JOHNS HOPKINS UNIVERSITY CIRCULARS.

Published with the approbation of the Board of Trustees.

No. 10.] BALTIMORE, APRIL, 1881. [PRICE 5 CENTS.

CALENDAR.

March 5—May 7.	**M. Rabillon's Lectures on French Literature.**
March 31—April 11.	**Professor McCrady's Lectures on the Theory of Development.**
April 15-18.	**Spring Recess.**
May 2.	**Session of Marine Laboratory at Beaufort Begins.**
June 6-9.	**Examinations for Matriculation.**
June 10.	**Present Term of Instruction Closes.**
September 20.	**Sixth Academic Year Begins.**
September 21-24.	**Examinations for Matriculation.**
September 27.	**Instructions Resumed.**

CONTENTS.

MEETINGS OF SOCIETIES.

Scientific. First Wednesday of each month, at 8 P. M. Next meeting, May 4.
L. B. Fletcher, Secretary.

Philological. First Friday of each month, at 12 M. Next meeting, May 6.
M. Warren, Secretary.

Metaphysical. Second Tuesday of each month, at 8 P. M. Next meeting, April 12.
Allan Marquand, Secretary.

Historical and Political Science. Third Friday of each month, at 8 P. M. Next meeting, April 15.
H. B. Adams, Secretary.

Mathematical. Third Wednesday of each month, at 8 P. M. Next meeting, April 13.
O. H. Mitchell, Secretary.

Naturalists' Field Club. Excursions each Saturday during the Spring and Autumn. Regular meetings for the reading and discussion of papers once a month.
E. M. Hartwell, Secretary.

ENUMERATION OF CLASSES, SECOND HALF-YEAR, 1880-81.

Mathematics. (26 Students).

Classes meet in Room 16.

Theory of Numbers: PROFESSOR SYLVESTER. Twice weekly, Tuesday and Friday, 1 P. M. (5).

Franklin. Mitchell. Van Velzer.
Ladd. Prentiss.

Mathematical Seminary: PROFESSOR SYLVESTER and DR. STORY. Third Wednesday of each month, 8 P. M. (16).

Bissing. Hathaway. Norwood.
Bland. Ladd. Perry.
Cuykendall. Matz. Pickle.
Davis. Miller, J. H. Prentiss.
Franklin. Mitchell. Van Velzer.
Gilman.

Problems in Mathematics: DR. STORY. Once weekly, Thursday, 12 M. (4).

Bissing. Norwood.
Matz. Prentiss.

Higher Plane Curves: *Advanced Course:* DR. STORY. Twice weekly, Tuesday and Friday, 12 M. (5).

Ladd. Mitchell. Prentiss.
Matz. Norwood.

Higher Plane Curves: *Elementary Course:* DR. STORY. Three times weekly, Tuesday, Wednesday and Friday, 11 A. M. (3).

Brown. Matz. Perry.

Solid Analytic Geometry: DR. STORY. Four times weekly, Monday, Tuesday, Thursday and Friday, 10 A. M. (5).

Brown. Gilman. Perry.
Davis. Matz.

Conics: DR. STORY. Three times weekly, Monday, Wednesday and Friday, 1 P. M. (8).

Cuykendall. Garthe. Matz.
Davis. Keeler. Reese, C. L.
Day, W. C. Liebig.

Mechanics: DR. STORY. Twice weekly, Monday and Thursday, 11 A. M. (6).

Bissing. Mitchell. Perry.
Matz. Norwood. Van Velzer.

Partial Differential Equations: DR. CRAIG. Twice weekly, Wednesday and Friday, 4 P. M. (5).

Bissing. Perry. Van Velzer.
Mitchell. Prentiss.

Modern Algebra: DR. FRANKLIN. Twice weekly, Monday and Wednesday, 10 A. M. (6).

Bissing. Mitchell. Perry.
Matz. Norwood. Van Velzer.

Integral Calculus: DR. FRANKLIN. Three times weekly, Monday, Wednesday and Friday, 11 A. M. (5).

Cuykendall. Harlan. Pickle.
Gilman. Page.

Theory of Equations: DR. FRANKLIN. Twice weekly, Tuesday, 11 A. M., Thursday, 10 A. M. (2).

Cuykendall. Reese, C. L.

Differential Equations: DR. FRANKLIN. Three times weekly, Monday, Wednesday and Friday, 3 P. M. (4).

Freeman. Matz.
Koyl. Perry.

Physics. (27 Students).

Classes meet in Rooms 3, 4, 7, 8.

Electricity and Magnetism: PROFESSOR ROWLAND. Four times weekly, Monday, Tuesday, Wednesday and Friday, 11 A. M. (3).

Freeman. Koyl. Perry.

Laboratory Work: PROFESSOR ROWLAND. Daily. (3 advanced students).

Fletcher. Freeman. Koyl.

Hydrodynamics: DR. CRAIG. Four times weekly, Monday, Wednesday and Friday, 3 P. M.; Saturday, 11 A. M. (3).

Bissing. Perry. Prentiss.

General Physics: DR. HASTINGS. Daily, except Saturday, 10 A. M. (14).

Adkins. Earle. Robinson.
Berry. Ebeling. Stratton.
Boston. Ingle. Tiffany.
Broun. Johnson. Wiegand.
Day, D. T. Page.

Major Course: DR. HASTINGS. Lectures once weekly, Thursday, 1 P. M.; Laboratory work during week, especially Wednesday. (9).

Bissing. Day, W. C. Mitchell.
Coale. Liebig. Pickle.
Cuykendall. Matz. Prentiss.

Laboratory Work: (*Class in General Physics*). DR. HALL. Once weekly, Tuesday. (8).

Boston. Earle. Stratton.
Broun. Noyes. Wiegand.
Day, D. T. Page.

Chemistry. (35 Students).

Classes meet in Chemical Laboratory.

Laboratory Work: PROFESSOR REMSEN and DR. MORSE. Daily, except Saturday. (31).

Baden. Harlan. Palmer, C.
Bayley. Keeler. Pickle.
Broun. Keyser. Price.
Coale. Kimball. Pund.
Cooke, C. A. Kuhara. Stevens.
Day, D. T. Liebig. Stokes.
Day, W. C. Mahon, O. L. Stratton.
Dosh. Marburg. Thomas.
Earle. Noyes. Trimble.
Frick. Palmer, A. G. Wiegand.
Garthe.

Chemistry of Carbon Compounds: PROFESSOR REMSEN. Four times weekly, Tuesday, Wednesday, Thursday and Friday, 9 A. M. (12).

Day, W. C. Keyser. Price.
Donaldson. Matz. Stevens.
Dosh. Noyes. Thomas.
Freeman. Palmer, A. G. Trimble.

General Chemistry: *Metals:* DR. MORSE. Daily, except Saturday, 9 A. M. (14).

Baden. Harlan. Marburg.
Bayley. Keeler. Stratton.
Cooke, C. A. Kimball. Warren, H. C.
Earle. Liebig. Wiegand,
Garthe. Mahon, O. L.

Biology. (23 Students).

Classes meet in Biological Laboratory and Lecture Room.

Animal Physiology: PROFESSOR MARTIN. Thrice weekly, Monday, Wednesday and Friday, 11 A. M. (14).

Donaldson. Lockwood. Schimper.
Dosh. Milroy. Shippen.
Hartwell. Moale. Warfield.
Howell. Reid. Wilson, E. B.
Keyser. Rolando.

General Biology: PROFESSOR MARTIN. Thrice weekly, Tuesday, Thursday and Saturday, 11 A. M. (6).

Moale. Schimper. Trimble.
Reid. Stevens. Warfield.

Comparative Osteology: DR. BROOKS. Daily, except Saturday, 10 A. M. (5).

Donaldson. Stevens. Warfield.
Reid. Trimble.

Physiology of the Voice; Embryology of Organs: DR. SEWALL. Once weekly, Monday, 4.15 P. M. (8).

Donaldson. Keyser. Rolando.
Dosh. Milroy. Warfield.
Howell. Reid.

Laboratory Work: PROFESSOR MARTIN, DR. SEWALL and MR. SEDGWICK. Daily, except Saturday, 9 A. M. to 5 P. M. (23).

Barton.	Keyser.	Schimper.
Clark, B.	Le Van Bender.	Shippen.
Clarke, S. F.	Lockwood.	Sternberg.
Donaldson.	Milroy.	Stevens.
Dosh.	Mitsukuri.	Trimble.
Fitzgerald.	Moale.	Warfield.
Hartwell.	Reid.	Wilson, E. B.
Howell.	Rolando.	

Structural Botany: MR. SEDGWICK. This course will begin in April.

Vegetable Physiology: DR. SCHIMPER. This course will begin in May.

Greek. (28 Students).

Greek Seminary: PROFESSOR GILDERSLEEVE. Thrice weekly, Monday, Wednesday and Thursday, 12 M., Room 13. (13).

Alexander.	Gjellum.	Short.
Bevier.	Harding.	Spicker.
Burgess.	Nicolassen.	Tidball, C. M.
Cooke, F. H.	Seelye.	Tidball, W. J.
Fleming.		

Lectures on Grammar: PROFESSOR GILDERSLEEVE. Twice weekly, Tuesday and Friday, 10 A. M., Room 13. (16).

Alexander.	Gjellum.	Short.
Bevier.	Harding.	Spieker.
Burgess.	Nicolassen.	Tidball. C. M.
Cheek, S. R.	Sale.	Tidball, W. J.
Cooke, F. H.	Seelye.	Treadwell.
Fleming.		

Thucydides: PROFESSOR C. D. MORRIS. Four times weekly, Monday, Wednesday, Thursday and Friday, 9 A. M., 187 North Howard Street. (4).

Gordon.	Patterson.
Ingle.	Tiffany.

Euripides: *Alcestis, Hippolytus:* PROFESSOR C. D. MORRIS. Four times weekly, Monday, Wednesday, Thursday and Friday, 10 A. M., 187 North Howard Street. (6).

Baden.	Crowe.	Gittings.
Canfield.	Glenn, W. L.	Miller, C. W. E.

Greek Prose Composition: PROFESSOR C. D. MORRIS.

Class A. Once weekly, Tuesday, 9 A. M., 187 North Howard Street. (5).

Fleming.	Harding.	Tiffany.
Gordon.	Ingle.	

Class B. Once weekly, Tuesday, 10 A. M., 187 North Howard Street. (6).

Baden.	Crowe.	Gittings.
Canfield.	Glenn, W. L.	Miller, C. W. E.

New Testament Greek, etc: MR. CROSS. Eight meetings weekly, Monday, Tuesday, Wednesday, Friday and Saturday, 11 A. M.; Tuesday, Wednesday and Friday, 10 A. M., Room G. (2).

Beadenkopf.	Read.

Attendance on Saturday lecture. (14).

Latin. (32 Students).

Classes meet at 187 North Howard Street.

Terence: DR. WARREN. Once weekly, Wednesday, 4 P. M. (12).

Bevier.	Fleming.	Nicolassen.
Burgess.	Fowler.	Sale.
Cheek, S. R.	Gjellum.	Spieker.
Derby.	Harding.	Tidball, C. M.

Latin Rhetoricians: DR. WARREN. Once weekly, Monday, 4 P. M. (10).

Alexander.	Derby.	Nicolassen.
Bevier.	Fleming.	Spieker.
Burgess.	Gjellum.	
Cheek, S. R.	Harding.	

Cicero: *Letters;* ***Pliny:*** *Letters;* ***Juvenal:*** *Satires:* DR. WARREN. Four times weekly, Tuesday, Wednesday, Thursday and Friday, 11 A. M. (11).

Adkins.	Glenn, W. L.	Patterson.
Cheek, S. R.	Ingle.	Sale.
Fleming.	Kimball.	Tiffany.
Gordon.	Miller, C. W. E.	

Latin Composition and Translation: DR. WARREN. Once weekly, Monday, 11 A. M. (8).

Adkins.	Glenn, W. L.	Miller, C. W. E.
Cheek, S. R.	Ingle.	Tiffany.
Gordon.	Kimball.	

Horace: MR. STOCKBRIDGE. Four times weekly, Tuesday, Wednesday, Thursday and Friday, 9 A. M. (11).

Boston.	Duffy.	Murray.
Canfield.	Fels.	Reese, C. L.
Crisp.	Glenn, J.	Wilson, H. V.
Cromwell.	Jones.	

Latin Prose Composition: MR. STOCKBRIDGE. Once weekly, Monday, 9 A. M. (10).

Boston.	Duffy.	Jones.
Canfield.	Fels.	Reese, C. L.
Crisp.	Glenn, J.	Wilson, H. V.
Cromwell.		

German. (36 Students).

Old High German: MR. BRANDT. Twice weekly, Tuesday and Friday, 4 P. M., Room A. (2).

Bright.	Fowler.

Middle High German: *Nibelungenlied:* MR. BRANDT. Twice weekly, Thursday and Friday, 11 A. M., Room A. (11).

Berry.	Ebeling.	Keeler.
Bowdoin.	France.	Reese, R. M.
Brinton.	Garthe.	Wilson, H. V.
Day, D. T.	Johnson.	

German Seminary: MR. BRANDT. Once weekly, Saturday, 9 A. M., Room A. (12).

Alexander.	Brinton.	Johnson.
Berry.	Ebeling.	Reese, R. M.
Bowdoin.	France.	Wilhelm.
Bright.	Garthe.	Wilson, H. V.

German Ballads: MR. BRANDT. Once weekly, Tuesday, 11 A. M., Room A. (9).

Berry.	France.	Johnson.
Bowdoin.	Garthe.	Reese, R. M.
Brinton.	Gerke.	Wilson, H. V.

German Prose Composition: MR. BRANDT.

Class A. Once weekly, Monday, 11 A. M., Room A. (11).

Alexander.	Ebeling.	Keeler.
Berry.	France.	Reese, R. M.
Bowdoin.	Garthe.	Wilson, H. V.
Brinton.	Johnson.	

Class B. Once weekly, Wednesday, 12 M., Room A. (17).

Adkins.	Frick.	Price.
Boston.	Glenn, J.	Stratton.
Brown.	Jones.	Thach.
Crisp.	Murray.	Thomas.
Duffy.	Palmer, A. G.	Trimble.
Fels.	Pickle.	

Gryphius: *Peter Squentz:* MR. STOCKBRIDGE. Once weekly, Wednesday, 11 A. M., Room A. (January–March). (9).

Berry.	France.	Keeler.
Bowdoin.	Garthe.	Reese, R. M.
Brinton.	Johnson.	Wilson, H. V.

Goethe: *Faust:* MR. STOCKBRIDGE. Once weekly, Wednesday, 11 A. M., Room A. (10).

Berry.	Garthe.	Keeler.
Bowdoin.	Gerke.	Reese, R. M.
Brinton.	Johnson.	Wilson, H. V.
France.		

Goethe: *Prosa:* MR. STOCKBRIDGE. Twice weekly, Monday and Thursday, 12 M., Room A. (15).

Boston.	Frick.	Palmer, A. G.
Brown.	Gittings.	Price.
Crisp.	Glenn, J.	Stratton.
Duffy.	Jones.	Thach.
Fels.	Murray.	Thomas.

Helmholtz: *Populäre Wissenschaftliche Vorträge:* MR. STOCKBRIDGE. Twice weekly, Tuesday and Friday, 12 M., Room A. (20).

Adkins.	Frick.	Pickle.
Boston.	Gittings.	Price.
Brown.	Glenn, J.	Stratton.
Crisp.	Harding.	Thach.
Duffy.	Jones.	Thomas.
Fels.	Murray.	Trimble.
Fleming.	Palmer, A. G.	

Romance Languages. (24 Students).

Spanish: MR. ELLIOTT. Twice weekly, Monday and Wednesday, 12 M., Room C. (5).

Baden.	O'Connor.	Taylor, P. H.
Brinton.	Reese, R. M.	

Portuguese: MR. ELLIOTT. Once weekly, Friday, 4 P. M., Room C. (3).

Fay.	Garner.	O'Connor.

Provençal: MR. ELLIOTT. Twice weekly, Monday, 11 A. M.; Friday, 3 P. M., Room C. (3).

Fay.	Garner.	O'Connor.

Low Latin: MR. ELLIOTT. Once weekly, Friday, 5 P. M., Room C. (3).

Fay.	Garner.	O'Connor.

French Phonetics: MR. ELLIOTT. Once weekly, Tuesday, 10 A. M., Room C. (6).

Baden.	Garner.	Reese, R. M.
Bright.	O'Connor.	Taylor, P. H.

French: *Major Course:* MR. MARCOU. Three times weekly, Tuesday, Thursday and Friday, 12 M., Room B. (3).

Gordon.	Reese, R. M.	Taylor, P. H.

French: *Minor:* MR. MARCOU. Daily, except Saturday, 1 P. M., Room B. (12).

Bowdoin.	Gerke.	Mahon, O. L.
Brown.	Glenn, W. L.	Ramage, B. B.
Crisp.	Gordon.	Ramage, B. J.
France.	Miller, C. W. E.	Wilson, H. V.

French: *Reading Class:* MR. MARCOU. Once weekly, Thursday, 3 P. M., Room B. (5).

Beadenkopf.	Canfield.	Wiegand.
Boston.	Duffy.	

English. (17 Students).

Anglo-Saxon: MR. COOK. Thrice weekly, Monday, Wednesday and Friday, 10 A. M., Room A. (7).

Bemis.	Gordon.	MacClintock.
Boyle.	Jameson.	Ramage, B. J.
Brinton.		

This class will take up the study of ANGLO-SAXON LAWS in April.

Anglo-Saxon Poetry: MR. COOK. Twice weekly, Monday, 12 M.; Wednesday, 4 P. M., 123 West Madison Street. (1).

Bright.

Historical English Grammar: MR. COOK. Once weekly, Friday, 4 P. M., 187 North Howard Street. (2).

Cheek, S. R. MacClintock.

Chaucer: MR. COOK. Four times weekly, Tuesday, Wednesday, Thursday and Friday, 3 P. M., Room B. (6).

Armstrong.	Cheek, F. J.	Day, D. T.
Boyle.	Cheek, S. R.	MacClintock.

General English Literature: MR. COOK. Once weekly, Monday, 3 P. M., Room B. (9).

Boyle.	Day, D. T.	Leftwich.
Cheek, F. J.	Evans.	MacClintock.
Cheek, S. R.	Johnson.	Reese, R. M.

History of English Language: MR. COOK. Four times weekly, Tuesday, Wednesday, Thursday and Friday, 3 P. M., Room B. (6).

Armstrong.	Cheek, F. J.	Day, D. T.
Boyle.	Cheek, S. R.	MacClintock.

Icelandic: MR. COOK. Once weekly, Thursday, 11 A. M., 123 West Madison Street. (Until March). (2).

Bright. Gjellum.

History and Political Science. (30 Students).

Comparative Constitutional History: DR. H. B. ADAMS. Once weekly, Saturday, 12 M., Peabody Institute. (17).

Bemis.	Goodman.	Ramage, B. J.
Brinton.	Jameson.	Sale.
Cheek, F. J.	Johnson.	Stebbins.
Derby.	Linthicum.	Swift.
Douglas.	McIlwaine.	Wilhelm.
Evans.	Ramage, B. B.	

English Constitutional History: DR. H. B. ADAMS. Once weekly, Wednesday, 12 M., Peabody Institute. (11).

Bemis.	Fels.	Ramage, B. B.
Berry.	France.	Ramage, B. J.
Crowe.	Ingle.	Tiffany.
Derby.	Jameson.	

International Law: DR. H. B. ADAMS. Four times weekly, Monday, Tuesday, Thursday and Friday, 4 P. M., Room A. (24).

Adkins.	Fels.	Murray.
Bemis.	France.	Ramage, B. B.
Berry.	Gordon.	Ramage, B. J.
Bowdoin.	Ingle.	Robinson.
Brinton.	Jameson.	Sale.
Cheek, F. J.	Johnson.	Stebbins.
Ebeling.	Leftwich.	Tiffany.
Evans.	McIlwaine.	Wilhelm.

Logic. (9 Students).

Advanced Logic: MR. PEIRCE. Four times weekly, Monday, Tuesday, Thursday and Friday, 9 A. M., Room C. (6).

Bissing.	Gilman.	Marquand.
Davis.	Ladd.	Stebbins.

Elementary Logic: MR. PEIRCE. Once weekly, Wednesday, 9 A. M., Room C. (3).

Robinson.	Short.	Wilhelm.

History of Philosophy, and Ethics. (14 Students).

German Philosophy: PROFESSOR G. S. MORRIS. Thrice weekly, Monday, Tuesday and Thursday, 12 M., 187 North Howard Street. (13).

Beadenkopf.	Howell.	Robinson.
Bemis.	Leftwich.	Stebbins.
Brinton.	McIlwaine.	Swift.
Burt.	Read.	Wilhelm.
Crowe.		

Aristotle's Ethics: PROFESSOR G. S. MORRIS. Once weekly, Wednesday, 8 P. M., 187 North Howard street. (4).

Burt.	Stebbins.	Swift.
Marquand.		

Drawing. (10 Students).

MR. NEWELL. Twice weekly, Monday and Friday, 2–4 P. M., Room 18.

Bond.	Marburg.	Stratton.
Earle.	Price.	Thomas.
Frick.	Reid.	Warfield.
Glenn, J.		

Elocution. (15 Students).

MR. WOODWORTH. Daily, 9 A. M., Hopkins Hall.

Bemis.	Gjellum.	Murray.
Davis.	Johnson.	O'Connor.
Duffy.	MacClintock.	Sale.
Fels.	Mahon, O. L.	Schimper.
France.	Mitchell.	Seelye.

HOURS FOR LECTURES AND RECITATIONS, SECOND HALF YEAR, 1880-81.

HOURS	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M. 9	Chemistry. (Remsen and Morse.) Thucydides. (C. D. Morris.) Latin Prose. (Stockbridge.) Logic: Advanced. (Peirce.) Elocution. (Woodworth.)	Chemistry. (Remsen and Morse.) Greek Prose. (C. D. Morris.) Horace. (Stockbridge.) Logic: Advanced. (Peirce.) Elocution. (Woodworth.)	Chemistry. (Remsen and Morse.) Thucydides. (C. D. Morris.) Horace. (Stockbridge.) Logic: Elementary. (Peirce.) Physics: Major. Laboratory work, 9 A. M. to 5 P. M. (Hastings.) Elocution. (Woodworth.)	Chemistry. (Remsen and Morse.) Thucydides. (C. D. Morris.) Horace. (Stockbridge.) Logic: Advanced. (Peirce.) Elocution. (Woodworth.)	Chemistry. (Remsen and Morse.) Thucydides. (C. D. Morris.) Horace. (Stockbridge.) Logic: Advanced. (Peirce.) Elocution. (Woodworth.)	German Seminary. (Brandt.)
10	Physics. (Hastings.) Euripides. (C. D. Morris.) Modern Algebra. (Franklin.) Osteology. (Brooks.) Anglo-Saxon. (Cook.) Solid Anal. Geometry. (Story.)	Physics: Experimental Lecture. (Hastings.) Greek Prose. (C. D. Morris.) Osteology. (Brooks.) Greek Grammar. (Gildersleeve.) French Phonetics. (Elliott.) Hebrew. (Cross.) Solid Anal. Geometry. (Story.)	Physics. (Hastings.) Euripides. (C. D. Morris.) Modern Algebra. (Franklin.) Osteology. (Brooks.) Anglo-Saxon. (Cook.) Hebrew. (Cross.)	Physics. (Hastings.) Euripides. (C. D. Morris.) Theory of Equations. (Franklin.) Osteology. (Brooks.) Solid Anal. Geometry. (Story.)	Physics: Experimental Lecture. (Hastings.) Euripides. (C. D. Morris.) Osteology. (Brooks.) Anglo-Saxon. (Cook.) Greek Grammar. (Gildersleeve.) Hebrew. (Cross.) Solid Anal. Geometry. (Story.)	
11	Animal Physiology. (Martin.) German: Major. (Brandt.) Latin Composition. (Warren.) Mechanics. (Story.) Calculus. (Franklin.) New Testament Greek. (Cross.) Provençal. (Elliott.) Electr. & Magnetism. (Rowland.)	General Biology. (Martin.) German: Major. (Brandt.) Cicero. (Warren.) Elem. Higher Pl. Curves. (Story.) Theory of Equations. (Franklin.) New Testament Greek. (Cross.) Physics: Minor. Laboratory work, 11 A. M. to 5 P. M. (Hall.) Electr. & Magnetism. (Rowland.)	Animal Physiology. (Martin.) German: Major. (Stockbridge.) Cicero. (Warren.) Elem. Higher Pl. Curves. (Story.) Calculus. (Franklin.) New Testament Greek. (Cross.) Electr. & Magnetism. (Rowland.)	General Biology. (Martin.) German: Major. (Brandt.) Cicero. (Warren.) Mechanics. (Story.)	Animal Physiology. (Martin.) German: Major. (Brandt.) Cicero. (Warren.) Elem. Higher Pl. Curves. (Story.) Calculus. (Franklin.) New Testament Greek. (Cross.) Electr. & Magnetism. (Rowland.)	General Biology. (Martin.) New Testament Greek. (Cross.)
M. 12	Greek Seminary. (Gildersleeve.) German: Minor. (Stockbridge.) Spanish. (Elliott.) German Philos. (G. S. Morris.)	German: Minor. (Stockbridge.) French: Major. (Marcou.) Adv. Higher Pl. Curves. (Story.) German Philos. (G. S. Morris.)	Greek Seminary. (Gildersleeve.) German: Minor. (Brandt.) Spanish. (Elliott.) Eng. Const. History. (Adams.)	Greek Seminary. (Gildersleeve.) German: Minor. (Stockbridge.) French: Major. (Marcou.) Math. Problems. (Story.) German Philos. (G. S. Morris.)	German: Minor. (Stockbridge.) French: Major. (Marcou.) Adv. Higher Pl. Curves. (Story.)	Comp. Const. History. (Adams.)
P. M. 1	French: Minor. (Marcou.) Conics. (Story.)	French: Minor. (Marcou.) Theory of Numbers. (Sylvester.)	French: Minor. (Marcou.) Conics. (Story.)	French: Minor. (Marcou.) Physics: Major. (Hastings.)	French: Minor. (Marcou.) Conics. (Story.) Theory of Numbers. (Sylvester.)	
2	Drawing. (Newell.)				Drawing. (Newell.)	
3	Gen. English Lit. (Cook.) Hydrodynamics. (Craig.) Diff. Equations. (Franklin.)	Chaucer. (Cook.)	Chaucer. (Cook.) Hydrodynamics. (Craig.) Diff. Equations. (Franklin.)	Chaucer. (Cook.) French: Reading Class. (Marcou.)	Chaucer. (Cook.) Provençal. (Elliott.) Hydrodynamics. (Craig.) Diff. Equations. (Franklin.)	
4	Internat. Law. (Adams.) Latin Rhetoricians. (Warren.) Physiology of the Voice. (Sewall.)	Internat. Law. (Adams.) Old High German. (Brandt.)	Part. Diff. Equations. (Craig.) Terence. (Warren.)	Internat. Law. (Adams.)	Internat. Law. (Adams.) Part. Diff. Equations. (Craig.) Old High German. (Brandt.) Portuguese. (Elliott.) Hist. English Gram. (Cook.)	
5			Ethics. (G. S. Morris, 8 P. M.)		Low Latin. (Elliott.)	

The public lectures in Hopkins Hall begin at 5 P. M.

SYNOPSIS OF THE RECENT SCIENTIFIC JOURNALS

Published here.

American Chemical Journal. Edited by PROFESSOR REMSEN. *Vol. II. No.* 6. February, 1881.

Article I.—On a Simple Form of Apparatus for Determining the Specific Heat of Solids and Liquids with small Quantities of Material. By J. W. MALLET.

The forms of apparatus most in use for the determination of specific heat—those of Regnault and Bunsen—are somewhat troublesome to prepare. The Author describes in this paper a simple form, easily constructed, and giving good results. No adequate idea of the apparatus can be given without the aid of the four detailed drawings which accompany the article.

Article II.—On Jarosite from a new Locality. By G. A. KÖNIG.

The material used in this investigation was collected by the Author in a "prospect" for carbonates in porphyry, in Chaffee county, Colorado. The jarosite itself, $K_2Fe_6S_4O_{22} + 6H_2O$, is mixed with some thurgite $Fe_4H_2O_7$.

Article III.—On Beegerite, a new Mineral. By G. A. KÖNIG.

This mineral was found to have the empirical formula $Pb_6Bi_2S_9 = 6PbS + Bi_2S_3$. It occurs in the Baltic Lode of the Geneva Mining Company, Park county, Colorado.

Article IV.—Researches on the Substituted Benzyl Compounds:—The Synthesis of Anthracene and Phenanthrene from Orthobrombenzylbromide. By C. L. JACKSON and J. FLEMING WHITE.

While it has been known for some time that anthracene consists of two benzene residues united by means of two—CH—groups, it was not known whether the union is effected in the ortho, meta or para- position. The synthesis here described shows clearly that the hydrocarbon is an ortho-compound. The synthesis was effected by treating orthobrombenzylbromide, $C_6H_4Br.CH_2Br$ in an ethereal solution with sodium. Phenanthrene is also formed at the same time.

Article V.—On Sauer's Method of Estimating Sulphur, and some Modifications. By W. G. MIXTER.

Article VI.—The Determination of Sulphur in Sulphides and in Coal and Coke. By T. M. DROWN.

The method employed and here described consists in treating the substance to be analyzed with sodium hydrate in a beaker, then adding bromine cautiously to supersaturation, and finally hydrochloric acid to acid reaction. This method is found to be especially valuable in the analysis of coal.

Article VII.—On the Oxidation of Substitution Products of Aromatic Hydrocarbons:—Sulphoterephthalic acid. By IRA REMSEN and W. BURNEY.

The acid was obtained by oxidizing cymenesulphamide, first with potassium pyrochromate, and the sulphamineparatoluic acid thus obtained, with potassium permanganate. Its tribasic character was proved by the preparation of three well characterized barium salts the compositions of which correspond to those required for the primary, secondary and tertiary salts. It yields a sulphinide of the formula $C_6H_3\begin{cases} CONH_2 \\ CO \\ SO_2 \end{cases} NH$. The acid was also prepared by oxidizing cymenesulphonic acid, and, thus obtained, it has the same properties as that obtained as above described.

Article VIII.—Sulphoterephthalic acid from Paraxylenesulphonic acid. By IRA REMSEN and M. KUHARA.

To verify the results reached in the investigation described in the preceding paper the sulphonic acid of pure paraxylene was oxidized. By first converting into sulphotoluic acid and then oxidizing the latter with potassium permanganate, sulphoterephthalic acid was obtained.

Brief Review of the most important changes in the Industrial Applications of Chemistry within the last few years, (continued). By J. W. MALLET.

The subjects taken up in this report come under the general heading—"Materials and Processes connected with the Construction of Buildings," The subheadings are: *Chief Building Materials for External Use: Stone and Brick; Lime-burning, Mortar and Hydraulic Cements; Stucco; Preservation of Timber; Glue and other Cements of various application; Pigments for House-Painters' use; Vehicles for Paints; Varnishes:* and in an "Appendix to Building Appliances" there are: A. *Explosive Agents;* B. *Disinfectants.*

Recent Progress in Agricultural Science. By H. P. ARMSBY.

The subjects treated are: *Metastasis; Proteid Metastasis.*

Then follow Notes on: *Properties of Ozone,* by Hautefeuille and Chappuis; *New Ethers of Carbonic acid,* by Röse; *The Atomic Weight of Glucinum,* by Nilson; *Synthesis of Tropic acid,* by Ladenburg and Rügheimer; *The Hydrocarbons of American Petroleum,* by Beilstein and Kurbatow; *Concerning the Formula of Benzene,* by Julius Thomsen; *Arsinobenzoic acid,* by La Coste; *Baeyer's Method for the Synthesis of Indigo; Brevities; List of New Publications.*

The Number closes with the Index completing the Volume of 448 pages.

The first Number of Volume III of the American Chemical Journal is nearly ready. It contains original communications by J. W. Mallet, S. P. Sadtler, C. L. Jackson, H. B. Hill, E. J. Hallock, M. Kuhara, M. W. Iles, and R. B. Warder.

THE AMERICAN JOURNAL OF PHILOLOGY.

Announcement of Volume II, by the Editor.

The American Journal of Philology is about to enter upon its second volume. The experiment of the first year has been so far successful as to warrant a continuance of the enterprise and it is hoped that a widening support will enable the Editor and those who are associated with him to make the Journal a more and more adequate representative of the philological life of America, and an efficient organ for the promotion of philological research and study. There is every prospect of an ample supply of original papers for the new volume. The first number will contain the sequel of Professor Nettleship's valuable paper on Verrius Flaccus, a study of Bentley's English by Professor Shepherd, the first part of an elaborate essay on the consonant declension in Old Norse by Dr. S. Primer and an article on *-ne* in Latin by Dr. Minton Warren. For the second number an essay on the revision of King James's version has been prepared by Professor Charles Short, one of the American revisers. Reviews will as heretofore be intrusted, as far as possible, to specialists, and any expansion that the success of the Journal may admit will be largely in this direction. The reports of Periodicals, which have proved so acceptable a feature, will be kept up and most of the scholars who have undertaken this task—which requires so much knowledge, judgment and tact—have kindly consented to continue their help and new forces have been added. The Bibliography, which is intended to comprise all important publications of the time, will also continue to be a regular department of the Journal. For the general management the Editor is of course responsible, but he has the great advantage of advice and help not only from his own colleagues but from philological friends on both sides of the water, and in the department of general philology and comparative grammar he is permitted to count on the aid of Professor Whitney, who has generously given to the Journal his counsel and his personal work From the beginning the oriental department has been in charge of Professor Toy and the Anglo-Saxon in that of Professor Garnett, and these scholars will continue to lend their valuable assistance.

With a better organization and a clearer view of the capabilities of the field, the Editor enters upon the work of the new year with a more reasonable confidence that the Journal is destined to a usefulness commensurate with the expectations of those who generously made the undertaking possible.

The price of the Journal is unchanged, $3 a volume—of four numbers—payable to the Editor in advance. The first volume contains 536 pp. with a full index.

B. L. GILDERSLEEVE.

NOTES FROM THE BIOLOGICAL LABORATORY.

No. 2.*

A Study of Blood Pressure in the Coronary Arteries of the Heart. By H. NEWELL MARTIN and W. T. SEDGWICK.

The great anatomist Thebesius, (*Diss. med. inaug. de circ. sang. in corde*, 1708,) propounded the theory that the flaps of the semilunar valve of the aorta are pressed against the wall of that vessel during the systole of the heart, and occlude the mouths of the coronary arteries which lie behind them. This view fell into oblivion until it was revived and powerfully supported in recent times by Brücke. The reasoning of the latter is largely teleological; since the heart is a hollow structure which diminishes its bulk, and, so far as the ventricles are concerned, obliterates its cavity in contraction, he points out that a forcible injection of the heart arteries with blood during the systole of the organ, would tend to make its walls tense and oppose the contraction; while if the coronary arteries received no blood during the ventricular systole but were filled with it during the diastole, the contraction of the heart would not be impeded and its subsequent dilatation would be promoted. Arguing from the general mechanical perfection found in the mammalian body, he concluded that it was probable that the view of Thebesius was correct, and that the semilunar valve flaps were really so placed during the ventricular systole as to prevent blood from entering the proper cardiac arteries; while in diastole the organ had its walls tensely filled with blood and its cavities consequently expanded.

The experimental evidence for and against this view cannot be discussed in this brief article; it will suffice to state that prominent physiologists have been hitherto divided on the question, and experiments and anatomical observations have been published on each side; the result being a general belief that the question could only be definitely settled by an observation of arterial pressure in the coronary vessels; if the coronary pulse coincided with that in other arteries Brücke would be wrong; if it alternated with it, he would be right. The difficulty of introducing a cannula into the arteries of the living beating heart, seems hitherto to have foiled physiological experimenters, and we undertook the task without any very great hopes of success, but induced by the many important points in the physiology of the mammalian heart and the mechanism of the circulation, which would be rendered available for study should we succeed.

Our experiments were made on dogs, placed very completely under the influence of morphia; after a considerable number of failures we have succeeded in getting on seven or eight animals simultaneous graphic records of mean arterial pressure and pulse beats in the carotid and coronary arteries. The results of a careful examination of these are—

1. The blood pressure in the coronary arteries is comparatively very great; being in a small branch very little less than equal to, or greater than that in the carotid trunk.

2. The coronary and carotid pulses are practically synchronous in time; there is no trace whatever of an alternation in them. This holds true whether the arterial pressure be high or low, or the heart's rhythm slow or quick; and every minutest feature of the graphic record in the tracing of blood pressure in the carotid is simultaneously and perfectly repeated in that obtained from the coronary artery. Whether the heart's beat be slowed by stimulation of the cardio-inhibitory nerves, or arterial pressure be greatly raised by inducing dyspnœa, the general and sphygmic variations of pressure in the two arteries are perfectly synchronous and similar in form: the record traced from each artery is in its variations an exact duplicate of that obtained from the other.

The results of these experiments prove that for the dog the Thebesius-Brücke view (with a predilection in whose favor we started) is untenable: although the ventricular systole might be conceived to raise pressure in the coronary artery, it is inconceivable that every minute character of the carotid tracing should be synchronously and perfectly reproduced in that from the coronary artery unless both were due to the same immediate cause, viz: the elevation of arterial pressure in the aorta by the systole of the left ventricle; the mouths of the coronary arteries are therefore not closed by the flaps of the semilunar valve during ventricular systole.

We are now engaged in an examination of the results of stimulation of the accelerator nerves upon the mean pressure in the coronary artery, with the hope of discovering whether these puzzling nerves are not the vasomotor branches controlling the cardiac arteries, but our results on this point are not ready for publication.

A full account of the experiments on which the above statements are based, with reproductions of the tracings obtained, will shortly be published in the Journal of Physiology.

No. 3.

On a Method of Isolating the Mammalian Heart. By H. NEWELL MARTIN.

To obtain a mammalian heart isolated from the rest of the body and keep it alive for a time sufficient to allow the examination of the effect of various conditions upon its activity has long been a physiological desideratum. The frog's heart has for years been the subject of minute study but hitherto the mammalian heart has been a baffling object It seems to have been forgotten that while the frog's heart is a spongy structure having no arteries of its own, the mammalian heart is a dense organ dependent for its life on a continuous blood flow in its capillaries; and all attempts hitherto made, so far as I know, have been efforts to apply to the mammal the methods found successful with the frog, with merely the addition of arrangements adapted to keep up the comparatively high temperature at which the mammalian heart normally beats. By working in another way I have recently succeeded in keeping the mammalian heart alive for more than an hour, and beating with perfect rhythm and normal force; the organ is thus made almost as available for study as the heart of the frog. The method adopted is as follows: The animal having been narcotised and the chest opened, the aorta is tied just beyond its arch; then the trunk which, in the cat, gives origin to the right subclavian and the two common carotids, is ligatured close to its origin, and a cannula put in the left subclavian: finally, the inferior and superior venæ cavæ and the azygos vein, and the root of one lung are tied.

Artificial respiration is of course started so soon as the thorax is opened, and kept up henceforth. The course of the circulation is thus:—left auricle, left ventricle, commencement of aorta, (and along the left subclavian to the cannula which is connected with a manometer), coronary system, right auricle, right ventricle, pulmonary vessels of one lung, and then back to the left auricle; in other words, the only section of the systemic circulation left is that through the vessels of the heart itself. Since the physiological actions taking place in the lung are among the best known of all occurring in the body, they may be eliminated, and we have practically an isolated and well-working living mammalian heart for study. The nerves going to the heart may be divided if desired, but that is hardly necessary as the want of blood-flow in the nerve centres of the body incapacitates them after a very short time, and they no longer are capable of exerting any influence on the heart. It is possible, however, that changes in the lung vessels may affect the results of experiments made on the heart's work under different conditions, (*e. g.* when defibrinated blood is sent into it from a vein under various pressures, or when drugs are administered to it), and an investigation of the nerves, if any, governing the lung vessels must be undertaken as a preliminary to a further study of the direct action of various conditions on the heart's work.

* Note No. 1, on page 51.

PROCEEDINGS OF UNIVERSITY SOCIETIES.

Abstracts of the More Important Papers Read at Recent Meetings.

Scientific Association.

January Meeting.

On the Double Submaximal Stimulation of Muscle and Nerve, by H. SEWALL.

This paper embodied a discussion of the nature of "tetanus," as dependent upon a summation of excitements or of contractions. The polarizing effects of very weak induced currents upon the nerves were also considered.

Some Arithmetical Theorems Derived from a Question in Probability, by FABIAN FRANKLIN.

From a consideration of the probability that an event, which has occurred in all the trials (say n trials) of a given kind that have been made, will occur in each of the next r trials of the same kind, we obtain the well known theorem $\Sigma_0^r \binom{n+x}{n} = \binom{n+r+1}{n+1}$. If in the n trials the event has occurred λ times and failed $n-\lambda$ times, then by considering the probability that in the next r trials it will occur μ times and fail $r-\mu$ times, we obtain the theorem, which perhaps is new, that $\Sigma_0^r \binom{\lambda+x}{\lambda}\binom{n-\lambda+r-x}{n-\lambda} = \binom{n+r+1}{n+1}$; it is to be observed that the value of the sum is independent of λ. From this equation a theorem relating to the determinants of binomial coefficients immediately follows.

February meeting.

A New Computation of the Compression of the Earth, from Pendulum Experiments, by C. S. PEIRCE.

The principles adopted were as follows: 1. Only experiments with the Kater invariable pendulum were used 2. These were newly reduced, using the temperature and pressure coefficients determined by the India survey. 3. The continents were considered to be formed by upheaval, so that the usual reduction for continental attraction disappeared In estimating the small residual effect, it was assumed that the thickness of the crust upheaved is $\frac{1}{8}$ of the diameter of the arch which gives $\frac{1}{12}$ of the usual correction. 4. The entire attraction of the ocean has been allowed for. It was shown that the adoption of these principles in the computation greatly reduces the station errors. The resulting compression is $\frac{1}{293.0 \pm 0.5}$.

Some new Experiments on the Oxidation of Sulphaminemetatoluic Acid, by R. D. COALE.

If sulphaminemetatoluic acid be oxidized by potassium permanganate in *neutral* solution, it has been found that the sulphamine group is transformed into the sulpho group, and the product is sulphoisophthalic acid. If, however, this oxidation be carried on in *alkaline* solution, the product belongs to a class of anhydro bodies which have been called sulphinides, and is anhydro-sulphamine-iso-phthalic acid or sulph-inido-iso-phthalic acid. This point is disputed by Jacobsen, and experiments are in progress to definitely settle the matter.

A Spectroscopic Note, by C. S. HASTINGS.

This paper, with one read at a previous meeting, described a method by which the spectrum of sodium vapor in a Bunsen lamp might appear, in a powerful spectroscope, either as the well known double bright line; as four bright lines and two dark ones; as six bright lines and four dark; or, finally, as eight bright lines and six dark. All but the last named phenomenon had been observed by Young and others. Certain peculiarities occasionally observed in the spectrum of the sun are readily explained in the same manner.

March meeting.

The Cause of Serial Homology and Bilateral Symmetry, by W. K. BROOKS.

Owing to the length of this paper, only part of it was read. In this portion the writer attempts to show that the explanation which attributes phenomena of this kind to inheritance from a community of independent individuals which have become specialized into a compound organism, is not supported by the facts of embryology, and that even if it were, this would not account for the phenomena, since they exhibit evidence that the bond between serially homologous structures is persistent.

The phenomena in question cannot, at present, be explained by natural selection, and the view that they are due to the direct action of the conditions of life, or to polarity, is also inadequate; and at present we have no explanation of them.

They are so similar to the phenomena of ordinary or special homology, that, so long as they are unexplained, we cannot give unqualified acceptance to the explanation of special homologies, which attributes them to descent with modification.

A New Determination of the Mechanical Equivalent of Heat, by L. B. FLETCHER.

This determination was made by measuring the heat developed by a current of measured strength flowing for a measured time through a wire of measured resistance.

The result is $J = 42{,}200{,}000 \left(\frac{\text{centimeter}}{\text{second}}\right)^2$ gram at 25.°8 C, on the assumption that 1 Ohm $= 1 \frac{\text{earth quadrant}}{\text{second.}}$

The mean of Joule's and Rowland's direct measurements gives $J = 41{,}700{,}000 \left(\frac{\text{centimeter}}{\text{second}}\right)^2$ gram at 25.°8 C. The difference between these two values is about 12 parts in 1,000.

The inference is that the Ohm $= .988 \frac{\text{earth-quadrant}}{\text{second}}$ which agrees fairly with the direct measurements of the Ohm by Rowland and Lorenz.

The Structure of the Gills of Yoldia and Nucula, by K. MITSUKURI.

In the ordinary lamellibranchs the gills are extremely complicated structures, which not only perform a respiratory function but also gather food from the water, convey it to the mouth, effect the fertilization of the eggs, and, in some forms, also serve as nursing chambers for the young.

In Nucula and Yoldia the gills are quite simple in structure, and have only a respiratory function. A careful study of their structure indicates that we have in them the primitive form of lamellibranch gill, which has, in most forms, become specialized into the ordinary complex gill.

In these two genera they are much like the gills of gasteropods and cephalopods, and their structure lends support to the view that these forms rather than the lamellibranchs are nearest to the primitive molluscs and that the gills of ordinary lamellibranchs have gradually assumed nutritive and reproductive functions, as these animals have become adapted to a sedentary life.

Philological Association.

January Meeting.

Final Sentences in the New Testament, by J. M. CROSS.

The unsatisfactory treatment of final sentences in the New Testament is the result of a theory that the particles are used indiscriminately without reference to their classical connection or signification, because of ignorance of Greek on the part of the writers. This theory is based, to a

great extent, on the Received Text and supported by many isolated passages that a critical text now removes. An examination of those which are retained—640 in all—shows, 1st, that, while there is a marked departure from classical rules in the use of the moods, there is evidence of a tendency to emphatic statement, which will, in a measure, explain the change. After secondary tenses the optative is no longer used, the subjunctive taking its place in all cases. After primary tenses with ἵνα, the future indicative, as a more vivid form begins to appear. ὅπως is not used with the future indicative and μή in but few passages. 2d. There is evidence of selection in the use of the final particles themselves, ὡς having disappeared, ὅπως and μή being very much restricted, while ἵνα has been greatly extended and has almost absorbed the others. The MS. evidence for all the disputed passages was examined and the explanation offered for the peculiar case of the moods and the extension in the form of ἵνα, viz: that the former was due to the desire for emphatic and vivid statement, causing the choice of the subjunctive for the optative, and the future indicative for the subjunctive; and the latter to the influence of Hebrew teleology. If this theory is correct, it follows that great care must be exercised in exegesis not to unduly press the signification of the subjunctive, as there is no longer any ground for comparison with the optative; and also, that the telic force of ἵνα is not to be obliterated until it can be shown to be contrary to the sense of the passage in which it appears.

On the Negative in Early French, by B. F. O'CONNOR.

The particle "*mie*" (*mica*) first appears in French as an adverb in the "Fragment de l'Alexandre d'Alberic de Besançon," and almost simultaneously is found joined to the particle "*ne*" as a re-enforcement of the negative. From this epoch, XIth century, down to XVIth century, about which time it disappears from ordinary use, it is employed in this latter sense only.

The cause of its being joined to "*ne*" as an essential part of the negation is due to the weakening of the negative signification of "*ne*" so evident in early French writings where this particle is sometimes used as a conjunction.

Mr. A. S. COOK gave an account of a recent Collection of English Idioms by Kwong Ki Chiu, late of the Chinese Educational Mission to the United States.

February meeting.

On the Genuineness of the First Antiphontean Oration, by L. BEVIER.

This oration was regarded by Maetzner as a mere rhetorical exercise, like the tetralogies. By others, *e. g.* Pahle and Fuhr, it has been declared spurious. The arguments advanced by Maetzner in support of his position are not cogent and have been answered in detail by Ottsen. In comparing the first speech with the others, we find many important differences especially from the standpoint of literary criticism Most important of all is the wide divergence in the purpose and management of the different parts of the orations. The narrative and arguments of the first oration differ fundamentally in form and relative importance from the corresponding parts of the others Antiphon, as we know him in his undoubted works, is subtle and skillful in argument but pays little attention to the construction of the narrative In this oration on the other hand we find an artistic narrator and bungling logician. Differences may also be noted in tropology, the handling of synonyms and the use of *a priori* probability as an engine in argument. A minute examination of the language itself however reveals some coincidences, *e. g.*, in the use of τε — τε, τε — καί, τοῦτο μέν — τοῦτο δέ, the articular infinitive, and certain periphrases, but to counterbalance these, the first oration differs from the others, in the use of τε καί, in not employing the neuter singular of adjectives and participles as abstracts, in the choice of prepositions both simple and in composition, in the position of the possessive pronouns, and with regard to special words, *e. g.*, μέλλω, compound relatives, etc. Since the strong testimony of the form and general style is not weakened but rather strengthened by closer linguistic examination, we may reasonably affirm that this oration is not the work of Antiphon.

On Certain Locatives in Andocides, by E. S. BURGESS.

The locative endings considered were -δε and -ζε, -θεν, -ι, with names of places. It was shown that in Andocides they occur twice, or more than twice, as often proportionately as in any other Attic orator or in Thucydides Regarding Andocides as a representative of the spoken Attic, their source in colloquial speech is thus suggested. They became early a marked feature of legal language. They were less stately than the corresponding prepositional phrases, and occur comparatively seldom in Antiphon or Isocrates, in original sentences of Thucydides or the public orations of Demosthenes.

With Athens the Attic orators generally used the locative ending. Byzantine scholarship condemned any other use, and it has been followed by Liddell and Scott, and others. On the contrary Thucydides uses prepositions with Athens regularly and Demosthenes in Oration 56 frequently.

The earlier orators used the locative endings only with places in or near Attica, or the seats of national games. Demosthenes and his contemporaries failed to maintain this use of the locative with neighboring places but increased the use with Athens. Of examples of locative endings, those with Athens therefore constitute in the earlier orations but a small part, in the later almost the entire number.

The Omission of the Copula in Plautus and Terence, by M WARREN.

A statement was made of the views of Ritschl in regard to the omission of the copula, of the modifications made by Brix, and the objections urged by Ussing. It was shown that Ritschl had too often introduced *est* into the text against the manuscript authority, but that his observation in the main is strongly confirmed by statistical comparisons. In some cases not considered by Brix the omission of the copula may be due to the strong emotion. The use of the phrase *meliust* or *melius est*, received special attention. It is found 39 times in Plautus and 5 times in Terence. *Melius erit* with the Perfect Infinitive, a usage common in Livy, does not occur in Plautus, and is found but once in Terence, Adel. 180. The peculiar diminutive *meliusculumst* occurs Curc. 489. Eleven examples are found of *meliust* followed by *te* with an active Infinitive. Finally 5 examples were cited of *melius* with an active Infinitive where the ground for the omission of the copula may be the same as in Hor. Sat., II 1, 45 *melius non tangere* and Cic. ad Att. XIV, 22 *melius mori milies.*

PROFESSOR GILDERSLEEVE described a terra-cotta jar with three compartments, found by Schliemann at Hissarlik, and offered an explanation of its probable use.

March Meeting.

Dialect Peculiarities of *Richars le Biaus*, by A. M. ELLIOTT.

From a detailed count of the dialect-forms in the *Richars*, this paper was intended to show its leading phonetic characteristics, which, it is held, prove both author and copyist to have been Picard. The statements of Förster and Knauer with reference to certain vowel combinations (*e g.* the diphthongisation of Latin position — *i* = *ie*, and the traces of the Burgundian *oi*) were found to be incorrect, when the whole body of vocalisation of the poem was carefully considered. and the relations of these phenomena more accurately determined. Examples were drawn from Tobler's *Aniel*, Gaston Paris' *Vie d'Alexis* and from Modern French to illustrate the strong tendencies to Picard diphthongisation manifest throughout the work. The guttural system (both *tenues* and *mediae*) substantiate the results obtained from the vowel-system.

The Limits of New Testament Textual Criticism, by J. M. CROSS.

The arguments for the theory that any text of the New Testament at this day, as *e. g.* that determined upon by the Revision Committee, can be a complete and final one, are inconclusive, because: 1. We cannot say that we have all the evidence for establishing the text that we ever shall have New manuscripts may turn up, which would essentially alter the views now held as to the value of special types. 2 The materials we possess have not yet been exhausted, and there is still a great deal of work to be done in the collation of manuscripts and sifting of Patristic quotations. Mistakes of Tischendorf and Tregelles, commented upon, show the need of more careful examination of the sources on which they depend. 3. The application of the same generally accepted principles gives rise to very different results at the hands of different critics. Consequently, any text represents simply the individual judgment of the editor on the evidence before him. and the results reached give us an approximate text only. Textual criticism has reached the limits of its application when it has brought forward all the evidence that is capable of being produced, carefully weighed and accurately stated, so that every one, after a full and free examination, can form his own conclusion on disputed points. The result is not so unsatisfactory, for its value lies in the unanimous evidence which is given for the main portion of the text about which there can be no dispute.

On the First Appearance in English of the Words 'Father' and 'Mother,' by W. D. MacClintock.

As far as known the modern forms of *father* and *mother* occur for the first time in the Göttingen manuscript of the Cursor Mundi. The original spelling *fader* occurs 117 times, but the altered form *father* 18 times. Again the form *moder* is found 99 times, but *mother* 17 times. The Göttingen manuscript is of the Northern dialect, and its date is between 1300 and 1320.

An Account of L. K. Enthoven's Dissertation on the Ion of Euripides, by C. D. Morris.

Besides touching on other antiquarian and critical points of interest, the essay is devoted mainly to the proof: (1) that the play was brought out in B. C. 412, at the same date as the Helena, whereas Bœckh places it not much later than B. C. 429; (2) that the poet conceived the cave of Pan on the north side of the rock of the Acropolis, and not the cave of Aglauros, as having been the scene of the event which gave occasion to the action of the play.

Historical and Political Science Association.

January Meeting.

A Review of the Life of Francis Lieber, by H. B. Adams.

French and English Colonization in the New World, by C. H. J. Douglas.

The ultimate decay of the French colonies in America and the supremacy of the English, was due, (1) to the motives actuating the founders, (2) to the policy of the home government towards each, and (3) to the principles on which the colonies were conducted. New England represented the great progressive movements then going on in Europe; New France represented movements that were already retrogressive. The one was the exponent of liberty; the other, of absolutism. The submission of New France placed the Anglo-American colonies in two new relations: (1) They were freed from the fear of further trouble from the French colonies, and (2) the French government was converted from a jealous enemy into an ally, burning only to revenge itself upon England by assisting the colonies to their independence.

Local Government in Michigan, by E. W. Bemis.

During the early French and later British dominion in the Northwest, there was no local self government in that region. This lack of local institutions was a source of great weakness to the early settlements. The development of the township system in Michigan was the result of the administration of Governor Cass, from New Hampshire, and of the immigration of people from New England and New York. The town institutions of Michigan are, in the main, modelled after those of New England. Although the functions of selectmen and assessors are discharged by a so-called supervisor, yet the sovereign local power resides in the people in town meeting assembled. The powers of the town meeting and of township officers in Michigan, were described in detail. The school system is managed by freeholders grouped in local districts. The intermediate unit between the township and the state is the county, which, in Michigan, has more powers than the New England county and more nearly resembles that of New York. The village in Michigan is a smaller unit than the township. Three hundred or more freeholders, residing in a district not above two square miles in extent, may be incorporated, and may effect village improvements, for which, in New England, the whole town would be taxed,—a circumstance which often leads to bitter quarrels and the retardation of village development in the latter section of country, although recent laws in some of the New England states provide for the incorporation of villages. The analogy between Michigan townships and Michigan city-wards was briefly indicated. Ward-supervisors and township-supervisors often form together a county-board. The custom of city-wards assessing themselves for local improvements is a vestige of old English custom, for wards were once towns or parishes, which were gradually annexed to a city in its expanding growth.

Local powers in Michigan are checked by law, which forbids taxation or the accumulation of debt on the part of cities or townships, above a certain *per cent.* of the valuation. The consent of the county-board is required for any extraordinary local expenditure. Although the people in township meeting have, otherwise, almost exclusive control of local affairs, yet there is seldom any clashing of powers between township, county, and state, because all matters affecting general interests are under the authority of state law. The county sees to it that there is a just valuation of property in the various townships, and the State exercises similar supervision over the counties.

February meeting.

The Theory of Primitive Communism, by D. W. Ross, of Cambridge, Mass.

It was shown, from the *Lex Salica*, the *Lex Alamannorum*, the *Lex Angliorum et Werinorum hoc est Thuringorum*, and other folk-laws, that a law of inheritance in land was common to all branches of the Teutonic race in the earliest period of their recorded history. This law of inheritance prescribed equal division among brothers, from which fact it was inferred that the earliest form of possession of land among the Germans was ownership *per stirpes*. This is inconsistent with communism, which may be described as ownership *per capita*. It was shown further, that the testimony of Cæsar and Tacitus is inconsistent with the theory of primitive communism Cæsar and Tacitus describe a partnership in the ownership of land, with a share-holding according to the law of inheritance applied to genealogical relationships. This was illustrated by the account, given by Sir John Davis, of Irish gavelkind. Then it was shown how all persons not members of the land-inheriting genealogy, *stirps*, were landless men, dependants and vassals of the land-inheriting clansmen. They were distributed in two classes: the class of feudal and the class of customary tenants. The latter lived in villages,—village communities. The Teutonic village community was in its origin a community of dependants and tenants, if not of serfs.

On Plans for organizing Charity, by F. K. Carey.

In many cities of Great Britain and America, societies have been established for the purpose of organizing the various agencies for charitable relief. Baltimore is without such a society, and it is probable that the city suffers in consequence. It is unquestionable that the efficient administration of relief among the needy of the city is hampered by the lack of coöperation among the numerous and wealthy citizens. Work is allowed to overlap and be duplicated, thus involving waste and making it impossible to treat a given case with wisdom and precision. On the other hand, fields of work are neglected and cases of crying need are passed over. Work is often badly done because agencies have cases forced upon them for which they have no proper appliances. Another evil lies in the impossibility of discovering promptly the exact needs and deserts of the applicant; from which it results that much imposition is practised, and that pauperism is often created or encouraged by unwise, indiscriminate giving of alms.

The plans for organizing charity which have been adopted elsewhere aim at alleviating these evils by putting all the charitable agencies of a city in close correspondence through the medium of a central office, by instituting a system of branch ward-associations, by pursuing through these branches a thorough system of personal investigation by a volunteer corps of lady visitors, and by a full and accurate registration of all the information which can be gained concerning the poor of the city and the relief which is afforded them. The personal nature of the relations of these societies with the poor makes it possible to carry out the following principles: (1) Except in cases of extreme need, alms ought never to be given without careful investigation; (2) Alms should never be given when advice, sympathy, influence, or work can be substituted; (3) The aim of charity is to cure, not to alleviate temporarily, the disease of poverty.

Metaphysical Club.

December Meeting.

Understanding and Reason, *Verstand* and *Vernunft*, by B. C. Burt.

Locke's, Hume's and Coleridge's uses of *Understanding* and *Reason* were briefly discussed; and then Kant's use of *Verstand* and *Vernunft* with Hegel's criticism thereupon. Hegel's own use was somewhat fully illustrated. For Hegel, *Verstand* and *Vernunft* are ways of looking at the world rather than faculties; they have a philosophical rather than a psychological meaning. For reason, the object is completely determined as unity of universal and particular, content and form; while for understanding, it falls into a thing-in-itself and a determinateness which comes to it from without. Understanding is abstract, presupposes, looks at things as static results; reason is concrete, self-determining, sees the process-nature of things. The principle of the understanding is abstract identity; that of reason, the unity of opposites.

January Meeting.

On Wundt's Algebra of Logic, by Miss Christine Ladd.

It was shown that the essential features of Wundt's Algebra of Logic are those which it has in common with that of Schroeder, and that in

those respects in which it differs, it differs for the worse; that the caution which he deduces from the fact that

$$x, = m\,(a + b + c), = ma + mb + mc,$$

(that to get the negative of x the second value must be used and not the first) is both unnecessary and the cause of a great increase of labor, and that his rule for what he calls the ambiguous case (that from $px\bar{y} + p\bar{x}y = 0$ follows either $x = py$ or $y = px$) is incorrect.

A Point of Logical Notation, by FABIAN FRANKLIN.

If in a logical problem there occur the terms $a, b, c, d, \ldots$, we may represent any combination of these terms and their negatives $\bar{a}, \bar{b}, \bar{c}, \bar{d}, \ldots$ as a number, by writing the letters in a fixed order and reading the combination as a number in the dual notation; any positive term being read as 1 and any negative term as 0. Thus $a\,\bar{b}\,c\,\bar{d}\,e$ is 21, $\bar{a}\,b\,\bar{c}\,\bar{d}\,e$ is 9, being in the dual notation 10101 and 1001 respectively. If in a combination one or more of the letters be missing, there correspond to the combination all the numbers which can be obtained by filling up the vacancies in all possible ways with 0's and 1's. Thus $a\,c\,\bar{d}$ is 20, 21, 28, 29.—If the premises in an argument are universal propositions, each premise may be expressed as the exclusion of one or more combinations; so that by the above notation we can register the premises on a natural scale; and it is easy to see how the elimination of any term or terms is to be performed. Thus, to eliminate the *last* term we have merely to see whether any even number and the next following odd number appear; if so, a certain combination of the terms other than the last (being common to these numbers) is excluded.—The notation can also be applied to the combination of universal and particular propositions.

February meeting.

The Physiology of Visions, by E. M. HARTWELL.

Apparitions, hallucinations, and visions, were held to be manifestations of pseudopia or false sight, due to lesion or disorder in some portion of the visual mechanism. It was the aim of the paper to show, through the discussion of the laws of normal vision, that the explanation of pseudopia is based upon the doctrine of reflex nervous action. Accordingly the nature of reflex action and its essential factors was first discussed. The physiology of sense organs in general, and of the visual organ in particular, was next considered; especial emphasis being laid upon the fact that sight is a function of certain centres or regions of the brain, rather than of the eye or of the optic nerve which are respectively organs for the reception and transmission of visual stimuli. The antagonistic theories of Ferrier and Goltz regarding the localization of the functions of the brain were commented upon. The peculiar effects of certain drugs in producing visions were noted. Numerous cases of pseudopia were cited; and especial attention was called to those of Joan of Arc, Swedenborg, and of certain carefully recorded cases which occurred in the practice of the late Dr. E. H. Clarke, of Boston. The conclusion was reached that the visions seen by the victims of delirium tremens, emotional insanity, narcotic poisons, and approaching death are attributable, chiefly, to disease or disturbance of centres in the brain; but that in the present state of science the precise localization of such centres is impossible.

Inhibition of Mental Action, by W. T. SEDGWICK.

Hypnotism, by D. L. BRINTON.

Mathematical Seminary.

January meeting.

On the Resultant of Two Congruences, by J. J. SYLVESTER.

Let an integer function of a variable be understood to mean an integral rational function thereof whose coefficients are all of them positive or negative integers.

Suppose p to be a fixed prime number; any integer function which is contained in $Fx + p\psi x$, where ψ is an arbitrary integer form, may be termed a modular factor of Fx. and all modular factors which are equivalent (quâ the fixed modulus) may be regarded as identical.

An integer function containing no modular factor (except itself) may be regarded as modularly irreducible, and as a very advantageous *façon de parler* may be affirmed to have as many modular roots as there are units in its degree. If linear, there is one modular root which is *actual*, in other cases the modular roots may be termed *hypothetic*, (words which seem preferable to *real* and *imaginary* for the purpose in view). The theorem of Gallois, that the number of modular roots of any integer function is the same as the number of units in its degree, is then tantamount to the affirmation that just as an integer number is capable of being resolved in only one way into a product of prime integer factors, so an integer function can be resolved in only one way into a product of modularly irreducible factors.

If one integer root of an irreducible integer function is also a root of a second function, it is well known that all the roots of the first are roots of the second: from that it follows that, *If the resultant of two integer functions vanishes, they must have an irreducible factor in common.* This is analogous to, or, rather is, so to say, an exaltation of, the fact that if the resultant of two real functions of a variable vanishes, they must have a real factor, linear or quadratic, in common; * indissoluble association of pairs of imaginary roots in the world of real quantity being the analogue of indissoluble association of groups of hypothetic roots in the world of integer numbers. In what immediately precedes, the factors spoken of are ordinary algebraical factors. If now we pass from ordinary to modular factors or roots, the theorem above stated on the introduction of the word 'modular' becomes the theorem referred to by Professor Smith, in the British Association Reports, 1860, p. 162, and by Mr. Hathaway at the last meeting, which may be thus expressed: "*If the resultant of two integer functions is modularly zero* (*i. e.* contains the modulus), *they must have a modular factor in common.*"

* So as a particular exemplification, if one of two integral rational functions with only real coefficients has no real root and their resultant vanishes, they must have two roots in common.

A Proof of Abel's Theorem, by T. CRAIG.

The proof given possesses the property of bringing into evidence, without in any way complicating the processes, quite a number of theorems from the ordinary Theory of Functions. A function f exists which gives on a certain $2p + 1$-fold Riemann's surface a single-valued spread. Denoting the Riemann's surface by R, conceive R to be dissected by the ordinary method, into a simply connected surface R'; on R' draw lines connecting the zero points with the poles of f, and call the surface in this shape R''. Take a new function $\frac{dw}{dz}$ which has certain prescribed discontinuities over R''. Remove the regions in which these discontinuities occur by drawing small circles round the points lying at finite distances from the origin, and a large circle excluding points at infinity. The function $\log f\,dw$ is single-valued and continuous over the surface R''' formed in this manner, and consequently

$$\int_{R'''} \log f\,dw = 0\,.$$

The values of $\log f$ and of $\frac{dw}{dz}$ are given in ascending powers of $(z - z_k)$ for the points at a finite distance from the origin, and in descending powers of z for points at infinity. The moduli of the functions f and $\frac{dw}{dz}$ are known along the various cuts that have been made; so substituting in the above integral for $\log f$ and $\frac{dw}{dz}$ their values, we obtain readily the theorem in its usual form.

Proof that there are only Three Linear Associative Algebras in which Division is an Unambiguous Process, by C. S. PEIRCE.

February meeting.

The Cyclotomic Functions, Considered with respect to a Prime Modulus p, by A. S. HATHAWAY.

We may divide the ef primitive kth roots of unity into e periods of f roots each, so that the periods shall be the roots of a rational integral function $x^e +$ &c. Such a period is $\rho + \rho^{\lambda_1} + \ldots \rho^{\lambda_{f-1}}$ where ρ is a primitive kth root of unity and $1, \lambda_1, \ldots \lambda_{f-1}$ a conjugate set of the totitives of k. *i. e.*, such that $(1 \,.\, \lambda_r)$. $(\lambda_1 \,.\, \lambda_r), \ldots (\lambda_r \,.\, \lambda_r), \ldots (\lambda_{f-1} \,.\, \lambda_r)$, is the same set of totitives (mod. k.) Such a cyclotomic, $f(x)$, breaks up into factors as follows for the prime modulus p:

Let $k = k_1 p^\nu$ where k_1 does not contain p; then $f(x)$ is a power (mod. p) of the cyclotomic $f_1(x)$ whose root is $\rho_1 + \rho_1^{\lambda_1} + \ldots \rho_1^{\lambda_{f-1}}$, ρ_1 being a primitive k_1th root of unity. This power ($=h$) lies between p^ν and $p^{\nu-1}$. Let the ith be the first of the series $p, p^2, p^3, \ldots$ which is congruous to any one of the set $1, \lambda_1, \ldots \lambda_{f-1}$ mod k_1; then $f_1(x)$ will break up exclusively into irreducible factors of the ith degree, (mod p);[1] except that if p is a divisor of $f(0)$, then in $f_1(x)$ the factor x^i will occur.

For the modulus $p^n + 1$, $f(x)$ generally breaks up into irreducible factors of the hith degree, h and i being defined as above.[2]

Notes by author:—

1 Since presenting this theorem to the Mathematical Seminary, I find that Professor R. Dedekind has previously obtained the same from the theory of ideal primes.

2 I obtain these theorems by a use of the theory explained in University Circulars, May, 1880, p. 67, January, 1881, p. 97, after it is extended to congruences involving modular functions as moduli.

On Certain Compound Determinants, by C. A. Van Velzer.

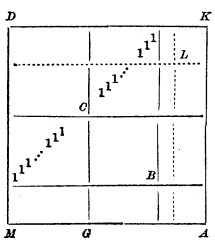
A determinant of order n whose elements are a_{ik} will be designated by A_n, a minor of A_n of order λ by A_λ, the determinant of all minors of A_n of order m by M, and $\frac{r!}{s!\,(r-s)!}$ will be designated by r_s.

If in the determinant A_n we select a minor A_h and form all those minors of order m of A_n $(m < h)$ which are not formed by selecting *entirely* from A_h we form a determinant M_μ of order $n_m - h_m$ which satisfies the equation

$$(A) \ldots\ldots\ldots M_\mu = A_{n-h}^{(h-1)_{m-1}} \cdot A_n^{(n-1)_{m-1}-(h-1)_{m-1}}.$$

This is easily proved by means of the theorems in Scott's Determinants, pg. 61, sec. 10 and pg. 64, sec. 16.

Now border A_n with $n-h$ rows and columns as in diagram, where the units run perpendicular to the principal diagonal and all other elements in the border are zeros, and where AC represents the determinant, A_n.



It is evident that the whole determinant $AD = AB$, *i. e.* $= A_h$.

Consider the determinant AD divided by the dotted lines in the figure, so that KL is a square block, say of order k $(< h)$.

If we form an m^{th} minor of AD by striking out m of the rows and columns intersecting in KL, it is plain that this minor reduces to a square block formed by striking out m columns of AB and substituting m columns from GB in their stead.

The determinant of all possible such m^{th} minors is a compound determinant of order k_m whose elements are determinants of order h formed by replacing m columns of AB, which are to the right of the vertical dotted line, by m columns of GB selected from the k columns adjacent to AB.

The determinant of these m^{th} minors is, of course, a minor of the determinant of *all* m^{th} minors of AD, and, as such, we have, designating this minor by M_k,

$$M_k = (AD)^{k_m - (n-1)_{m-1}} \cdot M' = A_h^{k_n - (n-1)_{m-1}} \cdot M'$$

M' denoting the complementary minor in the reciprocal block.

Applying formula A to this case we obtain

$$M_k = A_{n-k}^{(k-1)_{m-1}} \cdot A_h^{(k-1)_m}.$$

A_{n-k} is the square block ML, and evidently reduces to a square block of order h formed by the $h-k$ columns of AB to the left of the dotted line and the k right-hand columns of BG.

Hence the determinant T_h in Scott's Determinants, pg. 63, sec. 14, may, in certain cases, be expressed without reference to the complementary minor in another determinant.

Many other theorems might be deduced by different selections of the square block KL which may be any square block which contains none of the rows and columns intersecting in BC.

On the Prerogative of a Ternary Denominational System of Coinage, by J. J. Sylvester.

Professor Sylvester drew attention to the fact that a system of coinage in which each coin is three times the value of the one below it would possess a superiority *above every other* in so far as it would admit of all payments up to any assigned limit, being effected with the smallest possible number of pieces, this advantage increasing with the size of the limit. Thus suppose the limit of 10 dollars to be selected, two persons each possessed of 7 coins of the respective value of 1, 3, 9, 27, 81, 243, 729 cents could pay each other by interchange of their coins any sum from 1 cent up to this limit. The full amount so capable of being paid being of course, $\frac{3^7-1}{2}$ cents, *i. e.* \$10.43. Whereas with 7 coins doubling at each step, the extreme limit would be \$1.27.

Again if each coin were quadruple the value of its antecedent, the extreme limit attainable with 8 coins would be only 2 (1+4+16+64), or \$1.70. The sum of the geometrical progression 1+5+25+125+625 being 781; 10 coins at least would be required to be possessed by each of two persons to enable one of them to pay the other any amount from 1 cent up to \$7.81, whereas as previously shown, 7 would be more than sufficient to allow of this being done on the ternary scale.

Thus the absolutely perfect system of coinage, so far as this depends on the smallness of the number of coins necessary to be used, is that which proceeds in a geometrical progression according to the ternary scale.

The following problem in arithmetic, is suggested by the preceding considerations.

What is the condition that the sums and differences of the integers a_1, a_2, a_3, . . . a_n, not subject to any defined law of progression, may comprise between them all the numbers from 1 *up to* $a_1 + a_2 + a_3 \ldots + a_n$.

March meeting.

On Binomial Congruences, (mod. $p, f(x)$), by O. H. Mitchell.

If $f(x) = K = A^t B^u C^v \ldots$, where A, B, etc., are functions of x irreducible with respect to a prime modulus, p, and are of degrees a, b, c, respectively, then the number of functions of x, of a less degree than the degree of K, which contain no factor of K with respect to p, being designated by $\tau(K)$, and the number which contain A but no other factor of K being denoted by $\tau_A(K)$, etc. for $\tau_B(K)$, . . $\tau_{AB}(K)$, . . $\tau_{ABC}(K)$, . . , the values of these numbers are found from the corresponding numbers for an integer $k = a^t b^u c^v$, by substituting p^a for a, p^b for b, etc. Thus, if $K = A^t B^u C^v$,

$$\tau(K) = p^{(t-1)a} p^{(u-1)b} p^{(v-1)c} (p^a - 1)(p^b - 1)(p^c - 1),$$
$$\tau_A(K) = \quad " \qquad (\ldots\ldots)(p^b - 1)(p^c - 1),$$
$$\tau_{AB}(K) = \quad " \qquad (\ldots\ldots)(\ldots\ldots)(p^c - 1), \text{ etc.}$$

The roots of $X^2 \equiv X$ (mod. p, K) have the same properties as those of $x^2 \equiv x$ mod k. Thus if $i =$ the number of irreducible functions (mod. p) contained in K, there are 2^i roots one belonging to each of the 2^i classes of functions enumerated above. If these roots be designated by R_1, R_A, R_B, . . . R_{AB}, ... , and $s = AB \ldots D$, $s' = FG \ldots L$, then,

$$R_s R_{s'} \equiv R_{ss'} \text{ (mod. } p, K).$$

Also, the sum of any number of these roots is congruous (mod. p, K) to the sum of the same number of any others of them, provided the product of the subscripts is the same for each sum. If $\bar{s}$ denote the product of all the irreducible (mod. p) functions contained in K except those contained in s, then,

$$R_s R_{\bar{s}} \equiv 0 \text{ (mod. } p, K),$$
$$R_s + R_{s'} + R_{s''} + \ldots \equiv R_{\overline{ss's''\ldots}} \text{ (mod. } p, K).$$

If X_s denote any function of x which contains s and no factor of K not found in s, the analogue of Fermat's theorem is

$$X_s^{\tau_s(K)} \equiv R_s \text{ (mod } p, K);$$

and if ΠX_s denote the product of all the functions X_s of a less degree than K, the analogue of Wilson's theorem is

$$\Pi X_s \equiv R_s \text{ (mod. } p, K),$$

except s contain all but one of the factors of K, in which case

$$\Pi X_s \equiv -R_s \text{ (mod. } p, K).$$

Mr. Peirce called attention to the similarity existing between some of the above results and certain logical formulae.

On Two Kinds of k-th Totients, by W. E. Story.

If any number N is resolved into its prime factors, say $N = a^\alpha b^\beta c^\gamma \ldots$ the number

$$\tau^k(N) = a^{k(\alpha-1)} b^{k(\beta-1)} c^{k(\gamma-1)} \ldots (a^k - 1)(b^k - 1)(c^k - 1) \ldots$$

is the number of sets of k numbers each, neither greater than N, which do not all contain as a divisor any factor of N. This formula includes all the different permutations which can be obtained from any such set of k numbers. The number of such sets, excluding permutations, *i. e.* counting only one permutation to each set, is

$$\phi^k(N) = \frac{1}{k!}\left\{\tau^k(N) + t_1^k \cdot \tau^{k-1}(N) + t_2^k \cdot \tau^{k-2}(N) + \ldots + t_{k-1}^k \tau(N)\right\},$$

where 1, t_1^k, t_2^k, . . . t_{k-1}^k are the coefficients of the successive descending powers of x in the expression $(x+1)(x+2)(x+3) \ldots (x+k-1)$.

Let now a, b, c, . . . , instead of being the different prime factors of N, be the different *least* divisors of N, which have a given characteristic of any nature whatever. By a *least* divisor is meant one which is not a multiple of any other divisor of the given type. Let then the product of the binomial factors in the expression $\tau^k(N)$ above given be developed and every k-th power of a product of least divisors a, b, c, . . . be replaced by the k-th power of the least common multiple of such divisors occurring in that product. The value of $\tau^k(N)$ after these changes have been made and the value of $\phi^k(N)$ after the substitution of these forms of $\tau^k(N)$ will be the number of sets of k numbers each, none greater than N, which do not all contain any divisor of N having the given characteristic, respectively inclusive and exclusive of permutations. It is noticeable that if any divisor having the given characteristic, but not a least divisor of that type, were introduced into the formula the result would not be affected, provided account is taken of *all the least divisors.*

A. S. Hathaway also read a Paper on Modular Functions.

OFFICIAL ANNOUNCEMENTS.

CHARGES FOR TUITION.

By authority of the Trustees, February, 1881.

The charge for tuition is eighty dollars per year payable in two sums, forty dollars on the first of October, for the first half year, and forty dollars on the first of February, for the second half year. The Treasurer's office is not authorized to make a deduction for a period less than half a year, or to make a deduction because the student gives only a part of his time to study, or because he belongs to but one class.

Charges for materials, instruments, breakage, etc., are made in the laboratories, but there are no other extras.

Upon entering the University and before attending any class every student (*including the Fellows and the holders of Scholarships*) is required to deposit with the Treasurer the sum of ten dollars. This sum will be repaid to him when he withdraws from the University, if there are no charges against him in the Treasurer's office, the Library, the Laboratories, or elsewhere. A key to a coat closet will be furnished if asked for.

Holders of Fellowships and Scholarships are not charged the general tuition fee for any period after the date of their appointment. Holders of Scholarships are charged the fees for material, etc., made use of in the Laboratories.

Chemical Laboratory.

Workers in the Chemical Laboratory will be charged twenty dollars for the year, or ten dollars for the half year (in addition to the general tuition fee, which is eighty dollars,) for gas, chemicals, etc. From this charge Fellows only are exempt.

A charge will also be made, at the end of each year, against all (including Fellows) who work in the Laboratory for apparatus taken from the Laboratory stock and not returned in good condition.

Those who merely attend the annual course of Chemical lectures and have no other connection with the University, will pay for this privilege the sum of twenty dollars.

Biological Laboratory.

The fees for work in the Biological Laboratory are—

1. To undergraduate students, whether matriculates or not, taking the regular courses of instruction in Biology, there will be charged (in addition to the general tuition fee, which is eighty dollars,) twenty dollars, for material and the use of apparatus.

2. To medical men, graduate students and others taking only the annual course of instruction in Animal Physiology, with the corresponding laboratory practice, fifty dollars, which includes payment for material and the use of apparatus.

3. For a course of practical instruction in Histology, (including material and the use of apparatus), twenty-five dollars.

4. Students engaged in investigation or special individual work will be charged twenty dollars for the use of instruments, &c., and be required to pay for any material used except the usual histological and chemical reagents.

5. Those who merely attend the annual course of Biological lectures and have no other connection with the University will pay for this privilege the sum of twenty dollars.

NOTE IN RESPECT TO THE STUDY OF FRENCH AND GERMAN.

After a general consultation upon the subject, the following Note is published by authority of the Academic Council.

I. It is not required of every student to follow the French and German courses here prescribed; but no one will be allowed to graduate until he has given evidence that he has a knowledge of those languages, corresponding to that which may be acquired in the minor course here given.

II. The rudiments of French and German are not taught in this University. They may be learned by the student before or after his admission to the University; but they must be learned before he can enter here the classes in Modern Languages.

III. For admission to the minor course in German a candidate must show a knowledge of the inflections and of twenty-five pages of some German Reader.

For admission to the minor course in French the candidate must show as much knowledge as may be acquired by a study of Keetels' Analytic French Reader, Part I, and twenty-five pages of Part II; and of Ploetz' Grammaire nouvelle, (*Lexicographie.*)

IV. One year's successful study of either language counts as a minor course. The student who has completed a minor course, should be able to read, at sight, ordinary modern prose.

V. The major course, which occupies a second year, leads the student to a more critical study of the language, its history, structure and literature. The lessons are conducted in French or German, and the writing of essays is required.

VI. Students who have such an amount of knowledge as may be gained in the major courses, can pursue, if they choose, advanced courses of instruction as they are from time to time offered.

VII. If French and German are offered for matriculation, instead of Greek, the minor course in one and the rudiments of the other are required.

EXAMINATIONS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

The following statement in respect to the terms upon which the degree of Doctor of Philosophy is bestowed has been authorized by the Academic Council.

1. The candidate must have taken his first degree in a college of good standing.

2. An interval of three years or more must elapse between his baccalaureate examination and his graduation as Doctor of Philosophy.

3. He must be accepted as a candidate by the Academic Council of this University one year before his final examination.

4. He must file with the President, prior to his being accepted as a candidate, a statement of the principal and subordinate subjects on which he desires to be examined; and, when it is determined, a statement of the subject of his graduating thesis.

5. His thesis must be submitted to the Academic Council at least three months prior to the time when he proposes to pass his final examinations. This thesis will be carefully scrutinized, and, if found satisfactory, arrangements will be made for further oral or written examinations, one or more of which must be in the presence of the Academic Council.

6. In exceptional cases, by special permission of the Academic Council, non-resident students may be examined for this degree. Such scholars must be accepted at least two years before their final examination, and must prosecute their studies under such arrangements and conditions as shall meet with the approbation of the President and Professors of this University. In other particulars, the regulations above given will apply to these cases.

SPECIAL NOTICES AND CURRENT INTELLIGENCE.

VISIT OF PRESIDENT HAYES.

The President of the United States, RUTHERFORD B. HAYES, visited Baltimore, Saturday, February 12, 1881.

By invitation of the Hopkins Trustees, he came to the University, at 3 P. M., and the officers and students were personally presented to him in Hopkins Hall. By a vote of the Trustees the honorary degree of Doctor of Laws was conferred upon him, and he acknowledged the compliment in a brief address.

COMMEMORATION DAY.

The twenty-second of February, 1881, was observed, according to usage, as the Commemoration Day of the Johns Hopkins University. At eleven o'clock in the morning, Hopkins Hall was filled with an assembly which included the Trustees, the Academic Staff, the Graduates, the Students, and a number of invited guests, among whom was the Mayor of the City. After an address by President Gilman, which occupied nearly an hour, and reviewed the present condition of the various departments and agencies of the University, the academic degrees were conferred as follows:

Bachelors of Arts.

EDWIN G. RICHARDSON, of Baltimore, who received his previous training at the Pembroke School, Baltimore, and pursued while at this University, studies in Greek and Latin as major subjects, and in History, German and French as minor subjects.

LEE SALE, of Louisville, Kentucky, a former student of the Louisville High School, who has finished major courses in Latin and Greek, and minor courses in History, German and Physics.

Doctor of Philosophy.

CHRISTIAN SIHLER, of Cleveland, Ohio, who received his academic education at a German gymnasium, the Concordia College, in Indiana. He then entered the Medical Department of the University of Michigan, where he received the degree of Doctor of Medicine in 1871. He has been connected with the Johns Hopkins University for three years, as Student, Fellow, and Assistant in the Biological Laboratory. He was examined in Animal Physiology as his main subject, and in Animal Morphology and Chemistry, as subordinate subjects. His thesis, on "The Formation of Bone and Tooth," was submitted to Dr. George A. Otis, of the U. S. Surgeon-General's Office, Washington.

An address had been expected from Dr. A. Graham Bell, of Washington, but, on the day previous, a telegram was received from him, saying that ill health prevented him from complying with the invitation.

In the evening, from 8 to 11 o'clock, the library and halls of the University were thrown open to a company of gentlemen and ladies, several hundred in number.

MEETING OF AMERICAN LIBRARY ASSOCIATION.

The AMERICAN LIBRARY ASSOCIATION held the final session of its annual meeting in Hopkins Hall, Friday, February 11; the previous sessions having been held in Washington. Among those present were Justin Winsor, of Harvard University, President of the Association; Melvil Dewey, Secretary of the Association; H. F. Bassett, Waterbury, Conn.; E. C. Bigmore, London; J. S. Billings, Surgeon-General's Office; Alice J. Bragdon, Public Library, South Boston; Mellen Chamberlain, Boston Public Library; E. Cleaves, Boston; R. Colton, American Antiquarian Society Library; C. A. Cutter, Boston Athenaeum; C. C. Darwin, Congressional Library; Sarah F. Earl, Worcester Public Library; John Edmands, Philadelphia Mercantile Library; W. E. Foster, Providence Public Library; Sarah C. Godbold, Public Library, East Boston; S. S. Green, Worcester Public Library; W. M. Griswold, Bangor, Me.; G. W. Haines, Cornell University; H. A. Homes, New York State Library; J. K. Hoyt, Newark, N. J.; D. Hutchinson, Washington; F. Jackson, Newton, Mass.; J. N. Larned, Young Men's Library, Buffalo; F. Leypoldt, New York; C. N. Merrill, Cincinnati Public Library; E. J. Nolan, Philadelphia Academy of Sciences; S. B. Noyes, Brooklyn Library; W. T. Peoples, New York Mercatnile Library; W. F. Poole, Chicago Public Library; R. B. Poole, New York Young Men's Christian Association; W. J. Rhees, Smithsonian Institution; O. H. Robinson, University of Rochester; Mrs. M. A. Sanders, Pawtucket Free Library; A. W. Tyler, Indianapolis Public Library; F. Vinton, College of New Jersey.

Representatives of the principal Baltimore literary institutions were also present.

J. W. M. Lee, of the Mercantile Library; P. R. Uhler, of the Peabody Institute; and W. Hand Browne, of the University Library, acted as a committee of reception.

President Gilman welcomed the Association to Baltimore, and expressed his obligations and those of his colleagues to the librarians who have generously lent for use in Baltimore such books as have been called for in the prosecution of University work.

Papers were read by O. H. Robinson, of the University of Rochester, on "The Relation of Libraries to College Work," and by S. S. Green, of the Worcester Public Library, on "Library Aids."

After a lunch, to which the Association was invited by the Trustees of the University, the members of the Association visited the Peabody Institute, the Mercantile Library and the rooms of the Maryland Historical Society.

DUPLICATES IN LIBRARY.

The following volumes will be exchanged, or sold at annexed prices. Where no binding is specified, the book is unbound. Address Dr. W. Hand Browne, Librarian.

ARBEITEN AUS D. PHYSIOL. ANSTALT. LEIPZIG. Bd. 10, 8vo. hf. mor., Leipzig: 1876,	75
ARBEITEN A. D. ZOOLOG.-ZOOT. INST. Z. WÜRZBURG IV, 1, 8vo. Hamburg: 1877	75
ARCHIV FUR ANTHROPOLOGIE VIII, 3, 4, 4to., Braunschweig: 1876	2 50
ARCHIV. F. MIKROSKOP. ANATOMIE. XIII, 8vo., Bonn: 1876–7	5 00
ARCHIVIO GLOTTOLOGICO ITALIANO. V, 1, 8vo., Rome: 1878; VII, 1, 8vo., Rome: 1880, Each	50
ARISTOPHANES. Frösche. Ed. Kock, 8vo., Berlin: 1868	50
BAIN. Logic. 2 v., cr. 8vo., cloth (worn), London: 1870	1 75
BAUDISSIN. Studien z. Semit. religionsgeschichte hft. 2, 8vo., Leipzig: 1878	75
BOEHMER. Romanische Studien. XV, 8vo., Bonn: 1880	4 00
DOEDERLEIN. Homerisches Glossar. 3 v., 8vo., hf. mor. Erlangen: 1850	2 50
DÜNTZER. Homerische Abhandlungen, 8vo hf. mor., Leipzig: 1872	1 50
HEGEL. Encyclopädie, 2 v., 8vo., hf. cf., Berlin: 1843	2 00
HEGEL. Philosophie der Geschichte, 8vo., hf. cf., Berlin: 1840	1 00
HEGEL. Rechtsphilosophie, 8vo., hf. cf., Berlin: 1840	1 00
HERBART. Einleitung in die Philosophie, hf. cf., Leipzig: 1850	1 50
HOBBES. English works, Vol. I, 8vo., cloth, London: 1839	75
HOFMANN U. SCHWALBE. Jahresb. u. d. fort. d. Anat. u. Physiol. V. 2, Leipzig: 1878	25
HOLLAND. Roumans dou Chevalier au Lyon, 2d ed., 8vo., hf. mor., Hannover: 1880,	1 50
HUME. ESSAYS. 2 v., 8vo., old cf., London: 1788	2 00
JACOB. Bedeutung der Führer Dantes, pph., Leipzig: 1874	25
JOURNAL OF PHILOLOGY, VII, 8vo., London: 1876	1 00
JOURNAL DE MATHEMATIQUES, (Liouville), III, Série I, 4to., Paris: 1875	3 50
LITERATURBLATT F. GERM. U. ROMAN. PHILOLOGIE Nos. 1–7, 4to., Heilbronn: 1880,	75
LONDON MATH. SOC. PROCEEDINGS. Nos. 159–162, 8vo., London: 1880	50
MAREY. Physiologie Expérimentale, IV, 8vo., Paris: 1880	2 00
NITZSCH. Epische Poésie der Griechen, 8vo., hf. mor., Leipzig: 1862	2 50
PFLÜGER. Archiv. f. d. gesammt. Physiologie, XIV, 8vo., Bonn: 1877	2 00
POGGENDORFF'S ANNALEN. Ergänzungsb., VIII, 8vo., Leipzig: 1877	25
PRANTL. Geschichte der Logik, 4 v., 8vo., hf. mor., Leipzig: 1855	5 00
PREGER. Dante's Matelda. München: 1873	25
RAVAISSON. La Philosophie en France au XIX Siècle, 8vo., hf. mor., Paris: 1868	1 50
REHDANTZ. Indices z. Demosthenes Philippische Reden, 8vo., Leipzig: 1874	25
SCARTAZZINI. Dante, sein Zeit, sein Leben, &c., 8vo., Biel: 1869	1 00
SCHMIDT. Das Perikleische Zeisalter., Bd. 1, 8vo., hf. mor., Jena: 1877	75
SCHMIDT-MÜLHEIM. Physiol. d. Haussäugethiere, 8vo., Leipzig: 1879	1 50
STEINTHAL. Geschichte der Sprachwissenschaft., 8vo., hf. mor., Berlin: 1863	2 00
STEWART, DUGALD. Works, 11 v., 8vo., cloth, Edinburgh: 1854	12 00
TRENDELENBURG. Logische Untersuchungen, 2 v., 8vo., Leipzig: 1870	2 00
WÖHLER. Mineralanalyse, 8vo., hf. mor., Göttingen: 1861	75
ZEITSCH. F. DEUTSCHE PHILOLOGIE VII, 8vo., Halle: 1876	1 50
ZEITSCH. F. ROMANISCHE PHILOLOGIE I, 8vo., Halle: 1877	1 50

SEMI-ANNUAL EXAMINATIONS.

First Half-Year, 1880–81.

The Semi-Annual Examinations were held according to the following schedule:

Saturday, January 15.

Greek Prose Composition, *Classes A and B.* (7)
Psychology. (2)

Wednesday, January 19.

French: Major. (3)
Human Osteology. (3)

Thursday, January 20.

Human Osteology. (3)

Saturday, January 22.

German: Minor, Schiller, *Prose.* (13)
German: Schiller, *Wallenstein.* (10)

Monday, January 24.

Finance. (11)
General Biology. (3)

Tuesday, January 25.

Animal Physiology. (5)

Wednesday, January 26.

German Grammar and Prose Composition. (13)
German: Schiller, *Prose.* (7)

Friday, January 28.

Modern History. (18)
General Biology. (3)

Saturday, January 29.

Political Economy. (11)
Matriculation in Algebra. (14)
Matriculation in Geometry. (20)

Monday, January 31.

Animal Physiology. (5)
Latin Prose Composition. (10)

Wednesday, February 2.

Latin: Livy. (11)
Greek: Sophocles, *Electra*, *Antigone.* (5)
Greek: Herodotus, I, II (*private reading*). (1)
Latin: Horace, *Od.* III, IV, *Epod.*, etc. (*private reading*). (1)

Thursday, February 3.

Latin: Livy. (11)
Greek: Sophocles, *Electra*, *Antigone.* (5)

Saturday, February 5.

French: Minor. (8)
Italian: Dante. (4)
General Physics. (13)

Monday, February 7.

General Physics. (13)
Matriculation in Latin. (3)

Wednesday, February 9.

German: Goethe, *Egmont.* (11)
German Prose Composition and Bauer's Grammatik. (8)

Thursday, February 10.

German: Goethe, *Egmont.* (11)

Saturday, February 12.

Latin: Tacitus. (8)
Differential Calculus. (4)
Matriculation in Trigonometry. (18)
Matriculation in Analytical Geometry. (12)

Thursday, February 15.

French: Minor. (8)

Wednesday, February 16.

Latin: Livy (*private readings*). (6)
Latin: Tacitus (*private readings*). (3)

Saturday, February 19.

Greek: Herodotus. (4)
Theory of Functions. (3)
German Grammar and Prose Composition. (suppl). (3)
Greek: Homer. *Odyssey*, I–VI (*private readings*). (1)
Greek: Euripides. *Alcestis* (*private readings*). (2)
Matriculation in Greek. (2)

Wednesday, February 23.

Greek: Herodotus. (4)
Latin: Cæsar, *Bell. Civ.* (*private readings*). (1)

Thursday, February 24.

Spherical Trigonometry. (1)

Saturday, February 26.

French: Major. (3)

Thursday, March 3.

Greek: Homer, *Odyssey*, VII–XII (*private reading*). (1)

ADDITIONS TO ROLL OF STUDENTS.

(The full list of Officers and Students for the current year, will be found in University Circulars, No. 8, pp. 91–93.)

APPLEGARTH, ALBERT C.	Baltimore.	348 *Lexington St.*
Baltimore City College. *Candidate.*		
COOKE, CHARLES A.	Baltimore.	96 *Harlem Ave.*
Baltimore City College. *Chemistry.*		
COOKE, FREDERICK H.	Rock Bottom, Mass.	163 *Druid Hill Ave.*
A. B., Williams College, 1880. *Greek.*		
DAVIS, ELLERY W.	Oconomowoc, Wis.	156 *W. Biddle St.*
S. B., University of Wisconsin, 1879. *Mathematics.*		
DURFEE, WILLIAM P.	Berkeley, Cal.	*Belvidere House.*
A. B., University of Michigan, 1876. *Mathematics.*		
MILLER, JOHN H.	Camden, Ala.	263 *N. Howard St.*
A. B., Erskine College, (S. C.), 1880. *Mathematics.*		
NOYES, WILLIAM A.	Grinnell, Iowa.	19 *McCulloh St.*
A. B., Iowa College, 1879. *Chemistry.*		
TREADWELL, WILLIAM H.	Portsmouth, N. H.	43 *Cathedral St.*
Ph. D., University of Heidelberg, 1880. *Philosophy.*		
WHITING, GUY F.	Baltimore.	143 *W. Lanvale St.*
M. D., University of Maryland, 1878. *Biology.*		

Total number of Enrolled Students, 1880–81, 177, of whom 97 are Graduates.

FELLOWSHIPS.

Twenty Fellowships, each yielding five hundred dollars are annually awarded by the Johns Hopkins University to college graduates who desire to pursue special advanced courses of study. A circular explaining the system will be sent on application. *Applications for the next year should be made prior to May* 13, 1881.

BRIEF ANNOUNCEMENTS.

DR. AUSTIN SCOTT, Associate in History, in place of the course of public lectures heretofore announced to be given by him, will begin a class course of instruction in American Constitutional History, Wednesday, April 6, at 12 M., and continue the same on Wednesdays, at 4 P. M., and Saturdays, at 12 M., until May 25, 1881.

The lectures of PROFESSOR A. GRAHAM BELL on "Speech" may be expected in October next. Ill health and a pressure of engagements have prevented him from delivering them during the current year. He has however consented to give one lecture upon the Photophone, in Hopkins Hall, April 22, 1881.

PROFESSOR JOHN MCCRADY, of the University of the South, Sewanee, Tenn., formerly Professor of Zoölogy in Harvard University, will give a course of six public lectures on the Theory of Development and its Philosophical Significance, in Hopkins Hall, beginning Thursday, March 31, and continuing on Friday, April 1, Monday, April 4, Tuesday, April 5, Friday, April 8 and Monday, April 11.

M. RABILLON, Lecturer on French Literature, began a course of ten lectures (in French), on French Poetry, etc., Saturday, March 5, and will continue them on successive Saturdays until May 7.

SAMUEL F. CLARKE, Ph. D., Assistant in the Biological Laboratory, has been invited to lecture on Natural History at Smith College, Northampton, Mass. He will give instruction in Elementary Zoölogy, at the Chesapeake Zoölogical Laboratory, during its next session, as heretofore announced.

KAKICHI MITSUKURI, Ph. B., Fellow in Biology, has returned to the University of Tokio, Japan, and has consequently resigned the Fellowship held by him here.

ARTHUR WILSON WHEELER, A. B., of Rockland, Mass., a graduate of Amherst College in 1879, and a Fellow in Physics of this University, died in Baltimore, January 6, 1881, aged 21 years. A brief memorial notice of him has been printed and distributed.

HARRY SWANN, a native of England, who has been one of the janitors of this institution since 1876, died March 15, at the age of 27 years. He was an obliging, industrious and faithful man who was struggling against adversities, in a brave and helpful spirit, respected by all who knew him.

THE MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND will hold its next session in Hopkins Hall, beginning April 12, 1881.

DEATH OF

GALLOWAY CHESTON,

First President of the Board of Trustees of the Johns Hopkins University,

who was born in Baltimore, May 31, 1806, and died in Baltimore, March 9, 1881,

In the seventy-fifth year of his age.

BIOGRAPHICAL NOTE.

Galloway Cheston, the son of James Cheston, a successful merchant, passed his life in Baltimore, the place of his birth. After receiving a good education in St. Mary's College, before its well known academic department was given up, he engaged with success in mercantile pursuits. He was called to many positions of financial trust, and was selected to be a director in various philanthropic and educational institutions. In all these stations and in the various relations of private life he commanded the respect of those who knew him as an exemplary and upright man, attentive to every duty and governed by an unwavering Christian faith. He seldom failed to attend the meetings of the Board and was always the advocate of a liberal and enlightened policy.

The following statements regarding his life were published in the Baltimore American, March 10, 1881:

Galloway Cheston, after receiving an academic education, went into business with his father under the firm name of Cheston & Son, millers and flour merchants. The firm afterwards did a large business in the importation of coffee from Brazil. Mr. Cheston was in business in Baltimore for nearly half a century, and acquired a most excellent reputation for probity and intelligence, as well as for his success as a merchant. He was for a long time president of the Copper Smelting Company. One of the most responsible offices that he ever filled was that of chairman of the Finance Committee of the Baltimore and Ohio Railroad Company, after being a prominent director in the company. His rare business tact, shrewdness, and ability as a financier were so generally recognized, that at the death of the late Johns Hopkins, who had for many years been at the head of the finance committee of the road, he was unanimously chosen to succeed him. The excellent manner in which he discharged the duties of that office attested the wisdom of his selection for that important trust. He was for many years a director in the Farmers and Planters' Bank, of which his father, James Cheston, was the first president, . . . and also in the Savings Bank of Baltimore and in the Peabody Fire Insurance Company. His was a very active business life, and the large number of positions which he held shows the confidence reposed in him by those with whom he came in contact in his long mercantile career. . . . . He was president of the Board of Trustees of the Johns Hopkins University, a trustee of the Johns Hopkins Hospital, a trustee of the Peabody Institute, a director in the Manual Labor School, a director of the Maryland Bible Society, a director of the Baltimore Orphan Asylum and of similar institutions. He married a daughter of Mr. James Carey, a well-known Baltimore merchant. His wife preceded him to the grave several years ago. She died childless. Mr. Cheston retired from business some years since. He was an attendant at the meetings of the Orthodox Society of Friends, on Monument Street.

Minute adopted at a meeting of the Trustees and Academic Staff, March 15, 1881.

At a meeting of the Trustees and Academic Staff, the chair having been taken by Hon. George W. Dobbin, the following minute was presented by Hon. C. J. M. Gwinn, and after remarks by the mover, and by President Gilman, Mr. Francis T. King, and Judge Dobbin, was unanimously adopted. The action of the meeting was communicated to the family of Mr. Cheston, and will be entered upon the records of the Trustees.

"The Board of Trustees of the Johns Hopkins University, its President, Professors and Associates, having assembled to make some fitting record of the loss, by death, of Galloway Cheston, the President of its Board of Trustees, hereby record their estimate of his character and services.

"Mr. Cheston, who had been well known from his boyhood to the founder of this University, was named by him, when it was first organized, as the President of its Board of Trustees.

"He fully justified the choice thus made. Kindly, but firm in temper, broad, thoughtful and charitable in opinion, prudent and laborious in action, and pure in heart, his advice and effort have greatly aided in laying deep and strong the foundations of this University. If it should grow to greatness, as we trust it will, his name will be imperishably connected with its history."