aria cucullata) from South America, presented by Mr. W. E. Ayerst; four Florida Tortoises (*Testudo polyphemus*) from Florida, presented by Mr. Hugh Bellas; a Common Viper (*Vipera berus*) from Hampshire, presented by Mr. Gerald Waller, F.Z.S.; a Brown-throated Conure (*Conurus æruginosus*) from South America, a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, a Macaque Monkey *Macacus cynomolgus*) from India, deposited; a Bandicoot Rat (*Mus bandicoota*), a Bronze-spotted Dove (*Chalcopelia chalcopilos*), bred in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 *AUGUST* 15–21

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 15

Sun rises, 4h. 47m.; souths, 12h. 4m. 16·6s.; sets, 19h. 21m.; decl. on meridian, 14° 1′ N.: Sidereal Time at Sunset, 16h. 57m.

Moon (one day after Full) rises, 19h. 12m.*; souths, 0h. 13m.; sets, 5h. 19m.; decl. on meridian, 12° 13′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	5 13	12 4	18 55	9 7 N.
Venus	2 10	10 11	18 12	21 9 N.
Mars	10 48	15 59	21 10	10 23 S.
Jupiter... ...	8 45	14 44	20 43	0 55 S.
Saturn... ...	1 34	9 40	17 46	21 59 N.

* Indicates that the rising is that of the preceding evening.

Occultations of Stars by the Moon (visible at Greenwich)

Aug.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
17 ...	4 Ceti	6	21 58	near approach	345 —
17 ...	5 Ceti	6	22 3	22 32	10 323
17 ...	B.A.C. 5 ...	6	22 11	23 21	62 278
19 ...	*ν* Piscium ...	4½	22 42	23 47	68 261

Aug. h.
16 ... 8 ... Mercury in inferior conjunction with the Sun.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·2	81 16 N.	Aug. 17,	21 28	*m*
Algol	3 0·8	40 31 N.	,, 20,	0 18	*m*
R Comæ	11 58·4	19 25 N.	,, 17,		*M*
W Virginis	13 20·2	2 47 S.	,, 17,	0 0	*M*
δ Libræ	14 54·9	8 4 S.	,, 21,	20 4	*m*
U Coronæ	15 13·6	32 4 N.	,, 15,	2 21	*m*
W Herculis... ...	16 31·2	37 34 N.	,, 18,		*M*
U Ophiuchi... ...	17 10·8	1 20 N.	,, 17,	2 56	*m*
			,, 17,	23 4	*m*
W Sagittarii ...	17 57·8	29 35 S.	,, 21,	0 0	*M*
U Sagittarii... ...	18 25·2	19 12 S.	,, 15,	0 0	*M*
β Lyræ...	18 45·9	33 14 N.	,, 20,	21 0	m_2
S Vulpeculæ ...	19 43·7	27 0 N.	,, 21,		*M*
R Sagittæ	20 8·9	16 23 N.	,, 19,		*m*
δ Cephei	22 24·9	57 50 N.	,, 20,	2 0	*m*

M signifies maximum; *m* minimum; m_2 secondary minimum.

TENTH ANNIVERSARY OF THE JOHNS HOPKINS UNIVERSITY

THE tenth anniversary of the Johns Hopkins University at Baltimore was celebrated on April 26 last. Of the addresses delivered on that occasion we reprint two, the second of which reviews the work of this distinguished institution since its foundation. The work of the University in every department of human knowledge is well-known and appreciated in this country, and it is unnecessary to add a word to the address of Dr. Thomas, beyond expressing a cordial hope that the future may, in the words of the very appropriate ode read on the occasion, be

"Smooth course and splendour of the sunset-smiles."

The following is the address delivered by Prof. Henry A. Rowland, Ph.D., who took for his subject "The Physical Laboratory in Modern Education."

"From the moment we are born into this world down to the day when we leave it, we are called upon every moment to exercise our judgment with respect to matters pertaining to our welfare. While nature has supplied us with instincts which take the place of reason in our infancy, and which form the basis of action in very many persons through life, yet, more and more as the world progresses and as we depart from the age of childhood we are forced to discriminate between right and wrong, between truth and falsehood. No longer can we shelter ourselves behind those in authority over us, but we must come to the front and each one decide for himself what to believe and how to act in the daily routine and the emergencies of life. This is not given to us as a duty which we can neglect if we please, but it is that which every man or woman, consciously or unconsciously, must go through with.

"Most persons cut this Gordian knot, which they cannot untangle, by accepting the opinions which have been taught them and which appear correct to their particular circle of friends and associates: others take the opposite extreme, and, with intellectual arrogance, seek to build up their opinions and beliefs from the very foundation, individually and alone, without help from others. Intermediate between these two extremes comes the man with full respect for the opinions of those around him, and yet with such discrimination that he sees a chance of error in all, and most of all in himself. He has a longing for the truth, and is willing to test himself, to test others, and to test nature until he finds it. He has the courage of his opinions when thus carefully formed, and is then, but not till then, willing to stand before the world and proclaim what he considers the truth. Like Galileo and Copernicus he inaugurates a new era in science, or, like Luther, in the religious belief of mankind. He neither shrinks within himself at the thought of having an opinion of his own, nor yet believes it to be the only one worth considering in the world; he is neither crushed with intellectual humility, nor yet exalted with intellectual pride; he sees that the problems of nature and society can be solved, and yet he knows that this can only come about by the combined intellect of the world acting through ages of time, and that he, though his intellect were that of Newton, can, at best, do very little toward it. Knowing this he seeks all the aids in his power to ascertain the truth, and if he, through either ambition or love of truth, wishes to impress his opinions on the world, he first takes care to have them correct. Above all, he is willing to abstain from having opinions on subjects of which he knows nothing.

"It is the province of modern education to form such a mind, while at the same time giving to it enough knowledge to have a broad outlook over the world of science, art, and letters. Time will not permit me to discuss the subject of education in general, and, indeed, I would be transgressing the principles above laid down if I should attempt it. I shall only call attention at this present time to the place of the laboratory in modern education. I have often had a great desire to know the state of mind of the more eminent of mankind before modern science changed the world to its present condition and exercised its influence on all departments of knowledge and speculation. But I have failed to picture to myself clearly such a mind, while, at the same time, the study of human nature, as it exists at present, shows me much that I suppose to be in common with it. As far as I can see, the unscientific mind differs from the scientific in this, that it is willing to accept and make statements of which it has no clear conception to begin with, and of whose truth it is not assured. It is an irresponsible state of mind without clearness of conception, where the connection between the thought and its object is of the vaguest description. It is the state of mind where opinions are given and accepted without ever being subjected to rigid tests, and it may have some connection with that state of mind where everything has a personal aspect and we are guided by feelings rather than reason.

"When, by education, we attempt to correct these faults, it is necessary that we have some standard of absolute truth: that we bring the mind in direct contact with it, and let it be convinced of its errors again and again. We may state, like the philosophers who lived before Galileo, that large bodies fall faster than small ones, but when we see them strike the ground together, we know that our previous opinion was false, and we learn that even the intellect of an Aristotle may be mistaken. Thus we are taught care in the formation of our

opinions, and find that the unguided human mind goes astray almost without fail. We must correct it constantly and convince it of error over and over again until it discovers the proper method of reasoning, which will surely accord with the truth in whatever conclusions it may reach. There is, however, danger in this process that the mind may become over-cautious, and thus present a weakness when brought in contact with an unscrupulous person who cares little for truth and a great deal for effect. But if we believe in the maxim that truth will prevail, and consider it the duty of all educated men to aid its progress, the kind of mind which I describe is the proper one to foster by education. Let the student be brought face to face with nature: let him exercise his reason with respect to the simplest physical phenomenon, and then, in the laboratory, put his opinions to the test; the result is invariably humility, for he finds that nature has laws which must be discovered by labour and toil, and not by wild flights of the imagination and scintillations of so-called genius.

"Those who have studied the present state of education in the schools and colleges tell us that most subjects, including the sciences, are taught as an exercise to the memory. I myself have witnessed the melancholy sight in a fashionable school for young ladies of those who were born to be intellectual beings reciting page after page from memory, without any effort being made to discover whether they understood the subject or not. There are even many schools, so-called, where the subject of physics or natural philosophy itself is taught, without even a class experiment to illustrate the subject and connect the words with ideas. Words, mere words, are taught, and a state of mind far different from that above described is produced. If one were required to find a system of education which would the most surely and certainly disgust the student with any subject, I can conceive of none which would do this more quickly than this method, where he is forced to learn what he does not understand. It is said of the great Faraday that he never could understand any scientific experiment thoroughly until he had not only seen it performed by others, but had performed it himself. Shall we then expect children and youth to do what Faraday could not do? A thousand times better never teach the subject at all.

"Tastes differ, but we may safely say that every subject of study which is thoroughly understood is a pleasure to the student. The healthy mind as well as the healthy body craves exercise, and the school-room or the lecture-room should be a source of positive enjoyment to those who enter it. Above all, the study of nature, from the magnificent universe, across which light itself, at the rate of 186,000 miles per second, cannot go in less than hundreds of years, down to the atom of which millions are required to build up the smallest microscopic object, should be the most interesting subject brought to the notice of the student.

"Some are born blind to the beauties of the world around them, some have their tastes better developed in other directions, and some have minds incapable of ever understanding the simplest natural phenomenon; but there is also a large class of students who have at least ordinary powers and ordinary tastes for scientific pursuits: to train the powers of observation and classification let them study natural history, not only from books, but from prepared specimens, or directly from nature; to give care in experiment and convince them that nature forgives no error, let them enter the chemical laboratory; to train them in exact and logical powers of reasoning, let them study mathematics; but to combine all this training in one and exhibit to their minds the most perfect and systematic method of discovering the exact laws of nature, let them study physics and astronomy, where observation, common-sense, and mathematics go hand in hand. The object of education is not only to produce a man who *knows*, but one who *does*; who makes his mark in the struggle of life and succeeds well in whatever he undertakes; who can solve the problems of nature and of humanity as they arise; and who, when he knows he is right, can boldly convince the world of the fact. Men of action are needed as well as men of thought.

"There is no doubt in my mind that this is the point in which much of our modern education fails. Why is it? I answer that the memory alone is trained, and the reason and judgment are used merely to refer matters to some authority who is considered final, and worse than all they are not trained to apply their knowledge constantly. To produce men of action they must be trained in action. If the languages be studied, they must be made to translate from one language to the other until they have perfect facility in the process. If mathematics be studied, they must work problems, more problems, and problems again, until they have the use of what they know. If they study the sciences, they must enter the laboratory, and stand face to face with nature; they must learn to test their knowledge constantly, and thus see for themselves the sad results of vague speculation; they must learn by direct experiment that there is such a thing in the world as truth, and that their own mind is most liable to error. They must try experiment after experiment and work problem after problem until they become men of action, and not of theory.

"This, then, is the use of the laboratory in general education—to train the mind in right modes of thought by constantly bringing it in contact with absolute truth, and to give it a pleasant and profitable method of exercise which will call all its powers of reason and imagination into play. Its use in the special training of scientific men needs no remark, for it is well known that it is absolutely essential. The only question is whether the education of specialists in science is worth undertaking at all, and of these I have only to consider natural philosophers or physicists. I might point to the world around me, to the steam-engine, to labour-saving machinery, to the telegraph, to all those inventions which make the present age the 'Age of Electricity,' and let that be my answer. Nobody could gainsay that the answer would be complete, for all are benefited by these applications of science, and he would be considered absurd who did not recognise their value. These follow in the train of physics, but they are not physics; the cultivation of physics brings them and always will bring them, for the selfishness of mankind can always be relied upon to turn all things to profit. But in the education pertaining to a University we look for other results. The special physicist trained there must be taught to cultivate his science for its own sake. He must go forth into the world with enthusiasm for it, and try to draw others into an appreciation of it, doing his part to convince the world that the study of nature is one of the most noble of pursuits, that there are other things worthy of the attention of mankind besides the pursuit of wealth. He must push forward and do what he can according to his ability, to further the progress of his science.

"Thus does the University, from its physical laboratory, send forth into the world the trained physicist to advance his science and to carry to other colleges and technical schools his enthusiasm and knowledge. Thus the whole country is educated in the subject, and others are taught to devote their lives to its pursuit, while some make the applications to the ordinary pursuits of life that are appreciated by all.

"But for myself I value in a scientific mind most of all that love of truth, that care in its pursuit, and that humility of mind which makes the possibility of error always present more than any other quality. This is the mind which has built up modern science to its present perfection, which has laid one stone upon the other with such care that it to-day offers to the world the most complete monument to human reason. This is the mind which is destined to govern the world in the future and to solve problems pertaining to politics and humanity as well as to inanimate nature.

"It is the only mind which appreciates the imperfections of the human reason, and is thus careful to guard against them. It is the only mind that values the truth as it should be valued, and ignores all personal feeling in its pursuit. And this is the mind the physical laboratory is built to cultivate."

Dr. Thomas's address was as follows:—

"The foundation and growth of a University is an event of the greatest interest.

"Its functions and use have been elaborately discussed by many modern thinkers and scholars. I shall call your attention to three statements of men of differing schools of thought.

"Goldwin Smith, discussing Oxford University organisation, says:—

"'Experience seems to show that the best way in which the University can promote learning and advance science is—

"'(1) By allowing its teachers, and especially the holders of its great professorial chairs, a liberal margin for private study;

"'(2) By keeping its libraries and scientific apparatus in full efficiency and opening them as liberally as possible;

"'(3) By assisting, through its press, in the publication of learned works which an ordinary publisher would not undertake;

"'(4) By making the best use of its power of conferring literary and scientific honours.'

"Matthew Arnold says, the University 'ought to provide facilities, after the general education is finished, for the young man to go on in the line where his special aptitudes lead him, be it that of languages and literature, of mathematics, of the natural sciences, of the application of these sciences, or any other line, and follow the studies of this line systematically, under first-rate teaching.'

"Again, 'The idea of a University is, as I have already said, that of an institution not only offering to young men facilities for graduating in that line of study to which their aptitudes direct them, but offering to them also facilities for following that line of study systematically under first-rate instruction. This second function is of incalculable importance, of far greater importance even than the first. It is impossible to over-value the importance to a young man of being brought in contact with a first-rate teacher of his matter of study, and of getting from him a clear notion of what the systematic study of it means."

"John Henry Newman says:—'It is a great point, then, to enlarge the range of studies which a University professes, even for the sake of the students; and though they cannot pursue every study which is open to them, they will be gainers by living among those and under those who represent the whole circle. This I conceive to be the advantage of a seat of universal learning, considered as a place of education. An assemblage of learned men, zealous for their own sciences and rivals of each other, are brought by familiar intercourse and for the sake of intellectual peace to adjust together the claims and relations of their respective subjects of investigation. They learn to respect, to consult, to aid each other. Thus is created a pure and clear atmosphere of thought, which the student also breathes, though in his own case he only pursues a few sciences out of the multitude. He apprehends the great outlines of knowledge, the principles on which it rests, the scale of its parts, its lights and its shades, its great and its little, as he otherwise cannot apprehend them.

"'Hence it is that his education is called "Liberal." A habit of mind is formed which lasts through life, of which the attributes are freedom, equitableness, calmness, moderation, and wisdom. This, then, I would assign as the special fruit of the education furnished at a University. . . . This is the main purpose of a University in the treatment of its students.'

"And a great thinker of another generation, George Fox, advised the setting up of schools for instructing 'in whatsoever things were civil and useful in the creation.'

"We may then conclude that a University, wisely planned and faithfully administered, should be able to gather together a company of teachers, distinguished in character and learning; to present courses of study, important and thorough; and to attract scholars mature in age and competent by reason of previous training to pursue special lines of study, in order to fit themselves in a worthy manner for their chosen vocation. It should be wide in its scope and able to supplement the College, and aid students to perfect themselves in many departments of learning. It should provide liberally all the apparatus for this study. It should be rich in laboratories, in books, in instruments. It should endow research and stimulate investigation and discovery. It should be prepared to give results of work done within its halls speedy and wide publicity amongst scholars engaged in kindred pursuits. It should give its contribution to society by training men who are fitted to help in the solution of the problems of the age—scientific, social, political, moral, and religious, both by stimulating the production of books and by contributions to the journals and literature of the day. It should encourage all noble aspirations, conserve all good inheritances of the past, and create an atmosphere of enthusiasm for hard work. It should be able to bestow honours worthy of the name in reward for faithful devotion and for the successful fulfilment of its courses of study. Its work should be known and recognised where learning is known and recognised, and its name should carry weight in other Universities and centres of research in the world of letters.

"Such thoughts as these, I am sure, Judge Dobbin, were in your mind and in the minds of the other trustees to whom was intrusted by our late townsman, Johns Hopkins, the foundation and guidance of this University which was to bear his name. On the completion of the first decade of its existence, in the presence of the trustees and the President and Faculty of the University, before the graduates, the present Fellows, and students of the University, and in the presence of this company of our friends and fellow-citizens, it has seemed fitting to allude to these sentiments as we proceed to consider the progress of this University.

"I am glad to take this opportunity of replying in public to questions such as were asked me by a young Baltimorean, who the other day said: 'Why do Baltimoreans have to go to New Haven or somewhere abroad to learn about the Johns Hopkins? Why do you not tell us what is being done?' In order to do this before a Baltimore audience, I have supposed my friend to have asked the following questions, to which I shall briefly reply:—

"(1) Have great teachers been attracted to the University?

"(2) Have important courses of study been instituted?

"(3) Have students come, and from whence?

"(4) Have patient and successful researches been carried on?

"(5) Has the University gathered together suitable apparatus, &c., for study?

"(6) Have the results of these researches been given by the University to the world?

"(7) Has the work done here been recognised elsewhere?

"(8) Has the training given proved valuable to those who have received it?

"(9) What has the University done for this community?

"The Board of Trustees was incorporated in August 1869, at the instance of Johns Hopkins and during his lifetime. About a year after the death of the founder, in December 1873, the Board was put in possession of the endowment provided by his beneficence, and organised for work. The President of the Board, the late Galloway Cheston, took an active part in the enterprise, and by his advice greatly aided in laying the foundation of the University, and his name will always be honourably associated with its history. The other members of the Board, all of whom had been named by Johns Hopkins, were Reverdy Johnson, Jun., the first Chairman of the Executive Committee, Francis T. King, Lewis N. Hopkins, Thomas M. Smith, William Hopkins, John W. Garrett, Francis White, Charles J. M. Gwinn, George W. Dobbin, George William Brown, and James Carey Thomas.

"*What Great Teachers have been attracted?*—It was soon apparent that the wise and untrammelled directions of Johns Hopkins to his trustees to found a University would attract the attention of those interested in the cause of education, especially in the United States.

"The opportunity of developing an institution suited to the needs of the country was sufficient to draw to Baltimore from across the Continent the then President of the University of California, Daniel C. Gilman, who was named to the trustees as the man best fitted by previous training and devotion to the study of educational methods, to advise and direct the establishment of the new foundation, by his former colleagues of Yale College—by President Eliot, of Harvard University, at once the most renowned and the most venerable institution of learning in the country—by President White, of Cornell University, then in the early days of its growing importance and usefulness—by President Angell, of the University of Michigan, the crowning institution of learning of the well-organised system of public instruction in that great and strong Western State—and by numerous other leading educators. At the request of the trustees Mr. Gilmun came to Baltimore, and after consultation with them accepted the Presidency of the Johns Hopkins University. Under his thoughtful care and constant and laborious effort the plan originally contemplated has been gradually and harmoniously developed.

"Besides President Gilman, the University also drew from across the ocean, from Woolwich, England, Prof. Sylvester, one of the two greatest English mathematicians, and indeed one of the greatest of the world; and from Virginia, in our own land, Prof. Gildersleeve, second to none in his attainments in and devotion to Greek and other classical study—besides younger men whose subsequent career has justified the bright promise of their early years. I shall not mention further by name the present distinguished staff of Professors and teachers, whose work I have alluded to, and who form the permanent renown and attraction of the University.

"I will give a list in chronological order of those gentlemen, not now connected with the University, who, for a longer or shorter period, have lectured here during the past ten years:—

"In Language and Literature, Profs. F. J. Child, James Russell Lowell, W. D. Whitney, C. R. Lanman, Thomas C.

Murray, H. C. G. Brandt, Sidney Lanier (too early lost), Profs. W. W. Goodwin, J. A. Harrison, J. Rendel Harris, Hiram Corson, A. S. Cook, Messrs. George W. Cable, Edmund Gosse, Justin Winsor, A. Melville Bell, Drs. Isaac H. Hall, and W. Hayes Ward; in History and Political Science, Profs. T. M. Cooley, F. A. Walker, W. F. Allen, the lamented J. L. Diman, H. von Holst, Austin Scott, James Bryce, E. A. Freeman (who gave six lectures and imparted a decided impulse to historical study here), R. M. Venable, Messrs. J. J. Knox and Eugene Schuyler; in Archæology and Art, Messrs. W. W. Story, F. Seymour Haden, J. Thacher Clarke, W. J. Stillman, Dr. Charles Waldstein, and Mr. Frederick Wedmore; in Philosophy and Logic, Profs. William James, G. S. Morris, Mr. C. S. Pierce, and Dr. Josiah Royce; in Physical and Mathematical Science, Profs. J. E. Hilgard, J. Willard Gibbs, John Trowbridge, A. Graham Bell, S. P. Langley, Arthur Cayley, C. S. Hastings, and Sir William Thomson; in Chemistry and Biology, Profs. J. W. Mallet, W. G. Farlow, J. McCrady, W. T. Sedgwick, H. Sewall, and W. Trelease.

"At our commencements, anniversaries, and other gatherings, we have heard from Presidents Eliot and White, from Dean Stanley, Dean Howson, Prof. Huxley, Archdeacon Farrar, Chief Justice Waite, Hon. W. M. Evarts, Dr. W. A. P. Martin, Dr. W. B. Carpenter, Hon. S. T. Wallis, J. B. Braithwaite, and others.

"Many of these have been listened to by those not members of the University who were specially interested in their subjects, and it may be fairly said that many eminent and great teachers have been both for long and short periods attracted to the University.

"*What University Courses are here offered, and what Graduate Students have been attracted?*—The courses of University studies that have been pursued have been so often and so fully referred to in the reports and circulars of the University, that I can only enumerate those in higher mathematics, in physics, in chemistry, in mineralogy and petrography, in biology; in Greek, in Latin, in Sanskrit, in Hebrew, in Aramæan, in Arabic, in Assyrian, and in Sumero-Akkadian; in English, in German, in the Romance group of languages, including French, old and modern, Wallachian, Italian, Spanish, Catalan, old Provençal, modern Provençal, and Portuguese; in history, ancient and modern, in political economy, physical and historical geography; in psychology, pedagogics and philosophy, in mental hygiene and ethics. In these studies advanced instruction has been given by all available means, such as lectures, laboratory practice, seminary work, books, models, and plates, in order to fit those who are preparing for teaching or special research.

"That these courses have succeeded in attracting students of mature age is evident from the fact that out of the total number of students (923) enrolled during the decade, 590 have pursued graduate courses, and these 590 came from more than 100 different Universities and Colleges as widely separated as Russia and Japan.

"*What Apparatus and Appliances have been gathered together?*—To aid in the instruction given, the trustees have from the first had in view securing the most convenient and free access to the most modern means of promoting research. They were greatly aided by the existence in Baltimore of a library of unusual value to students—the gift of the late George Peabody, and brought together with much care and diligence by the trustees, the provost, and the librarian of the Peabody Institute—and which has been liberally opened to members of the University. As a supplement to the Peabody collections the University has placed within its own walls 29,000 volumes—a portion of which are standard reference-books needed by all the teachers and students; the remainder are special and often costly books which have been called for by the specialists here engaged in work.

"The plans of the University being at first, from the nature of the case, tentative, the work was begun in two dwelling-houses purchased in 1875, on Howard Street, near Monument Street, and in a hall erected at the time, and named after the founder, which contained an assembly-room and accommodations for the library and for the biological laboratory, and in a chemical laboratory built at the same time, and this was for some time the modest seat of the University. The location was found more convenient than had been foreseen, both for students who lived in the city and for those that came from elsewhere, who readily found accommodation in lodgings suited to their taste and means. Easy access was had to the Peabody and other collections of books, as those of the Historical Society, and later of the Pratt Library, and there have gradually grown around the present site complete and well-equipped laboratories. The chemical laboratory has been greatly enlarged and perfected. The biological laboratory adjoining has been erected after plans suggested by years of work and by comparison with foreign institutions of a similar kind, and there is now building near by the physical laboratory, of which Prof. Rowland has been speaking to you to-day. Laboratory work in pathology has been begun in one of the buildings of the Johns Hopkins Hospital, and it is intended to erect the Medical School on a lot now owned by the University, adjacent to the hospital.

"Into these various buildings have been gathered, at the suggestion and under the careful personal supervision of various experts, about 70,000 dols. worth of apparatus of the most approved modern make, thus placing within the reach of investigators the means of pursuing advanced research, as well as enabling students to become familiar by personal use with the newest methods of study and experiment.

"*What Research is carried on, and what has been published?*—The researches which have been made have been many and varied. I cannot refer to the more technical, such as those in mathematics and inorganic chemistry, &c., but briefly to the more easily stated.

"Our knowledge of the nature of the sun, as perceived through the solar spectrum, has received accessions from the beautiful image thrown from the gratings first made here by the agency of a wonderful dividing-engine, the invention of the Professor of Physics. From this image a map of the spectrum has been published, very much more minute than any before made.

"Researches in electricity and magnetism have been made under the auspices of the United States Government, with the co-operation of other nations; the mechanical equivalent of heat has been redetermined; investigations have been conducted in physiology, especially of the heart's action; lower animal life has been studied, especially that of the oyster in connection with the State of Maryland; both here and in Boston the cause of water pollution in great reservoirs has been discovered; the curious geological formation of our own neighbourhood has been brought to notice and has attracted wide attention. The philologians and grammarians have been engaged in the investigation of Greek and Latin syntax; in editing ancient writings, such as Pindar, the newly discovered Greek MSS. of the Teaching of the Twelve Apostles, and part of an old Syriac MS. of the New Testament. Baltimore is now one of the centres for the interpretation of Sanskrit texts and of Assyrian inscriptions. A great contribution has been made to the study of American Institutions, and new methods of historical research and of publication have been initiated.

"It is with satisfaction that I state that these researches have been widely recognised at home and abroad, not as *promises* for the future, but as successful experiments recorded, and conclusions reached which have passed into the history of science. By means of them the fame of the University has been carried into every seat of learning in the world, from Oxford and Cambridge in England, to Tokio, Japan; from the northern and more modern Universities of Sweden and Russia to the ancient seats of learning in Italy and Southern Europe. The exchanges on the shelves of our library, received with almost every foreign mail in return for the six scientific journals published by the University,[1] attest both its importance and its estimation outside its own walls. Besides this, personal and unsolicited testimonials from eminent men are on file in the office which have been received from many quarters.

"These researches, delicate, prolonged, and important, and others not now mentioned, have been made by Professors, Fellows, and advanced students. Indeed the whole plan of Fellowships has in reality been a most practical and efficient endowment of research, and has richly repaid the University and the community in the importance and value of the results obtained.

"Twenty young men who have not quite completed their

[1] (1) The "American Journal of Mathematics," commenced in 1878, now in its eighth volume; (2) the "American Chemical Journal," commenced in 1879, now in its eighth volume; (3) the "American Journal of Philology," commenced in 1880, now in its seventh volume; (4) "Studies from the Biological Laboratory," commenced in 1879, now in its third volume; (5) "Studies in Historical and Political Science," begun in 1882, of which the fourth series is in progress; (6) the "Johns Hopkins University Circulars," begun in 1879, of which forty-nine numbers have been issued.

work as students following masters, but who have gone far enough to indicate that they are possessed of unusual ability, are annually chosen by the Academic Council, and are encouraged by a generous stipend to devote all their time to study which is not of a distinctively professional character. They are chosen because of the hope they give of future achievements, or are selected on the evidence they submit of their previous intellectual attainments. The system here adopted has elsewhere been followed.

"*What has been the Value of this Training?*—Has the training here been of value to the men that have submitted to the severe ordeal of discipline and who have often surrendered honourable and lucrative positions to avail themselves of the advantages offered for research and study? Or, in other words, are the diplomas to be given to-day as testimonials of the University to the attainments of those to whom they are so worthily awarded, of real value to their possessors?

"Of the 69 persons who in these ten years have been admitted to the degree of Doctor of Philosophy, denoting proficiency in various lines of special graduate study, either in letters or in science, 56 have obtained honourable positions as professors and teachers in 32 Universities and Colleges; and of the 90 to whom the degree of Bachelor of Arts has been given, 20 have engaged in teaching in 16 Colleges and high schools.

"I will conclude this part of my subject by quoting the reply made by a graduate student from North Carolina, when asked what he had found here of most use, he replied: 'The freedom of access to able teachers and the stimulant of studying in company with men of maturer minds than one meets elsewhere.'

"*But what has the University done for this community?*—Besides the incidental advantages which must accrue to any community from the presence of a great seat of learning, the trustees have had in mind from the first the special needs of this city and state. At the conclusion of the late war fewer boys were at college than at former periods. Many young men here and further south had foregone college training, and circumstances forbade the sending of others who were growing up. It was manifest that the need of our own people was first a college in order to train for life, or for further university instruction. So side by side with the University has developed the college department of the Johns Hopkins University. This was begun when the discussion of a fixed, a free, or wholly or partly elective college course had not been so warmly debated as at the present time, but it was evident that the wide range which the development of various branches of knowledge has taken since the old arrangement of college studies was effected, and the limited time which can ordinarily be devoted by students to preparation for their life-work, made a readjustment of the college course desirable. This was accomplished here by arranging, after a fixed matriculation, the studies in groups rather than years, and demanding in each group a certain required amount of training in other than the main study of the course. Thus classical students are required to study some science, scientific students some classics, and all to receive a fixed amount of general English training in literature, ethics, philosophy, and modern languages.

"The seven groups for which, in accordance with these principles, arrangements are now made, are these:—

"(1) Classical—corresponding closely with what has been hitherto known in this country as the usual college course.

"(2) Mathematical-Physical—which meets the wants of those who are expecting to enter upon the modern vocations in which rigid mathematical discipline is indispensable.

"(3) Chemical-Biological—which is adapted to those, among others, who expect to enter upon the subsequent study of medicine.

"(4) Physical-Chemical—which is most likely to be followed by students preparing for those scientific pursuits which are neither chiefly mathematical nor chiefly biological.

"(5) Latin-Mathematical—which affords a good fundamental training, without prolonged attention to the study of Greek.

"(6) Historical-Political—which furnishes a basis for the subsequent study of law.

"(7) Modern Language—where French, German, English, and in exceptional cases, other modern languages, take the place of Latin and Greek in the traditional classical course.

"It cannot be said that this arrangement is perfect, but it has worked well, and great effort is made to have it at once liberal and adapted to the exigencies of active life. I should like all the time at my disposal to expand more fully this slight sketch of the college course which lies near my own heart, but must content myself with stating that it has from the first attracted our own boys, to whom great inducement has been held out, and who have proved some of our most enthusiastic and successful students, have won for themselves many of our own Fellowships, and have gone out to positions of importance and emolument. Their number is rapidly increasing, and the University is constantly endeavouring to make closer the connection between the high schools, whether private or public, and the collegiate department of the Johns Hopkins University.

"Various free scholarships are annually offered to students coming from Maryland, Virginia, and North Carolina, and have been held by 150 students from these States. The existence in our midst of such advantages is stimulating our young men to avail themselve of them, and is increasing the number and efficiency of preliminary schools. We have now in the collegiate department 130 students.

"I have thus, in the briefest and most prosaic manner, endeavoured to summarise the work of ten years into the space of twice as many minutes. It has been impossible, although I have not even glanced at the various literary and scientific Societies formed for themselves by the members of the University, nor alluded to the common college life, nor spoken of the work of the Christian Association of the University, which has served an excellent purpose; but yet I think that I have shown that something has been done to bring together great teachers, to start liberal courses of study, to attract students, to collect libraries and apparatus, to stimulate research, to publish results, and have stated in what manner this work has been recognised, and how the needs of this community have been considered.

"But I am sure that in reaching these conclusions you must feel how little has been done in comparison with what is practicable with longer time and greater resources. The perpetuation and enlargement of the University on a broad and liberal foundation should be the pride of every citizen. It is a great trust to be handed down to those who shall succeed us. Let us be careful to see that no detriment happen to it.

"Amidst the jarring of contending factions and classes there needs must be thoughtful men trained to habits of patient investigation and quiet study—amidst the rush of business and competition, men who in secluded laboratories pass hours and days in subtle experiments—amidst the selfishness of politicians and placemen, historians and philosophers and teachers who can recall the lessons of past ages and vindicate the great moral principles which underlie all true progress.

"For these and other great purposes Universities should exist and be richly endowed. They should be few, but strong.

"A president of a growing Western College, last week in Baltimore, emphasised most strongly the importance of adding efficiency to existing Universities in order to make them great centres for training and research. The possessors of great wealth, most frequently in this country accumulated in the course of a single life, have often felt their responsibility in its ultimate destination. They have in many instances, amongst which the course of Johns Hopkins is conspicuous, returned their accumulated gains to the community in noble gifts, founding great institutions of learning and great charities for the training of the future citizen and for the alleviation of human suffering. These should be fostered and enlarged, as has been done at Harvard and at Cornell, in order that the greatest good may be accomplished.

"The training of *men* is after all the most important end of all educational effort. It is to you, young men, the sons of this new foundation, that your teachers and friends look as the best evidence of the success of their endeavour. Your learning, your usefulness, your accomplishments, your high aims and noble character, your achievements, whether in the pulpit or the forum, the college or the laboratory, at home and abroad will afford a continual and living reminder of this, the place of your training.

"To a State founded on the beneficent precepts of Christianity, the walls of its defence must be not the physical strength of its citizens but their moral character. In vain will science harness the powers of the universe unless they are yoked to the chariot of peace and goodwill. In vain will learning and training give efficiency to individual influence and native genius, unless the purposes of the man are noble and far-reaching. The truth which sets free is the truth which warms the heart and expands the sympathies, as well as enlightens the intellect, which is of

Him who is the truth Himself. Let us have confidence in the supremacy of truth. Such has hitherto been the guiding lamp of the Johns Hopkins University. May it ever be the beacon of the future."

SCIENTIFIC SERIALS

A LARGE space in the June number of the *Journal of Botany* is occupied by a long biographical notice, by the editor, of the late Rev. W. W. Newbould, of whom an excellent portrait is also provided. The other articles are almost entirely of local interest.

THE *Journal of the Franklin Institute*, vol. cxxi. No. 724, April 1886.—Lieut. J. P. Finley, tornado study: a useful summary of the principal facts scientifically known respecting tornadoes.—F. E. Galloupe, rapid transit and elevated railroads. This concludes the discussion on this topic.—G. E. Waring, Jun., mechanical appliances in town sewerage; discusses the systems employed in several American cities.—Prof. R. H. Thurston, construction of a large Prony brake. Gives an account of a brake capable of absorbing 540 horse-power.—Dr. W. H. Wahl, summary of engineering and industrial progress for 1885.—Report of Committee on Delany system of multiplex telegraphy.

No. 725, May.—J. M. Hartman, the blast-furnace: a very concise summary of present methods of construction and theories.—Lieut. A. B. Wyckoff, hydrographic work of the U.S. Navy. J. Shinn, the cultivation of flax in the United States.—L. D'Auria, the law of cylinder condensation of steam-engines. The new formulæ indicate that the proper way to decrease cylinder condensation is to increase piston speed.—C. J. Kintner, history of the electrical art in the U.S. Patent Office. An interesting account, in which two early forms of storage battery are described. The author, however, appears to think that nothing can be called an invention unless it has been patented in the United States. There were secondary batteries prior to Kintner's, electric motors prior to Davenport's, and telephones prior to Graham Bell's.—Report of examiners of electrical exhibition on applications of electricity to art productions.

No. 726, June.—Chief Engineer Isherwood, an account of experiments made by Chief Engineers Zeller and Hunt to ascertain the economic effect of using in a non-condensing engine saturated steam alone, and of using it mixed with compressed hot air. No economic saving was effected by this process, as there was not sufficient time for the steam and hot air, which were delivered into the cylinder in separate masses, to become mixed, and the air failed to prevent condensation.—S. L. W., on the Oram system of marine propulsion. This system has twin screws placed forward at about 1/5 of the vessel's length from the bow, in recesses in the sides.—G. W. Chance, the South Street Bridge.—W. Lewis, experiments on the transmission of power by gearing. Valuable researches on the causes of loss of power in worm-gearing and spur-gearing.

No. 727, July.—C. Sellers, Jun., Oliver Evans and his inventions. A biographical notice of this remarkable man, whose prediction of the future of the steam-engine is well known.—O. E. Michaelis, the applications of electricity to marksmanship. This is the first part of the paper, and treats rather of mechanical methods of measuring speed of projectiles, such as Robins's ballistic method.—H. M. Dubois, tests of vehicle wheels.—F. E. Ives, colour-sensitive photographic plates. A compound sensibilisator of fresh blue myrtle chlorophyll with a little eosin is found to be the most sensitive to yellow and green.—Report of Committee on the Phelps induction telegraph. The Committee praise highly this invention for telegraphing to and from a moving train.—Report of Committee on the process and furnace for the reduction of refractory ores and the production of metals, alloys, and compounds, invented by E. H. and A. H. Cowles. Cowles's electric furnace, for reducing ore by means of the voltaic arc between carbon poles, is merely a development of the electric furnace devised by the late Sir W. Siemens. It appears to be eminently suitable for the production of aluminium compounds.—Prof. E. J. Houston, some additional facts concerning the Reis articulating telephone. Gives an account of some recent experiments transmitting speech with the identical apparatus manufactured by Reis and used by him in his lecture before the Physical Society at Frankfort in 1861.

Annalen der Physik und Chemie, vol. xxviii. No. 5, May.—R. Colley, on some new methods for observing electric oscillations, and some applications of them. This paper gives certain relations between the time of oscillation of discharges through a shunt having a great coefficient of self-induction and the capacity of the conden er. Using a standard coil the coefficient of self-induction of which could be determined by its geometrical form, and a normal guard-ring condenser made of three sheets of silvered glass, the capacity of which could equally be determined, the author made experiments from which he deduces a new value of the ratio v, which he gives as $3{\cdot}015 \times 10^{10}$ centims. per second.—Hans Jahn, on the relation of the chemical energy and the current energy of galvanic elements. A discussion of Helmholtz's expression for the secondary heat, together with some determinations made on Daniell's and De La Rue's cells.—E. Riecke, on the pyro-electricity of tourmaline. The first part of this paper summarises the previous researches of Gaugain and others upon the electricity of the tourmaline in relation to its section, length, rate of cooling, &c., and gives an account of some new and careful observations made upon three tourmalines. The second part of the paper is devoted to the development of a mathematical theory of the electricity of the tourmaline, based on the physical hypotheses that the molecules possess an initial electric polarisation, measurable in terms of the electric moment per unit of volume, and dependent upon the temperature, and that there is a surface-conductivity of a certain value. The formulæ appear to agree very well with the observed facts.—T. Ihmori, on the absorption of mercury vapour by spongy platinum. A quantity of platinum, deposited from chloride by formic acid, was found to increase in weight in presence of mercury. The author uses this increase of weight to investigate the figures given by Hertz and by Hagen, for the pressure of mercury vapour at different temperatures. His results are considerably lower than those of Hagen, and a little higher than those of Hertz.—C. Pulfrich, on the elastic reaction of a caoutchouc tube.—A. König, on a new method of determining the modulus of elasticity. Errors of observation are avoided by using two mirrors, the inclination of which altered by the loading of the bar under examination.—Karl Exner, on sense-formulæ: lenticular action of non-homogeneous bodies. Discussion of lenticular action of cylindriform disks with parallel plane faces made of materials which, on being cast in moulds, cool non-homogeneously with refractive indices that increase or diminish from point to point below the surface. The formulæ deduced coincide with ordinary lens formulæ when the variation of refractive index is proportional to the square of the depth from the surface. This appears to be nearly the case in disks of cast glue.—W. Wien, researches on the absorption-phenomena occurring in the diffraction of light. This paper discusses diffraction in relation to the colours of metallic reflection. Incidentally it brings out an additional proof that the vibrations are perpendicular to the so-called plane of polarisation.—H. W. Vogel, on some colour-experiments, and on photography in natural colours. Two solutions, one of chrysanilin, the other of anilin blue, in alcohol, are respectively yellow and blue; but when superposed give red, not green. The violet of the spectrum appears to play a very unimportant part in colour-sensations; methyl-violet, and nearly all the so-called violet pigments and dyes owe their tint to mixtures of red and blue rays, not to rays of spectrum violet. For colour-printing at least six tints are found requisite, and in general sufficient. Hence the author thinks that all requirements of colour-photography would be met by six printings from six blocks produced by photography from plates of bromide emulsion, to which the following six substances have been used as "sensibilisators": *red*, naphthol blue; *orange*, cyanin; *yellow*, eosin; *green*, saffranin; *green-blue*, fluorescein; *blue*, chrysanilin or aurantin. The author further points out that as the actual tint of any colouring-matter is the complementary colour to that absorbed by the colouring-matter itself, it follows that each of the six plates ought to be printed off in the same dye-stuff that has served as photographic "sensibilisator."—P. Volkmann, note on Prof. Quincke's remarks on the determination of capillary constants of liquids.—R. Schultze, on a small improvement in Wiedemann's pyknometer.

No. 6, June.—A. Kundt and E. Blasius, remarks on some researches on the pyro-electricity of crystals. A convenient apparatus for heating crystals is described; also some observations on the amethyst. The effects of cracks in the crystals are also studied.—K. Mack, pyro-electric and optical observations