting as their fathers were hunters; they played at fishing as their fathers were fishermen; they played at fruit gathering as their fathers and mothers gathered fruit; and they played at war as their heroes made war, and thus mimetic sports were developed. The elders engaged in running races, in wrestling matches and various games of athletic prowess and skill, and thus their athletic sports began. They engaged in games of chance and staked their little stores of wealth and sought to divine their chances and developed simple methods of divination, and thus their intellectual games began. With sports of mimicry, sports of athletic skill and sports of chance and divination, the highway of pleasure was entered.

They began to express their ideas by gesture speech and oral speech in imitation of the sights and sounds of the world, and especially of the characteristics of one another; thus gesture speech and oral speech began, and the tribes entered upon the highway of speech.

In the biotic constitution of man the seeds of government are planted, for there must be husbands and wives, parents and children, and there must be authority and obedience. As the kinship tribes were developed authority and obedience grew with the group, and a system of terms was developed by which kinship through streams of blood and marriage relations was clearly exhibited, and to the elder was given the right to command, and to the younger the duty to obey—a system of perfect equality, for every individual grew in authority as he grew in years, and must command some and obey others. Thus began forms of government, and the tribes entered upon the highway of institutions.

Every child learns by experience. The accumulation of experience from infancy to old age is great even with primal man, but by speech the experience of the elder is taught to the younger. In the stream of generations there are elder and younger in every tribe, and the experience of ancestors is handed down. Thus primal man entered upon the highway of learning.

Let us see where the human race began. A multitude of kinship tribes spread over the habitable earth, each tribe on the highways of progress, with simple arts suited to local environment, with simple pleasures suited to home environment, with simple speech developed from the gestures and vocal sounds of men and the lower animals and the scenes of nature found in the environment, with simple governments developed out of biotic life conforming to the environment of kinship and age and the needs of daily life, and with simple knowledge gathered by the individual through experience and transmitted one to another by speech and handed down from generation to generation in an ever-growing stream of wisdom, all taught by the environment.

In this picture we have primal men in multitudes of distinct tribes under the differentiating forces of environment by which they may be developed into species, but for one overpowering factor—superior human intellect. There can be but one kind of mind. Two and two are four with every people; the moon is round, gibbous or crescent wherever it shines for man; the sun shines in every eye; the child grows in every experience. Thus the four great mental activities of number, form, cause and becoming are the same in every land, and the mind of every man is a unity of these four powers, and every mind is like every other mind in their possession. They differ only in extent of experience acquired directly by self or indirectly from others. While the mind is the same with all men the will is the same. All desire to gain good and to avoid evil, so all wills develop on a common plan. By mind and will, by mentality and volition, man progresses on the five highways of life, so that all men are impelled to the same goal of wisdom. Pursuit of the common end has proved to be more powerful in producing involution than the forces of environment in producing differentiation or classific evolution. It now becomes necessary to make a hasty sketch of human evolution.

The kinship tribes first developed by man gradually underwent a change. Tribe coalesced with tribe, and when tribes became too large by union or by natural multiplication they divided. In the consolidation of tribes the plan of union by kinship remained. Two or more tribes allied their fortunes by intermarriage, each furnishing wives to the other; so the chains of affinity were forged, and out of this affinity spring new bonds of consanguinity. In succeeding generations fathers and mothers belong to different clans, and each tribe is made up of individuals, every member of which is kin to both primal tribes. Kinship through affinity and kinship, through consanguinity, was maintained in knowledge by a device of naming, so that the name not only expressed kinship by clan, but also kinship by tribe as composed of clans, and at the same time expressed relative age by which authority was claimed and yielded and primeval equality maintained. In the coalescing of tribes in this manner a new generation became heirs to the activities of the coalescing tribes. They inherited industries, pleasures, languages, institutions and opinions of the ancestral tribes. So tribes coalesced with tribes and divided and coalesced again, until tribal society was lost in the confusion of ancestries. Then nations were born, based not on kinship bonds but on territorial boundaries. The first nation and every other nation since has in its very organization lost its ancestral identity by multiplied admixture of streams of blood. To speak of a nation as of one blood or as derived from one primeval tribe with its primitive industries, pleasures, speech, institutions and opinions is absurd. To search for the origin of a nation in one primeval tribe having some one or all of the primeval activities is a search for the impossible.

It is thus that the study of the human race has led to the discovery of its unity. It is found that we cannot classify men as biotic kinds with differing forms, functions and genealogies, as the lower animals are classified. An early tendency to such differentiation is discovered, but it is farther learned that this tendency has been partially obliterated and greatly obscured in the later history of mankind. By these discoveries many interesting facts have been recorded of variations in human forms, functions and genealogies. The study is one of interest and proves to be valuable. Thus the old science of ethnology remains as the study of biotic varieties of mankind, and is pursued with more vigor than ever and becoming of more and more importance.

In the study of ethnology as the science of biotic races the attempt was early made to supplement biotic characteristics with cultural characteristics from the domain of arts, or, as they are here called, *humanities*. This has led to the development of a new science pertaining to human activities as herein classified, and to which the term *demology* is sometimes given, while even the term ethnology is made to include both the biotic and the activital history of mankind. It may be well to keep the term ethnology to the limits of its primitive use and to adopt the term demology for the new science of human activities.

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ZOÖLOGICAL NOMENCLATURE.

THE EARLIEST GENERIC NAME OF THE GROUND SQUIRRELS COMMONLY PLACED IN THE GENUS SPERMOPHILUS.

The eccentric Rafinesque, who imposed such a multitude of new names upon animals and plants, seems to have been first to name the group of ground squirrels for which the later name *Spermophilus* of Cuvier (1825) has been in common use for more than half a century. In 1817 Rafinesque published a paper entitled 'Descriptions of new genera of North American Quadrupeds,' in which the 'Burrowing Squirrel' of Lewis & Clark was made the type of a new genus and species, *Anisonyx brachiura*.* This animal had been named *Arctomys columbianus* by Ord two years previously; † and was afterward erroneously referred to the genus *Cynomys*—likewise proposed by Rafinesque for one of Lewis & Clark's animals. Several years ago I showed that the animal in question is a true ground squirrel or spermophile, ‡ but refrained from reinstating Rafinesque's genus *Anisonyx* because it was then believed that a still earlier name would be found. A somewhat exhaustive search through the literature, however, has failed to bring to light anything earlier; hence it seems necessary to publicly reintroduce *Anisonyx* as the proper generic name for the group of mammals now commonly referred to *Spermophilus*.

THE EARLIEST AVAILABLE NAME FOR THE MOUNTAIN GOAT.

IT has been customary of late to refer the Mountain Goat to the genus *Mazama* of Rafinesque.§ But *Mazama* was based primarily on the *Temamazame* of Mexico, which Rafinesque called *M. tema*, and which has been since shown to be a deer.|| The next species mentioned by Rafinesque is our Mountain Goat, which he named *M. dorsata*. But under this species he makes the following unequivocal statement which seems to have been overlooked: "This species, with the following [*M. sericea*, which is really the same animal] and the *Mazama puda* [of Chili], will form a particular subgenus (or perhaps genus) which I shall call *Oreamnos*, distinguished by the horns slightly curved backwards or outwards, often rough or annulated, and long hair, besides living in mountains." (Am. Monthly Mag., II., 1817, 44). In view of these facts there seems to be no escape from the adoption of the name *Oreamnos* as the earliest available generic name for the Mountain Goat, which is the type and only known species of the genus, the '*M. puda*' being a South American deer. The full name for the species is *Oreamnos montanus* (Ord) 1815, and the type locality is the Cascade Range, near the Columbia River, in Oregon or Washington.

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* Am. Monthly Magazine, II., 1817, 45.

† Guthrie's Geography, 2dA m. Ed., II., 1815, 292 and 303–304.

‡ Mammals of Idaho, N. Am. Fauna, No. 5, July, 1891, 39–42.

§ Am. Monthly Mag., II., 1817, p. 44.

|| Biologia Centrali-Americana, Mammalia, 1880, p. 113.

THE NEED OF A CHANGE OF BASE IN THE STUDY OF NORTH AMERICAN ORTHOPTERA.

SOME twenty years ago one of the very acutest and most industrious of modern entomologists, the late Carl Stål, of Stockholm, began the publication of a Recensio Orthopterorum. In it and in kindred papers he had within five years laid the foundation of an entirely new system in nearly every family of Orthoptera, offering novel and taxonomically important but easily overlooked points of structure for subdivisions of a high order. A great deal of work has been done since then (the number of species has perhaps doubled), and it has been mainly upon the lines laid down by him, but in greater detail.

Most American students of Orthoptera, however, have been very poorly acquainted with these modern studies, and the result is that, with a distressing wealth of undetermined species, new forms have been described and referred to genera of ancient name, a procedure which in many cases has given little or a wrong impression of the real affinities of the insects in question, and it has now become impossible to correlate American and European work. Something, indeed much, has been done by European entomologists, but their autoptic acquaintance with our fauna is relatively poor; and while there are ample materials here, there appears a remarkable paucity of students inclined to serious work in this direction. Lists we have in number, but in them almost invariably figure Acridium, Caloptenus, Oedipoda, Stenobothrus, Mantis, etc., genera which in their now restricted application do not or hardly exist in North America.

There has been some excuse for this, since the broad scope of Stål's work, embracing the Orthoptera of the globe, rendered work upon exclusively American material difficult to one without means of reference to extra-American insects, collections of which are uncommon in this country, though easily obtainable by any one with means. Still, it is strange that no one having access to the museums in our larger cities or universities has undertaken to apply the modern system of classification to one or another of the families or subfamilies of American Orthoptera. He would have earned merited applause from all students in this field.

One attempt, indeed, was made to collate what could be known of the Acrididæ, but it was before Stål began his work, and it may almost be classed as a hindrance. Now, however, the field is open, for Brunner von Wattenwyl, whose collection of Orthoptera is the richest in the world, published a year ago a *Révision du Système des Orthoptères*, through which, by means of the tables given by him of an exceedingly simple character (sometimes in practice one finds them too limited), one may quickly group his collection in a natural order, and by means of the literature to which reference is briefly made, determine the generic position or affinities of whatever he has before him. The way for a revision of any group is therefore clearer than ever before, and our entomologists will have none but themselves to blame if they do not hereafter better coördinate their work with that of the European writers.

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SCIENTIFIC LITERATURE.

An Elementary Treatise on Theoretical Mechanics.—Part I., Kinematics; Part II., Introduction to Dynamics; Part III., Kinetics. —By ALEXANDER ZIWET, Assistant Professor of Mathematics in the University of Michigan.— 8vo.— Macmillan & Co., London and New York, 1893–94. Pp. viii+181, viii+183, viii+236.

Since Lagrange set the model for analytical mechanics in his *Mécanique Analytique*, a little more than a century ago, there has been no serious lack of good elementary works devoted to that science. Most conspicuous of the latter is Poisson's *Mécanique* (1811, 2d ed., 1833), which was undoubtedly more widely read and followed than any other work during the first half of this century. It is only recently, however, that the great advantage of the analytical over the geometrical method in mechanics has come to be generally recognized by authors and educators. The influence of Newton has long held English writers to the geometrical form of the *Principia*. To this, nevertheless, there are a few noteworthy exceptions, the most important of which in the present half century is probably Price, whose volumes on analytical mechanics (*Infinitesimal Calculus*, Vols. III. and IV., 1862) have done excellent service.

Along with the remarkable growth of science in general during the past thirty years a great impetus has been given to mechanics. This is traceable chiefly to two sources, namely: first, the development of the Faraday-Maxwell view of electricity and magnetism; and, second, the thought-inspiring qualities of the great work of Thomson and Tait on *Natural Philosophy*.

The latter treatise and the *Electricity and Magnetism* of Maxwell have stimulated a wonderful activity in the study of mechanical ideas; and, as a result, a number of high-class elementary books on pure mechanics have appeared during the past decade. The work of Professor Ziwet is one of the best of this class. It is up to date and distinctively in touch with the progressive spirit of the age. In accordance with the modern order of presentation, Part I. is devoted to kinematics, Part II. to statics as a special case of dynamics, and Part III. to kinetics. No one acquainted with the magnitude of theoretical mechanics would expect to find a complete treatise even in the space of 600 octavo pages. It goes without saying, in fact, that he who would now do battle in the fields of mechanics should be armed with a battery of treatises. But it must be admitted that the work of Professor Ziwet covers the ground exceedingly well, giving a fairly good idea of nearly every important principle and process from the composition of vectors to the kinetics of variable systems. The mode of treatment, though distinctly analytical, is tempered by the introduction of geometrical illustrations and analogues where they serve to give clearness and fixity of ideas. A noteworthy feature of the work is the large number of references to the literature of the science. These references alone make the work one of the best that can fall into the hands of the enterprising student. The typography and press work are worthy of the distinguished publishers under whose auspices the volumes appear. A few misprints and a few inaccuracies of expression are visible in the work; but these are inevitable in a first edition of such a treatise. A speedy demand for a second edition will, we hope, enable the author not only to remove these trifling defects, but also to add an index, which will much enhance the value of the work for purposes of reference. R. S. W.

From the Greeks to Darwin.—An outline of the development of the evolution idea.—By HENRY FAIRFIELD OSBORN.—Columbia University Biological Series 1.—New York and London, Macmillan & Co., 1894. Pp. 259. $2.00.

This is a timely book. For it is time that both the special student and the general public should know that the doctrine of evolution has cropped out on the surface of human thought from the period of the Greek philosophers, and that it did not originate with Darwin, and that natural selection is not a synonym of evolution.

The author divides his work into six sections, entitled respectively: The anticipation and interpretation of nature; Among the Greeks; The theologians and natural philosophers; The evolutionists of the eighteenth century; From Lamarck to St. Hilaire; Darwin.

It is clearly shown that evolution has reached its present completeness as a result of a slow growth during the past twenty-four centuries, and that Darwin owes more to the Greeks than has been hitherto recognized by any of us. The Greek philosophers in biology, as in geology, anticipated, at least in some slight degree, modern scientific philosophy. The doctrine of continuity in the organic and inorganic world, anticipations of the monistic philosophy, and of the evolution of life, were taught by Thales and Anaximander, while Aristotle spoke of some of the factors of transformation, and even clearly stated the principle of the survival of the fittest, though he afterwards rejected it.

The father of evolution was Empedocles, who believed in spontaneous generation, that plants came first, that animal life long after budded forth from the plants, and in his poetry Osborn finds the germ of the theory of the survival of the fittest or of natural selection. Democritus perceived the principle of adaptation of single organs to certain purposes, while Anaxagoras attributed adaptations in nature to intelligent design and was thus the founder of Teleology. But as Aristotle was the father of natural history so was he the first scientific evolutionist, being the earliest to conceive of the chain of being from polyps to man, a view afterwards generally held until Lamarck replaced it by his truer simile of a branching tree. The great Greek naturalist and anatomist understood the principle of adaptation of organs in its modern sense, discovered the law of the physiological division of labor, and conceived of life as the function of the organism; was not a vitalist; understood the doctrine of heredity, atavism or reversion; and finally, with all his errors and misconceptions, had vague notions of the unity of type, of nature, of gradations in nature, while the core of his views on evolution was the doctrine of an 'internal perfecting tendency,' which crops out in modern science in the writings of Owen, and even Koelliker, as well as others, including Weismann.

Passing to the evolutionists of the present century, Oken's place is, it seems to us, properly assigned; due credit is given to Buffon, who saw the force of isolation, and full credit to Erasmus Darwin, though sufficient stress is perhaps not laid on the fact that he was not a working zoölogist and had no followers. Osborn effectually disposes of the strong suspicion of Dr. Krause that Lamarck was familiar with the 'Zoonomia,' and made use of it in the development of his theory. He clearly brings out the fact, as stated by Martins, that Laplace supported Lamarck in the doctrine of the inheritance of acquired habits, as applied to the origin of the mental faculties of man, both of these authors anticipating Spencer, the doctrine being an old one, and expressed by De Maillet.

The statement of Lamarck's views is full and carefully drawn up, and his preëminence as the founder of modern evolution, though he had no immediate followers, owing to his Cuvierian environment, clearly stated. This being the case, and in view of the fact that the number of Lamarckian evolutionists is now so great and constantly increasing, we should have wished that he had devoted still more space to one of the greatest naturalists of pre-Darwinian times, giving more quotations from his works.

Osborn controverts, and with success, we think, Huxley's dictum that Treviranus should be placed in the same rank as an evolutionist with Lamarck. We certainly do not hear of Treviranians. The statement of the views of Owen is fair, and yet we should scarcely use the word 'hostility' in stating his attitude towards Darwinism or natural selection. Owen refused to attack the *Vestiges of Creation* when that book appeared, but rather sympathized with the general views of its author. As Osborn states, "Owen was an evolutionist in a limited degree," somewhat in the manner of Buffon, and perhaps a shade more from his wide knowledge of paleontology, but it is to be borne in mind that neither was Koelliker nor were others, Darwinians as such, and there are many still who accept the general doctrine of evolution, but do not regard natural selection as an adequate or efficient cause, or at least consider it as only one of many factors.

While mentioning Darwin and Wallace as the leading selectionists no reference is made to the botanist Hooker, who, in his *Flora antarctica* arrived at the doctrine of transformation independently of Darwin, and became one of his two strongest supporters. Also Bates should have been mentioned.

The book should be widely read, not only by science teachers, by biological students, but we hope that historians, students of social science, and theologians will acquaint themselves with this clear, candid and catholic statement of the origin and early history of a theory which not only explains the origin of life-forms, but has transformed the methods of the historian, placed philosophy on a higher plane, and immeasurably widened our views of nature and of the Infinite Power working in and through the universe. A. S. PACKARD.

BROWN UNIVERSITY.

Materials for the Study of Variation.—WILLIAM BATESON.—London and New York, Macmillan & Co., 1894. xv + 597 $6.50.

Over thirty years ago Mr. Darwin outlined the great problems for investigation in natural history, and, one after another, these lines of investigation have been studied by naturalists. Embryology, paleontology and systematic classification early attracted the attention of many naturalists, and these branches of investigation have been very thoroughly studied in the last quarter of a century. Geographical distribution was made a special subject of research by Mr. Wallace and others. These various lines of study, while, of course, they have not been exhausted, have certainly been studied to such an extent that most of the valuable lessons which they teach have been learned. In recent years also another factor of the evolution problem, namely, that of heredity, has been the subject of eager research by various naturalists. It is somewhat strange that the problem of variation has been so universally neglected except by Darwin's *Animals and Plants.* It is upon variations in animals that the whole of the theories of Darwin and all evolutionary doctrines are based, but while the last thirty years has seen much speculation as to variations, both concerning their causes and distribution, while many illustrative instances have been accumulated, while nearly all the modern theories of evolution are based directly upon certain conceptions of variation, there has been no systematic attempt to study this fundamental problem. Speculative zoölogy has always a greater attractiveness to most minds than the more laborious and less entertaining work of collecting facts. The last twenty-five years has seen an abundance of publications upon evolution from theoretical grounds, and while variations themselves have been discussed on both sides of the Atlantic, these discussions have been almost universally based upon a few stock illustrations, and must be recognized as without any proper foundation in facts. Natural science is certainly indebted to Mr. Bateson for having taken up at last this branch of research which lies at the very foundation of the origin of species. Mr. Bateson's book has a very modest title, and the author simply claims to have brought together materials out of which a theory of the origin of species may in the future be built. But this is the only systematic attempt yet made to study variations themselves. The present volume is only the first instalment, and we are promised more in the future. A book of nearly 600 pages, filled with numerous illustrations, describing in more or less detail variations of all kinds, in all types of animals, will certainly find its way into the library of every naturalist who has any interest in speculative thought.

A review of this character is hardly a fitting place to discuss the subjects presented in this work. In reading over its pages there are, however, three or four striking conclusions of so much general theoretical importance that they may be selected as the teachings of this first volume. Most prominent among them stands the deduction of the author that variations are discontinuous. It is the theory of Darwin, and, in general, of his followers, that species were produced by natural selection acting upon slight continuous variations. The difficulties of this thought were plain to Mr. Darwin, and have become more plain and more forcible as the years have passed. While the followers of Darwin's views have tried to shut their eyes to them and have tried to explain away the objections that have arisen, it has been plain to every thinking naturalist that the natural selection of minute accidental variations is entirely inadequate to accomplish the great end of producing species. The most important result of Mr. Bateson's study of variations is that the variations that occur in animals are not minute and continuous, or, rather, that they are frequently discontinuous. By this term the author means that variations may be sudden and extreme in character, such as the sudden development of a new tooth in a single generation, or the appearance of a new leg, or some other very prominent characteristic which appears at once without the numerous intermediate stages which Mr. Darwin's theory assumes. While Mr. Bateson does not claim that this view is demonstrated by the facts now collected, he does insist that all of his data point in that direction. The extreme significance of this conclusion upon the question of the origin of species is plain at once. A second conclusion which one reaches in the perusal of these instances is that variations are not haphazard, but, while, of course, they cannot be predicted with certainty, they do fall under certain definite laws. Mr. Bateson has found it possible to group the variations that occur in animals under very definite classes, so definite that, in many cases, at least, it is impossible to question that they are regulated by some organic law. Of course, Mr. Darwin recognized that variations had their causes, but, nevertheless, he was inclined to believe that they were 'par hazard.' According to the conclusions of Mr. Bateson, however, they are of a more or less definite nature. Incidentally also Mr. Bateson points out that the study of variation gives us a new conception of homology, and almost deprives us of the belief in the long recognized law of reversion. It is somewhat surprising to be called upon to abandon the law of reversion, and perhaps the author does not deny that it may be a factor in development, but he does claim most of the instances so explained have nothing to do with this principle. It is not possible here to dwell further upon the many suggestive facts which are brought out by this study.

In criticism one may say that the English is extremely poor. The subject, of course, is a difficult one, and the author is obliged to use a new terminology and to explain his principles as he progresses. This in itself renders the book somewhat obscure, but we must add to this the fact that in many cases his sentences are very involved and cumbersome, and altogether the work is difficult reading. We may also somewhat regret that the author does not weave into the work a few more suggestions as to the significance of some of the facts that he has treated. The great part of this work reads like a museum catalogue, and museum catalogues are much more intelligible if one understands the basis of classification. Mr. Bateson, however, distinctly states that he does not consider the evidence as yet sufficient to warrant conclusions except in regard to some few general subjects. One may also question if most of his material does not savor too strongly of abnormal, and, indeed, almost pathological variations, to fairly serve as a basis for a theory of the origin of species. But, in spite of one or two such minor criticisms, the book of Mr. Bateson is an extremely valuable addition to zoölogical literature, and when it is completed by subsequent volumes upon variations of different nature it is hardly possible to doubt that it will be one of the few valuable and lasting additions to the literature on the general subject of the evolution of organic nature.

H. W. CONN.

WESLEYAN UNIVERSITY.

Grundriss der Ethnologischen Jurisprudenz.—ALBERT HERMANN POST.—Two Vols.—Oldenburg and Leipzig, 1895.

Ethnologische Studien zur Ersten Entwicklung der Strafe.—S. R. STEINMETZ.—Two Vols.—Leiden and Leipzig, 1894.

In these two carefully prepared and thoroughly reasoned works we have for the first time an unbiased application of the facts furnished by ethnology to an analysis of the evolution of jurisprudence. The study of them will prove of the greatest profit to the advocate, the anthropologist and the philosophic student of the growth of society.

Dr. Steinmetz, in his over 900 large octavo pages devoted to the subject, pursues the idea of punishment through all the forms under which it appears in early conditions, such as personal revenge, blood feuds, compounding of offences, family, totemic and social punishment, the vengeance of the gods, and religious chastisement. The foundation for this historic analysis is laid in the earlier pages of the first volume by an able excursus on the psychological motives which underlie the thirst for vengeance and the passion for cruelty. This furnishes a philosophic basis on which the author constructs his conclusions by an inductive study of all the forms of punishment and penalty found in primitive and early peoples. With this he is contented, and with a temperance worthy of high commendation, he refrains from committing his work to one or another 'school' by applying it to the defence of some pet doctrine of popular sociology, which would at once limit its usefulness. He rather says: "Here are the psychic motives; and here are the results to which under various conditions they have given rise. Let the facts present their own inferences."

This impartial spirit also thoroughly pervades the more comprehensive study of Dr. Post. It is considerably over a thousand pages in length and is an exhaustive analysis of the whole notion of rights, of the person, the family, the clan and the state, as they apply to both persons and things. In the second volume he traverses in his investigation of penalties much of the ground occupied by Dr. Steinmetz, and a comparison of their methods and results is quite interesting. The author's reading is immense, and the care with which he cites his authorities is most praiseworthy. While fully aware of the distinctly philosophic nature of his subject,—for a people's abstract conceptions of ethics are embodied in their concrete forms of laws,—he withstands the temptation to theorize on these points and keeps himself strictly within the limits of objective and inductive inquiry.

Of both these works it may be said that they represent the purest scientific method, and that they stand in the front rank of the contributions to Ethnology in its true sense which have appeared of late years.

D. G. B.

Flora of Nebraska.—Edited by members of the Botanical Seminar of the University of Nebraska.—Introduction and Part 1., *Protophyta-Phycophyta;* Part 2, *Coleochætaceæ, Characeæ.*—Lincoln, Nebraska, Published by the Seminar, 1894. 4to, pp. 123, pl. 36.

The beautiful work here noticed must long hold first place in the published results of the exploration and study of a local flora. It is hard to find words in which to express our gratification at its appearance, and we have tried in vain to find any point which is fairly open to adverse criticism. Beginning with a synopsis of the larger groups, including families, and an introduction contributed by Professor Bessey, in the details of which there is room for much difference of opinion, there follow concise descriptions of the classes, orders, families, genera, species and varieties of Protophyta and Phycophyta found within the State, contributed by Mr. DeAlton Saunders, and of the Coleochætaceæ and Characeæ by Mr. Albert F. Woods. The descriptions are well drawn, the typography excellent and the plates accurate and well executed. We tender our cordial congratulations to all concerned in the production of the book and to all who may have opportunity to use it.

N. L. B.

NOTES.

THE SCIENTIFIC SOCIETIES.

The programs of the mid-winter meetings of the several scientific societies promise large attendance and many important papers. The American Society of Naturalists meets at Johns Hopkins University, Baltimore, and in conjunction with it the American Morphological Society and the American Physiological Society. At the same place and time the American Society of Geologists meets. During the same week the Anatomists meet at Columbia College, New York; the American Psychological Association meets at Princeton; the American Folklore Society meets at Washington, and the annual meeting of the American Mathematical Society is held at Columbia College. These meetings will be fully reported in Science.

PHYSICS.

Actual trial trips with flying machines have recently been made by Mr. Maxim and Prof. Langley. Mr. Maxim's machine was fastened to rails to prevent its rising, and sailed 500 feet at the rate of 45 miles per hour. Prof. Langley's æroplane was allowed to fly over the water at Quantico, Md., on December 8th. Both Mr. Maxim and Prof. Langley use light steam engines in preference to storage batteries.

The Société Internationale des Électriciens established a central laboratory at Paris about seven years ago. The principal object of the laboratory was the preservation of electrical standards, and to afford practical electricians an opportunity for testing their various instruments. It is evident that such a laboratory offers special advantages for the investigation of questions belonging to the science and industry of electricity. These facilities have been to some extent utilized; but, in order to increase the usefulness of the institution, the Society has added to it a School of Applied Electricity. This school, which will be opened on December 3d, has been constructed on a plot of land granted by the city of Paris, the funds for the building having been raised by private subscription. Purely practical instruction will be given at the school. There will be two chief courses, one dealing with the industrial applications of electricity, and the other with electrometry. It is hoped that the school will be a training ground for higher work in the Central Laboratory, to which it is attached.—*Nature.*

ANTHROPOLOGY.

Dr. Charles L. Dana's address on *Degeneration and its Stigmata*, delivered at the Anniversary Meeting of the New York Academy of Medicine, Nov. 28, 1894, has been printed in the *Medical Record*, of Dec. 15th. Dr. Dana traces with much skill the historic development of the scientific method that discovers mental traits and especially mental degenerations from their physical manifestations.

The charges made against the management of the Elmira Reformatory have been dismissed by Governor Flower. The majority of the commissioners who examined the charges report that the institution stands preëminent among the reformatories of the world and that its success in the reformation of criminals has been extraordinary. This confirms the views of the leading criminologists and reformers.

EDUCATIONAL.

DR. J. K. TALMAGE has been called to the professorship of geology recently established in the University of Utah.

AMERICA has accomplished much for the advancement of Anthropology, but the work has been largely done by the Government institutions and by individuals. Columbia College offers this year courses in Anthropology (Dr. Farrand and Dr. Ripley), and the University of California must now be added to the institutions proposing courses in this subject.

THE Universities of Oxford and of Cambridge have recently taken action of considerable interest to Americans proposing to study abroad. The comparatively few Americans who have been in residence at Oxford or Cambridge would undoubtedly agree in recommending this course to others as highly as studying at a German university. But hitherto degrees could only be obtained by undergoing very irksome examinations. Oxford will now confer the degrees Litt. B. and Sc. B. on evidence of 'a good general education,' and research work evincing 'a high standard of merit.' Three years' residence is required, but this condition may be modified. The grace adopted at Cambridge is as follows: "That a syndicate be appointed to consider: (1) the means of giving further help and encouragement to persons who desire to pursue courses of advanced study or research within the University; (2) what classes of students should be admitted to such courses; (3) what academic recognition, whether by degrees or otherwise, should be given to such students, and upon what conditions; that the syndicate be empowered to consult and confer with such persons and bodies as they may think fit; and that they report to the Senate before the end of the Lent Term, 1895."

THE fourth edition of *Minerva* (1894–1895) presents as frontispiece an etched portrait of Lord Kelvin by Herkomer. The book now extends to 930 pages, an increase of 69 pages over the preceding edition, many new institutions having been included. The American universities and colleges added in this edition are Bryn Mawr, Cincinnati, Colgate, Massachusetts Institute of Technology, Nebraska, Ohio Wesleyan, Vermont, Wellesley, Western Reserve, making the total number thirty-nine. In attendance of students the order of the great universities is Paris, Berlin, Madrid, Vienna, Naples, Moscow, Budapest, Munich, Athens, Oxford, Harvard. But in many of these institutions attendance on popular lectures seems to be included.

A WORK with the range of *Minerva*, giving the courses as well as the instructors in institutions of learning, would be of much use, but a difficult undertaking. The need has, however, been supplied for the different institutions of Paris by *Le livret de l'étudiant de Paris* (Delalain Frère 1894–95), prepared under the direction of the general council of the faculties.

FORTHCOMING BOOKS.

DR. DANIEL G. BRINTON, Professor of American Archæology in the University of Pennsylvania, has in press a *Primer of Mayan Hieroglyphics*, to be published by Ginn & Co., Boston, in which he aims to explain the elements of the mysterious writing on the monuments of Central America.

GINN & Co. also announce a series of handbooks on the *History of Religions*, edited by Prof. Morris Jastrow, Jr., of the University of Pennsylvania. *The Religions of India*, by Prof. E. W. Hopkins, of Bryn Mawr, will form the first volume.

MACMILLAN & Co. announce *The Principles of Sociology*, by Prof. Franklin H. Giddings, of Columbia College; *Monism, The Confession* *of Faith of a Man of Science*, by Dr. Ernst Haeckel; *Life at the Zoo*, by C. J. Cornish; a new edition of S. Thompson's *Electricity and Magnetism* and *Mental Development in the Child and in the Race*, by J. Mark Baldwin.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES.

J. A. MATTHEWS, *Notes on Carborundum.*

BASHFORD DEAN, *On the collections of Fossil Fishes at Berea, New London and Delaware, Ohio.*

L. McI. LUQUER, *The Relative effects of Frost and Sulphate of Soda Efflorescence as shown by Tests of Building Stone.*

J. F. KEMP, *Secretary.*

THE TORREY BOTANICAL CLUB.

B. D. HALSTED, *Abnormalities in Plants Due to Fungus Parasites.*

HENRY H. RUSBY, *Secretary.*

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

LUDWIG GUTMANN, *On the Production of Rotary Magnetic Fields by a Single Alternating Current.*

In the absence of the author, the paper will be presented in abstract by Dr. M. I. Pupin.

A meeting of Western members will be held the same evening at Chicago, where the paper will be read by the author.

RALPH W. POPE, *Secretary.*

SCIENTIFIC JOURNALS.

THE AMERICAN NATURALIST.

Quarternary Time Divisible in Three Periods, the Lafayette, Glacial, and Recent: WARREN UPHAM.

The Homologies of the Uredinea (The Rusts): CHARLES E. BESSEY.

On the Evolution of the Art of Working in Stone; a preliminary paper by J. D. McGuire: CHARLES H. READ.

Zoölogy in the High School: CLARENCE M. WEED.

Editorials; Recent Books and Pamphlets; Recent Literature.

General Notes:—Petrography; Geology and Paleontology; Botany; Zoölogy; Entomology; Archeology and Ethnology.

Proceedings of Scientific Societies.

THE PHYSICAL REVIEW.

Frontispiece: portrait of Professor von Helmholtz.

Studies of the Lime Light: EDWARD L. NICHOLS and MARY L. CREHORE.

A Study of the Residual Charges of Condensers and their Dependence upon Temperature: FREDERICK BEDELL and CARL KINSLEY.

A General Theory of the Glow-Lamp II.: H. S. WEBER.

Minor Contributions; Notes; New Books.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY.

On the Group of Holoedric Transformation of a Given Group into Itself: E. HASTINGS MOORE.

On the Non-Primitive Substitution Groups of Degree Ten: G. A. MILLER.

Briefer Notices; Notes; New Publications.

NEW BOOKS.

Popular Lectures and Addresses. Vol. II., *Geology and General Physics.* SIR W. THOMPSON. London and New York. Macmillan & Co. 1894. Pp. x., 599.

Light. Elementary text-book; theoretical and practical. R. T. GLAZEBROOK. Cambridge University Press. New York. Macmillan & Co. 1894. Pp. vii., 213. $1.00.

Manual of Physico-Chemical Measurements. By WILHELM OSTWALD. Trans. by JAMES WALKER. London and New York. Macmillan & Co. 1894. Pp. xii., 255. $2.25.

Electricity One Hundred Years Ago and To-day. EDWIN J. HOUSTON. New York. W. J. Johnson & Co. 1894. Pp. 199. $1.00.