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1870/1872

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TRANSACTIONS  
OF THE  
WISCONSIN ACADEMY  
OF  
SCIENCES, ARTS, AND LETTERS.

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1870-2.

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*Published by Order of the Legislature.*

MADISON, WIS.:  
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## CONTENTS.

	<i>Page.</i>
I. LISTS OF OFFICERS AND MEMBERS.....	5-8
II. REPORT OF THE PRESIDENT—	
Embracing:	
1. Reasons for the organization of the Academy, with a record of what had previously been done by, and in behalf of, Wisconsin in the Sciences, in the Arts, and in Letters .....	9
2. General Plan of the Academy.....	36
3. What the Academy has done.....	38
III. SOME OF THE PAPERS READ BEFORE THE ACADEMY:	
DEPARTMENT OF THE SOCIAL AND POLITICAL SCIENCES.	
1. The Relation of Labor and Capital. By A. L. Chapin, D. D., LL.D., President of Beloit College.....	45
2. The German Sunday. By Right Rev. W. E. Armitage, D. D., Protestant Episcopal Bishop of Wisconsin .....	62
3. Social Science and Woman Suffrage. By Rev. Charles Caverno, A. M....	72
4. The Common Jail System of the Country. By Hon. S. D. Hastings, Secretary of the State Board of Charities.....	90
DEPARTMENT OF THE NATURAL SCIENCES.	
5. Deep Water Fauna of Lake Michigan. By P. R. Hoy, M. D.....	98
6. On the Classification of Plants. By I. A. Lapham, LL.D.....	102
7. Insects Injurious to Agriculture—Aphides. By P. R. Hoy, M. D.....	110
8. Coniferæ of the Rocky Mountains and their Adaptation to the Soil and Climate of Wisconsin. By J. G. Knapp, Esq.....	117
9. Report on the Geology of the Region about Devil's Lake. By Professor Jas. H. Eaton, Ph.D .....	124
10. On the Age of the Quartzites, Schists and Conglomerates of Sauk County. By Professor Roland Irving, E. M.....	129
11. Suggestions as to a Basis for the Gradation of the Vertebrata. By Prof. T. C. Chamberlin.....	138
12. Ancient Lakes of Wisconsin. By J. G. Knapp, Esq.....	151
13. On the Mineral Well at Waterloo, Wis. By Rev. A. O. Wright, A. M....	154
14. On Potentials, [and their Application in Physical Science. By Prof. John E. Davies, M. D.....	155

DEPARTMENT OF THE ARTS, *and Letters*.

- |  |     |
|--|-----|
| 15. The Production of Sulphide of Mercury by a New Process, and its Use in Photography. By W. H. Sherman, Esq..... | 165 |
| 16. The Rural Population of England as Classified in Domesday Book. By Prof. William F. Allen, A. M.....           | 167 |
| 17. On the Place of the Indian Languages in the Study of Ethnology. By Prof. John B. Feuling, Ph. D.....           | 178 |

## IV.—PROCEEDINGS.

- |   |     |
|---|-----|
| 1. Proceedings of the Convention called to organize the Academy ..... | 183 |
| 2. First meeting of the Academy, February 16, 1870.....               | 185 |
| 3. First meeting the General Council .....                            | 186 |
| 4. Second meeting of the Academy, July 1870 .....                     | 186 |
| 5. Third meeting of the Academy, September, 1870 .....                | 188 |
| 6. First annual meeting of the Academy, February, 1871.....           | 190 |
| 7. Fifth meeting of the Academy, July 1871.....                       | 192 |
| 8. Sixth meeting of the Academy, September 1871,.....                 | 197 |
| 9. Second annual meeting of the Academy, February, 1871.....          | 197 |

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THE PRESIDENT OF THE STATE AGRICULTURAL SOCIETY.  
THE SECRETARY OF THE STATE AGRICULTURAL SOCIETY.



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\*Deceased.

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	Rev. A. O. Wright, New Lisbon.

## REPORT OF THE PRESIDENT.

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His Excellency, CADWALLADER C. WASHBURN,

*Governor of Wisconsin:*

SIR: In compliance with the law, I have the honor to submit the following report of the "financial and other transactions" of the Wisconsin Academy of Sciences, Arts and Letters, for the year ending February 13th, 1872. And inasmuch as circumstances prevented the delivery of the report of the previous year in time for its transmission to the last Legislature, it has been deemed proper to embody herein such important facts as are necessary to complete the public record of the Academy from the date of its organization.

### I.

#### MOTIVES IN WHICH THE ACADEMY ORIGINATED.

The Academy was organized on the 16th of February, 1870, by a Convention called for that purpose by the Governor and more than one hundred other prominent citizens of the State.

The general objects aimed at were these:

The material, intellectual and social advancement of the State;

The advancement of Science, Literature and the Arts.

1. On the part of the State, the reasons were as many as the number of the elements involved in both of these general objects. For while it was obvious that the advantageous geographical position of the State, the variety and vastness of its natural resources, and the character of its popula-

tion, both demanded and encouraged the employment of agencies calculated to rapidly advance it to a condition of material prosperity and power, it was no less demonstrable that true greatness could only be assured by the timely adoption and earnest use of measures looking to high intellectual and social development.

What then is the status of Wisconsin as a civilized State? was a question that demanded attention. And since the development of a people is illustrated and measured by its cultivation of Science and the application of it to the numberless uses of political, social and industrial life, as well as by its achievements in Literature and Art, it was a question that could be answered—a question, indeed, that *must* be answered, if new agencies for the advancement of the commonwealth were to be wisely planned and put into successful operation.

To the question, What has hitherto been done in the various departments of Science—that is, for Science and by means of it? the answers were these:

*In Philosophy*, which may be called the science of Science, and is the common, though unseen, source in which all the so-called sciences have their origin,—in Philosophy, distinctively considered, almost nothing, so far as had appeared to the public through the medium of any publication; unless, upon the one hand, by the application of established principles, to confirm past deductions, or, on the other, to supply facts for new generalizations. Indeed, we have learned of but a single important contribution to Philosophy made by a citizen of our State, and even that was a contribution to its literature rather than to Philosophy itself, to wit:

UPON THE PRESENT STAND-POINT OF PHILOSOPHY. By Dr. K. S. BAYRHOFFER, Ph. D., late of Green County, Wisconsin. Published by the *Philosophische Monatshefte* of Berlin, Germany, Vol. III., Nos. 4 and 5; Vol. IV., Nos. 4 and 5.

*In Jurisprudence*, barely so much as is represented by the organic and statute law of the Territory and State, and by the reports of judicial proceedings.

It was a just ground of pride and satisfaction that the decisions of the supreme court of Wisconsin had gained so high a reputation in the country at large, and that the jurists had won for themselves and the state so honorable a place in connection with American jurisprudence. But it was, nevertheless, a fact that hitherto no contribution had been made to the science and literature of this great department other than those contained in the catalogue of publications herewith presented, to wit:

Statutes of the Territory of Wisconsin. 1839 to 1848.

Revised Statutes of Wisconsin. 1849.

Revised Statutes of Wisconsin. 1858.

An Appendix to the Revised Statutes, from 1859 to 1867 inclusive, of the State of Wisconsin, in accordance with a Resolution of the Legislature. By D. A. Reed, Attorney-at-Law. Madison. 1868. 8vo. pp. 28.

The General and the Private and Local Laws since enacted and annually published.

A Digest of the Laws of Wisconsin from the year 1858 to the year 1868, both years inclusive; to which is added an Appendix, giving a List of all the Laws and Provisions of the Constitution passed upon by the Supreme Court. Compiled by E. A. Spencer, Counselor-at-law. Madison: Atwood & Rublee. 1868. One vol. 8vo. pp.

Laws of Wisconsin concerning the Organization and Government of Towns, and the Powers and duties of Town Officers and Boards of Supervisors, with numerous Practical Forms. By Elijah M. Hains. Chicago: Wm. B. Keene & Co. 1858. One vol. 8vo. pp.

Reports of the Supreme Court of the Territory of Wisconsin for 1842 and 1843. Reported by T. P. Burnett. Madison: Geo. Hyer. 1844. One vol. 8vo.

Reports of Cases Argued and Determined in the Supreme Court of the State of Wisconsin. By Daniel H. Chandler. Milwaukee: Sentinel Press. 1854. Four vols. 8vo. (1849 to 1851 inclusive.)

Reports of the Cases Argued and Determined in the Supreme Court of Wisconsin. With Tables of the Cases and Principle Matters. Vols. 1 to 11, by Hon. A. D. Smith; vols. 12 to 15, by P. L. Spooner, Esq.; vols. 16 to 24, by O. M. Conover, Esq. 1853 to 1870.

A Complete Digest of the Decisions of the Supreme Court of the State of Wisconsin, in Law and Equity, from its organization down to and including the Cases reported in vol. xiv of the Wisconsin Reports. By Wm. E. Sheffield, Counselor-at-Law. Chicago: E. B. Myers & Co. 1865. One vol. 8vo.

A Digest of Wisconsin Reports, from the Earliest Period to the year 1868; comprising all the Published Decisions of the Supreme Court of Wisconsin presented in Burnett's, Chandler's and twenty volumes of the Wisconsin Reports, with References to the Statutes. By James Simmons, Counselor-at-Law. Albany: William Gould & Son. 1868. One vol. 8vo.

Argument in the U. S. Supreme Court, in the matter of *ex-parte*, Wm. H. McCardle, Appellant. By Hon. Matt. H. Carpenter. 1868.

*In the Science of Politics*, so much had been done, and such contributions had been made, as appeared from the legislative journals, the executive messages, the proceedings of political conventions, the discussions and reports of discussions contained in the public journals, and the few political speeches which had been published in pamphlet form, namely:

Speech on the Fugitive Slave bill, delivered in the United States Senate, August 6, 1852, by Hon. Charles H. Durkee.

Speech on the Lecompton Constitution, delivered in the United States Senate, March 20, 1858, by Hon. Charles H. Durkee.

The Calhoun Rebellion; its basis. Speech of the Hon. J. R. Doolittle in the United States Senate, December 14, 1859.

State Rights. A speech delivered in Madison in 1860, by Hon. Abram D. Smith.

The State and the National Governments; their Mutual Political Relations; a speech delivered at Madison in 1860, by Hon. Tim. O. Howe.

Are we a Nation? By J. M. Bundy, Esq., Beloit, 1860. Second edition of same, with an Historical Letter by Hon. Tim. O. Howe. New York, 1869.

On approving certain acts of the President. Speech of Hon. Tim O. Howe in the United States Senate, August 2, 1861.

African Colozination. Speech of Hon. J. R. Doolittle in the United States Senate, April 11, 1862.

On the Conduct of the War. Letter of D. H. Waldo to Gov. Edward Salomon. Milwaukee, 1862.

On the Amendment to the Constitution. Speech of Hon. Tim O. Howe in the United States Senate, April 4, 1864.

- On Reconstruction: being a Review of a Speech made by Hon. J. R. Doolittle at Madison in 1865. By John Y. Smith, Esq., Madison, 1865.
- Reconstruction. Speech of Hon. J. R. Doolittle in the United States Senate, January 17, 1866.
- On a Military Despotism. Speech of Hon. J. R. Doolittle in the United States Senate. 1866.
- Reconstruction. Speech of Hon. H. E. Paine in the United States House of Representatives.
- Reconstruction and Equal Suffrage. Speech of Hon. M. H. Carpenter, delivered in the Music Hall at Milwaukee, October 4, 1866. Milwaukee. 8vo.
- The Legal Consequences of the Rebellion. Speech of O. H. Waldo, Esq., made at Racine in 1866.
- Confiscation. Speech of Hon. C. A. Eldridge in House of Representatives, December 10, 1867.
- Reconstruction. Speeches of Hon. Tim. O. Howe in the United States Senate, January 10, 1866, June 5, 1866, January 31, 1868.
- On the impeachment of the President. Speech by Hon. Tim. O. Howe in the United States Senate.
- On the Claims of Loyal Citizens living in the South during the Rebellion. Speech of Hon. Tim. O. Howe in the United States Senate, January 14 and 15, 1869.
- State Rights and the Appellate jurisdiction of the Supreme Court of the United States: A Constitutional Argument. By a member of the Rock County Bar. Beloit: *Journal and Courier* print, 1869. 8vo.
- The Mission and Future Policy of the United States. Address at the Dedication of Memorial Hall, Beloit College, July, 1869. By Hon. Matt. H. Carpenter.
- Neutrality between Spain and Cuba. Speech of Hon. Matt. H. Carpenter in the United States Senate, December 15, 1869.
- The Laws of Neutrality. Speech of the Hon. Tim. O. Howe in the United States Senate, February 2, 1870.

*In Social Science*, so much of Political Economy as was found in the executive messages, the legislative discussions and enactments, the annual reports of the State departments and industrial societies, of the boards of trade, and in the proceedings of conventions held in the interest of the various industries and of public improvements looking to our commercial supremacy; so much of Educational Science and Social Economy as was shown by our schools, libraries, charitable,



reformatory and penal institutions, by the statute law of the State, and by the documents, journals, and other publications mentioned below :

POLITICAL AND SOCIAL ECONOMY.

- Depreciation of the Currency: a short essay on the Financial Condition and Prospects of the Country. By John Y. Smith, Esq. Madison. 8vo, pp. 14.
- The Practical Development of the Resources of Science in relation to Agriculture and the Health and Habitations of the People. Dr. D. B. Reid, LL. D., F. R. S. E. 8vo, pp. 20. See also Trans. Wis. State Agr., vol. vi., 1860.
- The Position, Value, and Duties of the Agriculturist in the Economy of Society. An address by J. H. Lathrop, LL. D. 16mo, pp. 34. 1851. See also Trans. Wis. St. Agr. Soc., vol. i., 1851.
- The Farmer and the Manufacturer. Address by E. B. Ward, Esq., before State Agr. Soc. 8vo, pp. 20. 1868. See also Trans. Wis. State Agr. Soc., vol. viii., 1869.
- The Growth of Monopoly in the Carrying Business. An address by Hon. Matt. H. Carpenter, U. S. S. Milwaukee: Sentinel Print. 8vo, pp. 20. 1869. See also Trans. Wis. St. Ag. Soc., vol. viii., 1869.
- On Banks and Railroad Bonds. By Hon. Moses M. Strong. Milwaukee Sentinel Print. 185-. 8vo, pp. 21.
- On the Public Debt. Speech of Hon. Tim. O. Howe in the U. S. Senate, Feb. 12, 1862.
- National Currency. Speech of Hon. Tim. O. Howe in the U. S. Senate, Jan. 24, 1870.
- On the Purchase of Russian America. Speech of Hon. C. C. Washburn in the H. of R., Dec. 11, 1867.
- On the Postal Telegraph. Speech of Hon. C. C. Washburn in the H. of R., Dec. 23, 1869.
- The Iron Interests of America. Address of Hon. Tim. O. Howe before the American Iron Association, at Chicago, May 24, 1865.
- Banks and Banking. 8vo, pp. 6.
- Annual Reports of the State Treasurer of Wisconsin. 1848 to 1870.
- Annual Reports of the State Agricultural Society. 1851 to 1870.
- Annual Reports of the Milwaukee Chamber of Commerce. 1857 to 1870.
- Report on the Improvement of Rock River; submitted by a Committee authorized by the Legislature. Adopted by Legislature of 1867. Janesville. 1867. 8vo.
- Proceedings of the Wisconsin and Fox Rivers Improvement Convention, held at Prairie du Chien, November 10, 1868, and at Portage City, Octo-

ber 1869; with a Memorial to Congress. Prepared for publication under the direction of Lucius Fairchild, Governor of Wisconsin. Madison. Atwood & Culver. 1870. With maps. 8vo, pp. 88.

## EDUCATION AND SOCIAL ECONOMY.

Universal Education necessary to the Stability of Republican Institutions. Address by Hon. Tim O. Howe before Wisconsin State Teachers' Association in 1865. Madison. 8vo, pp. 20.

The Claims of the Natural Sciences to Enlarged Consideration in our Systems of Education. Inaugural Address by Dr. E. S. Carr, M. D., Wisconsin State University. 1856.

University Progress: a Paper presented to the National Teachers' Association at Trenton, New Jersey, in 1869. Part I. The University of the Past. II. The University of the Present. III. The University of the Future. By John W. Hoyt, A. M., M. D., President Wisconsin Academy of Sciences, Arts and Letters. New York. D. Appleton & Co. 8vo, pp. 88.

Education in Europe and America: Being a Report to the Government of the United States in connection with the Paris Universal Exposition of 1867. By John W. Hoyt, United States Commissioner. Washington. Government Printing Office. 8vo, pp. 398.

Annual Reports of the State Superintendent of Public Instruction. 1848 to 1870.

Annual Reports of the Regents' of the University of Wisconsin. 1849 to 1870.

Annual Reports of the State Board of Normal School Regents. 1857 to 1870.

Annual Reports of the Trustees of the State Institution for the Education of the Blind. 1850 to 1870.

Annual Reports of the Board of Trustees of the Wisconsin Institute for the Deaf and Dumb. 1852 to 1870.

Annual Reports of the Board of Management of the Soldiers' Orphans' Home, 1866 to 1870.

Annual Reports of the Board of Managers of the Wisconsin State Industrial School for Boys. 1859 to 1870.

Annual Reports of the State Prison Commissioners. 1852 to 1870.

Annual Reports of Board of Trustees of the State Hospital for the Insane, 1860 to 1870.

The annual publications of the colleges, seminaries, academies and local boards of education.

The published Proceedings of the Wisconsin State Teachers's Association. 1852 to 1870.

The Wisconsin Journal of Education. Published and edited successively by Geo. S. Dodge, Janesville; John G. McMynn, Racine; A. J. Craig and John B. Pradt, Madison, from 1856 to 1864; by Williams & Peck, Mineral Point, from 1866 to 1869.

The School Monthly. By Milwaukee Teachers' Association. 1869.

*In Journalism*, which might properly enough be considered under the head of Social Science, Wisconsin had reached a position which at once evidenced the general intelligence of her population and reflected credit upon her journalists; for the total number of newspapers and other periodicals was no less than 174,—of which 6 were monthly, 1 semi-monthly, 14 daily and weekly, and 153 weekly,—and for creditable appearance, editorial ability and extent of circulation, they compared favorably with the like publications of any state in the union.

It is also worthy of note that Wisconsin was one of, if not the, first of the states to form an editorial association (organized in 1857,) and that the same has had a career of uninterrupted prosperity and usefulness; holding annual meetings and publishing fourteen volumes of its proceedings.

A list of the newspapers and other periodical publications regularly issued at the date of January, 1870, will be found in the Legislative Manual for that year.

*In the Natural Sciences* more had been accomplished than at first appeared; but unhappily for our State, comparatively little of it could be credited to Wisconsin; and even this had been chiefly the work of a few private citizens devoted to scientific pursuits, such as Dr. I. A. Lapham, LL. D., and Dr. P. R. Hoy, M. D., who without other reward than the satisfaction of having done the public a great service, have continued their scientific labors without intermission even from early territorial times down to the present hour. Moreover, the work actually done, whether by citizens, the State, or the United States, had been almost wholly confined to geodetic, topographical, nautical and natural history surveys.

The State had four times in quick succession legally recognized the importance of a geological survey by the appointment of a geologist, or a commission of geologists, to perform that service—once in 1853, by the appointment of Edward Daniels; once in 1854, by the appointment of Jas. G. Percival to succeed Mr. Daniels; again in 1857, by the reappointment of Mr. Daniels, upon the death of Dr. Percival; and yet again by the appointment of a Geological Commission consisting of James Hall of New York, and Edward Daniels and E. S. Carr of Wisconsin, in 1858. Nevertheless, except in the Lead Region, to which considerable special attention had been given by the several state geologists, but little more than general or preliminary work had been accomplished up to 1861, when the law instituting the survey was repealed.

In Pure Mathematics, and in Physics, including Astronomy, nothing of importance could be claimed by us. What had actually been accomplished, both by us and for us, in the departments of scientific investigation first above named, up to the date of which we are now speaking (1870), will appear on reference to the following quite complete catalogues of the books, journals and charts embracing the results of such labor:\*

IN DESCRIPTIVE GEOGRAPHY, GEOLOGY, TYPOGRAPHY AND HYDROGRAPHY.

Report and Map of a visit to the Northwestern Indians in 1833. By Lieut.

J. Allen and H. R. Schoolcraft. Executive Document. 1833-4. No. 323. Washington. 8vo.

Notes on Wisconsin Territory—Iowa Land District. By Albert M. Lea. Philadelphia. 1836. 12mo, pp. 53.

Observations on the Wisconsin Territory: Chiefly on that part called "The Wisconsin Land District," with a Map of the settled part of the Territory, as laid off by Counties by act of the Legislature of 1837. Philadelphia. 1838. 12mo, pp. 134.

\*The author of this report has pleasure in stating that for the material of this and the subsequent bibliographical enumerations he is largely indebted to that efficient and conscientious public officer, Mr. Daniel S. Durrie, Librarian of the Wisconsin State Historical Society, and Member of the Academy, whose Bibliography of Wisconsin, being now quite complete, should somehow be published at an early day. For the perfection of his cartology, he acknowledges his indebtedness to Dr. I. A. Lapham.

- A Condensed Geography (and History) of the Western States, or the Mississippi Valley. Cincinnati. 1828. 2 vols. 8vo.
- Boundary, Township and Sectional Surveys. Land Office Reports. 1833-41-44-48.
- Map of Wisconsin Territory; Compiled from the Public Surveys. By Capt. T. J. Crane. Senate Document. No 140. 1st Session 26th Congress. 1838.
- Reports of Surveys of the Mouths of Milwaukee, Root, Manitowoc, Sheboygan and Kewaunee Rivers. By J. M. Berrien. Senate Document. No. 175. 25th Congress, 2d Session. February, 1838. With Maps.
- Report on the Improvement of Fox, Wisconsin and Rock Rivers. By Capt. T. J. Cram. Senate Document. No. 318. 26th Congress, 1st Session. March, 1840.
- Report relative to Internal Improvements in Wisconsin. By Capt. T. J. Cram. Senate Document, No. 140, 26th Congress, 1st Session. January, 1840. With Map of the State.
- Report on the Survey of the Boundary between Wisconsin and Michigan, with Maps. By Capt. T. J. Cram. Senate Document, No. 151, 26th Congress, 2d Session. February, 1841. Also Senate Document, No. 170, 27th Congress, 2d Session. March, 1842. See, also, Vinton on "the Northeast Boundary of Wisconsin," in Collections State Historical Society, Vol. 4, pp. 350, *et seq.*
- Report of the Survey of Green Bay. By Capt. Wm. G. Williams. See Executive Document No. 170, 1st Session 29th Congress. 1846.
- Report intended to Illustrate a Map of the Hydrographical Basin of the Upper Mississippi, made by I. N. Nicollet while in the employ of the Bureau of the Corps of Topographical Engineers, January 11, 1845. Washington. 1845. 8vo, pp. 170.
- Elevations in Wisconsin. By I. A. Lapham. See Silliman's American Journal of Science, Vol. 46, (1844), pp. 258.
- On the Public Land Surveys and the Latitude and Longitude of places in Wisconsin. By I. A. Lapham. See Collections State Historical Society of Wisconsin, Vol. 4, pp. 359 *et seq.*
- Land Office Report. 1845. Maps of surveys of Mineral Lands adjacent to Lake Superior. By Gen. John Stockton. Report of 1845.
- Report to the Secretary of War of Explorations and Surveys of the Mineral District of Lake Superior. By A. B. Gray. Washington. 1846. 8vo, pp. 23.
- Survey of the Upper Mississippi River: Report of Gen. G. K. Warren, to the Sec. of War, of the Surveys of the Upper Mississippi and its Tributaries. Senate Doc., 2d Sess., 39th Congress, Lib. 15, 1867. 8vo, pp. 116. Also his Report for the year ending June 30, 1867, in Appendix, "D," Ex, Doc. No. 1, House of Rep., 40th Congress, 2d Sess. 8vo, pp.

6. Also his Report for the year ending June 30, 1868, in Appendix G, Ex. Doc. 1, Part 2, House of Rep., 40th Congress, 3d Sess., Aug., 1868. 8vo, pp. 86.
- Geographical and Topographical Description of Wisconsin, with brief Sketches of its History, Geology, etc. By I. A. Lapham. Milwaukee. 1844. 12mo, pp. 255. Also 2d Ed. greatly improved, with Map. Milwaukee. 1846. 8vo, pp. 208.
- Report to the War Department of the Surveys, Commerce and Improvements of the Harbors of Wisconsin, Illinois, Michigan and Indiana. By Lieut. Col. Jas. D. Graham, U. S. A. Washington. 1856. 8vo, pp. 480.
- Surveys of Sheboygan and Manitowoc Harbors (charts). By Lt. Col. J. D. Graham, U. S. A. 1856.
- Chart of West End of Lake Superior, St. Louis River, etc. Lake Survey Report. 1861.
- Map of the Territories of Michigan and Ouisconsin. By John Farmer. Detroit. 1836.
- Map of the Surveyed Part of Wisconsin Territory. Compiled from pub. surveys. By S. Morrison, D. Dwelle and J. Hathaway, Jr. 1837.
- Map of the Northern Part of Illinois and the Surveyed Portion of Wisconsin Territory. New York. 1836.
- Sectional Map of Wisconsin. By I. A. Lapham. Milwaukee, 1846, 1847.
- Map of Wisconsin, with Recent Surveys. By L. Chapman. Milwaukee. 1857. Subsequent Editions.
- Map of the Copper Region of Lake Superior, embracing Michigan and Wisconsin. By J. Farmer. 1858.
- Map of Wisconsin, prepared for Legislative Manual. By I. A. Lapham. 1865.
- Map showing the Position of the Reef near Racine Harbor. By S. Farmer. 1837. The same, smaller. 1838.
- Township Map of Wisconsin. By S. Farmer. 1837. The same, reduced. 1868.

COUNTY MAPS OF THE FOLLOWING COUNTIES.

- Winnebago. By I. H. Osburn. 1855.
- Milwaukee, Waukesha, Racine, Kenosha and part of Walworth.  
By S. Chapman.
- Dane. By A. Menzes and A. Ligowski. 1858.
- Milwaukee. By Louis Lipman. 1858.
- Milwaukee. By H. F. Walling. 1858.
- Waukesha. By H. F. Walling. 1859.
- Dodge. By ———— 1860.
- Racine. By Redding and Watson. 1860.

- Kenosha. H. F. Walling, 1861.  
 Green. By J. T. Dodge. 1861.  
 Sauk. By W. H. Canfield. 1861.  
 Columbia. By A. Legonski & C. Wasmund. 1861.  
 Sheboygan, By Randall & Palmer. 1862.  
 Jefferson. By H. Steeger.  
 Grant. By J. T. Dodge. 1863.  
 Grant. By Gray & Pettengill. 1868.  
 Milwaukee County and City. By Silas Chapman & S. Crampton.  
 1869.

IN PHYSICAL GEOGRAPHY.

- On Supposed Tides on the Lakes, with Observations at Green Bay. By Maj. Henry Whiting. *See Silliman's American Journal of Science*, Vol. xx, pp. 205. 1831.
- Indian Summers at Fort Winnebago, etc. *See Silliman's Journal of Science*, Vol. 30, 1836, pp. 8.
- On the Tides of the North American Lakes, with Observations at Green Bay. By D. Ruggles. *See Silliman's American Journal of Science*, Vol. xlv., pp. 18, 1843.
- Lake Superior: Its Physical Character, etc. By Lous Agassiz. Boston. 1850. 8vo, pp. 428.
- The Fluctuations of the Water Level at Green Bay. By Col. Chas. Whitteley. *See Silliman's American Journal of Science*, May No., 1859, pp. 8.
- Some of the Supposed Causes of the Peculiar Climate of Wisconsin. Illustrated by a Chart of the State. By J. W. Hoyt. *See Transactions Wisconsin State Agricultural Society*, Vol. vi, 1860. Republished in pamphlet by the State.
- Map of Wisconsin, with lines showing the Remarkable Effect of Lake Michigan in Elevating the Temperature of January and Depressing that of July. By I. A. Lapham. 1865. Republished in *Transactions of Chicago Academy of Sciences*, Vol. i, Plate x. 1865.
- Remarks on the Climate of the Country bordering on the Great Lakes. By I. A. Lapham. *See Transactions Chicago Academy of Sciences*, Vol. i, p. 58. With Map. 1867.
- Certain Physical Features of the Upper Mississippi River. By Gen. G. K. Warren. *See Proceedings of American Association for the Advancement of Science*. 1868.
- The Mississippi Valley: Its Physical Geography; With Sketches of Topography, etc. By J. W. Foster. Chicago: S. C. Griggs & Co. 1869. 8vo.
- Reports of Meterological Observations. *See Army Meterological Register*,

1826-1854. 4to and 8vo. Also Transactions Wisconsin State Agricultural Society, 1851 to 1859. Also Patent Office Reports, 1849 to 1861. Also Reports of Commissioners of Agriculture, 1863 to 1872.

Report on the Disastrous Effects of the Destruction of Forest Trees in the State of Wisconsin. By J. G. Knapp, I. A. Lapham and Hans Crocker, State Commissioners for that purpose. Madison. 1867, pp. 104.

## IN GEOLOGY:

The Wisconsin and Missouri Lead Regions. By James T. Hodge. See American Journal of Science. Vol. 13, pp. 35 to 72. 8vo.

Report on Copper Mines of Montreal River. By James T. Hodge. 8vo. pp. 19.

Report of a Geological Reconnaissance made in 1835 from the seat of Government, by way of Green Bay and the Wisconsin Territory to the Couteau de Prairie. By Geo. W. Featherstonhaugh. Washington. 1836. 8vo, pp. 168.

Geology of the Region about Fort Winnebago. By D. Ruggles. See Silliman's American Journal of Science. Vol. 30, part 1. With Figures. 1836.

On the Mining Country in Wisconsin. By J. P. Sheldon. See Senate Documents, 25th Congress, 2d session. No. 411. May, 1838.

Report of a Geological Exploration of the Mineral Lands of Iowa, Wisconsin and Northern Illinois. With maps, plates, etc. By David Dale Owen, United States Geologist. Washington. 1840. 8vo. pp. 161. Includes Report of John Lock on Geological Magnetism and Antiquities of Lead Region of Wisconsin, pp. 116.

Fossils from Wisconsin, etc. By Alex. Winchell. See Silliman's American Journal of Science. Part 2. Vol. 37. pp. 226.

Observations on the Lead-bearing Limestone of Wisconsin, and Description of Fossils. By T. A. Conrad. See Proceedings Academy of Natural Sciences. Philadelphia. Vol. 1. 1843. pp. 329.

Report Relative to the Lead Mines. By Lieut. Col. G. Talcott. See House Documents, No. 152. 27th Congress, 3d session. February, 1843. Also another Report on same subject. House Documents, 28th Congress. pp. 28.

Report of the Ordnance Bureau on the Mineral Lands of the Upper Mississippi. Washington. 1844. 8vo, pp. 52.

Report to the Secretary of War relative to the Copper Mineral of Lake Superior. By Walter Cunningham. Washington. 1845. 8vo. pp. 8.

Report of the Secretary of War on the Condition and Government of the Mineral Lands on Lake Superior, with maps. By John Stockton. Washington. 1845. 8vo, pp. 22.



- A Canoe Voyage up the Minnaw Sator; with an account of the Lead and Copper Deposits of Wisconsin, etc. By G. W. Featherstonhaugh. London. 1847. 2 vols. Eighty maps and plates.
- On the Lacustrine Deposits in the vicinity of the Great Lakes. By I. A. Lapham. See Silliman's Amer. Jour. of Science, 1847, pp. 90, with figures.
- Report of a Geological Reconnoissance of the Chippewa Land District of Wisconsin; with a portion of the Kickapoo Country of Iowa and Minnesota. Numerous plates. By David Dale Owen. Washington. 1848. 8vo, pp.134.
- Report on the Geology of Wisconsin. By J. G. Norwood. See Ex. Doc. No. 57, 1st Sess. 30th Congress. 1848. pp. 73-129. Washington. 8vo.
- Report on the Geology of Wisconsin. By J. G. Norwood. See Executive Doc. No. 57, 1st Sess. 30th Congress. 1848. pp. 73-129. Washington. 8vo.
- The Geological Formations of Wisconsin. By I. A. Lapham. See Transactions of Wis. State Ag. Soc. Vol. 2. 1857. Page 122 *et seq.*
- On the mineral Regions of Lake Superior. By F. C. Koch, Gottingen. 1851. 8vo.
- Report of a Geological Survey of Wisconsin, Iowa and Minnesota and a portion of Nebraska, with 72 wood cuts, 27 steel plates and 18 maps. By David Dale Owen. Philadelphia. 1852. 4to., pp. 638.
- On the Geology of the south-east portion of Wisconsin not heretofore surveyed. By I. A. Lapham. See Foster and Whitney's Report on the Geology of the Lake Superior Land District. Part 2d, p. 167 *et seq.* Washington. 1851.
- Annual Report (first State Report) on the Geology of Wisconsin. By Edward Daniels, State Geologist. See Executive Messages and Documents of 1845. Doc. "H." 8vo, pp. 84.
- First and Second Annual Reports of the Geological Survey of Wisconsin. By James G. Percival, State Geologist; (being for the years 1855 and 1856), with map. See Executive Messages and Documents of those years. pp. 101 and 111.
- Report on the Iron Region of Dodge and Washington counties, with Maps. By Jas. G. Percival. Milwaukee. 1855. 8vo, pp. 9.
- A Geological Map of Wisconsin. By I. A. Lapham. 1855.
- Second Report of Edward Daniels on the Geology of Wisconsin; (being for the year 1857). See Executive Message and Documents. Doc. "P." 1857.
- Preliminary Report on behalf of the State Commission of Wisconsin. By James Hall. Executive Message and Documents. 1858.
- Report of Progress on behalf of the Geological Commission of Wisconsin. By James Hall. Executive Message and Documents. 1859.

- Report of the Superintendent of Geological Survey of Wisconsin. By James Hall. January 1, 1861. Executive Message and Documents. 1861. 8vo, pp. 52. (Descriptive of Fossils.)
- Report of the Geological Survey of Wisconsin. By James Hall, Superintendent; (covering Report of J. D. Whitney on "the Lead Region.") Vol. 1. Royal 8vo, pp. 466. With Plates and Maps. Albany. 1862.
- The Penokee Iron Ridge, with Map. By I. A. Lapham. See Transactions Wisconsin State Agricultural Society. Vol. v. 1858-9. pp. 391 *et seq.*
- Descriptions of New Species of Fossils from the Northwestern States. By I. H. McChessney. Chicago. 1859. Royal 8vo. pp. 154. With Plates.
- Wisconsin Building Stones and Marbles. By Edward Daniels. See Transactions Wisconsin State Agricultural Society. Vol. vi. 1860. pp. 299 *et seq.*
- On the Drift Cavities or Potash Kettles of Wisconsin. By Col. Chas. Whittlesey. See Proceedings American Association for Advancement of Science. Vol. 13, pp. 297. Springfield. 1860. Also, by same author, Origin of the Azoic Rocks of Wisconsin and Michigan. pp. 301.
- Notice of New Potsdam Sandstone Fossils of Wisconsin and Missouri. By B. F. Sherward. See Transactions St. Louis Academy of Sciences, Vol. 2, 1862. pp. 101.
- Fauna of the Potsdam Sandstone. By Jas. Hall. See Annual Report of Regents of University of New York, 1863. pp. 119. With Plates and numerous Figures of Wisconsin Fossils.
- Iron Ridge Mines, Wisconsin. Milwaukee. 1863. 8vo, pp. 16.
- Description of Fossils of the Niagara Group. By James Hall. See 20th Annual Report of Regents of University of New York. pp. 308. Plates and Figures of Wisconsin Fossils.
- The Penokie Mineral Range, Wisconsin. By Chas. Whittlesey. See Proceedings of Boston Natural History Society, July 1863. pp. 10.
- Relations of Niagra Group. Recent Limestone. By James Hall. See Annual Report of Regents University of New York. 8vo. pamphlet, printed in advance. pp. 48.
- Report of the Bladder Rock Iron Property, Ashland county. By Chas. Whittlesey. 8vo, pp. 9. 1865.
- Report on the Montreal River Copper Location, Ashland county. By Chas. Whittlesey. 1865. 8vo, pp. 5.
- Report on the Marangoin Iron Property, Ashland county, with Map. By Chas. Whittlesey. 8vo, pp. 7. 1865.
- Account of the Copper Lands of Sections 15, 16 and 21, Town 45 north Range 2 west, Ashland county. By Chas. Whittlesey. 8vo. pp. 6. 1865.
- Fresh Water Glacial Drift of the Northwestern States. By Chas. Whittlesey. See Smithsonian Contributions. Vol. 15. 1866. pp. 32. Maps and Figures,

- Mineral Regions of Lake Superior as known from their earliest discoveries to 1865. By Henry M. Rice. *See* Collections of Minnesota State Historical Society. 1867, pp. 8-12.
- On the Mines of Wisconsin. By Edward Daniels. *See* Transactions of Wisconsin State Agricultural Society. Svo.
- Remarks on the Wisconsin Meteorite. By J. Lawrence Smith. *See* Silliman's American Journal of Sciences. Part. 2d. Vol. 47. March 1859, pp. 271.
- On the Western Boulder Drift. By E. Andrews. *See* Silliman's American Journal of Sciences. Part 2. Vol. 48. 1769. pp. 172.
- A new Geological Map of Wisconsin. Prepared from Original Observations, By I. A. Lapham. 1860. 15 miles to the inch.

## IN BOTANY.

- Catalogue of Plants found in the vicinity of Milwaukee. By I. A. Lapham. 1838. 12mo, pp. 23.
- On the Plants of Wisconsin. By I. A. Lapham. *See* Proceed. Amer. Ass'n for Advancement of Science, Vol. 2, 1850, p. 19. Also published in Trans. of Wis. State Ag. Soc., Vol. 2, 1852, pp. 375 *et seq.*
- Notes on the Woods of Wisconsin. By P. R. Hoy. *See* Trans. Wis. State Ag. Soc., Vol. 2, 1852, pp. 419 *et seq.*
- The Grasses of Wisconsin and the adjacent States. By I. A. Lapham. *See* Trans. Wis. State Ag. Soc., Vol. 3, pp. 397 *et seq.*
- The Forest Trees of Wisconsin. By I. A. Lapham. *See* Trans. Wis. State Ag. Soc., Vol. 4, pp. 195 *et seq.*
- Additions to the Flora of Wisconsin. *See* Trans. Wis. State Ag. Soc., Vol. V., 1858, pp. 417; also Vol. VI., 1860, pp. 258.
- Map of Wisconsin illustrating Distribution of Timber, etc. By J. W. Hoyt *See* Trans. Wis. State Ag. Soc., 1860.

## IN ZOOLOGY.

- Fauna of Wisconsin. By I. A. Lapham. *See* Trans. Wis. State Ag. Soc., Vol. 2, 1852, pp. 237 *et seq.*
- Notes on the Ornithology of Wisconsin. By P. R. Hoy. *See* Transactions State Agricultural Society, Vol. 2, 1852, p. 341; also the same, with additions, in Proceedings Academy Natural Sciences, Philadelphia, Vol. 6, pp. 304, 381, 425, 1854.
- Description of Minerals from Wisconsin. By P. R. Hoy. *See* Proceedings Academy Natural Sciences, Philadelphia, Vol. 6, p. 210, 1854.
- Quadrupeds of Illinois, Wisconsin, etc. By Robert Kennicott. *See* Patent Office Reports, 1856. pp. 52.
- The Sapsucker (*Picus varius* and *Picus pubescens*); with Illustrations. By Dr. P. R. Hoy. *See* Transactions Wisconsin State Agricultural Society, Vol. vi., 1860, pp. 243-249.

## IN MEDICINE.

Transactions of the Wisconsin State Medical Society, Vols. I and II, 1842 to 1869.

Reports of Superintendent of the State Hospital for the Insane. See Reports of Board of Trustees, 1866 to 1870.

*The Useful Arts* had been cultivated with considerable success. Agriculture had advanced with steady pace, until the improved lands had an area of nearly five-and-a-half-million acres, and a total valuation of more than three hundred million dollars. Horticulture had won many honors in its struggles with the adversities of climate. The inventive genius of our citizens had made valuable contributions to the mechanic arts. Manufactures had reached an aggregate annual production of more than eighty million dollars, and in some important classes gained a supremacy in the western markets. State and county societies were in successful operation, guiding and stimulating the industry of the state in its various departments. Books and lesser documents had been regularly issued by authority of the legislature, while periodical and occasional publications, looking to the same end, had made good record of individual enterprise, and sown the seed of future harvests, as will appear from the following catalogue of industrial publications:

Notes on Wisconsin Territory—Iowa Land District. By Albert M. Lea. Philadelphia. 1836. 12mo, pp. 53.

Observations on the Wisconsin Territory; chiefly on the part called the "Wisconsin Land District," with a map of the settled part of the Territory, as laid off by counties, by act of the Legislature of 1837. Philadelphia. 1838. 12mo, pp. 134.

A condensed Geography (and History) of the Western States, or the Mississippi Valley. Cincinnati. 1828. 2 vols. 8vo.

Valley of the Mississippi: or the Emigrant's and Traveler's Guide to the West. With maps. By R. B. Philadelphia. 1835. 12mo, pp. 572.

The Western Transit to Ohio, Michigan, Illinois, and Wisconsin, and the Territories of Wisconsin and Iowa. By J. Calvin Smith. New York. 1840. 12mo, pp. 180. With maps.

- Notes on the North-west or Valley of the Upper Mississippi. By J. A. Bradford. New York. 1846. Pp. 302.
- The Wisconsin Farmer; a monthly Magazine devoted to Agriculture, Horticulture, Mechanic Arts and Rural Economy. 18 vols. 8vo. 1848 to 1866, inclusive. Managed from 1848 to 1856 by Mark Miller; 1856 by Powers & Skinner; 1857 to 1860, by Powers, Skinner & Hoyt, 1860 to 1866 by Hoyt & Campbell; 1866 by W. B. Davis. Changed January, 1867 to a weekly folio, with title of Western Farmer; 1867 to 1870, by Morrow Brothers.
- Transactions of the Wisconsin State Agricultural Society. 8 vols., to wit: vol. 1, 1851; vol. 2, 1852; vol. 3, 1853; vol. 4, 1854-5-6-7; vol. 5, 1858-9; vol. 6, 1860; vol. 7, 1861-8; vol. 8, 1869, 8vo, pp. 500, each. Prepared by A. C. Ingham, D. J. Powers and J. W. Hoyt, successive Secretaries.
- Industrial Progress and Condition of Counties. Trans. Wis. State Ag. Society, vol. vi., 1860.
- The Emigrants' Hand Book and Guide to Wisconsin. By Samuel Freeman. Milwaukee. 1851. 8vo, pp. 147.
- Wisconsin: a paper prepared for the use of the State Immigration Agency. By J. H. Lathrop. Madison. 1852. 8vo, pp. 16.
- Industrial Resources of Wisconsin. By John Gregory, C. E. Chicago. 1853. 12mo, pp. 329.
- Wisconsin Gazetteer: containing the names, location and advantages of the counties, cities and towns, etc. By J. W. Hunt. Madison. 1853. 8vo, pp. 255.
- Wisconsin Almanac and Annual Register. By J. W. Hunt. Milwaukee. 1856. 8vo, pp. 96. 1857. 8vo, pp. 119.
- Hand Book of Wisconsin; or Guide to Travelers and Emigrants. By Silas Chapman.
- Northern Wisconsin; its Capacities and Wants. By Albert G. Ellis. *See* Transactions Wisconsin State Agricultural Society, Vol. 2, 1852, pp. 326; also Historical Society Collections, Vol. 3, pp. 135.
- Western Portraiture and Emigrants' Guide; a Description of Wisconsin, Illinois and Iowa; with remarks on Minnesota; with Map. By Daniel S. Curtis. New York. 1852. 12mo, pp. 180.
- Wisconsin and its Resources; with Lake Superior, its Commerce and Navigation; Map. By Jas. S. Ritchie. Philadelphia. 1857. 12mo, pp. 312.
- Wisconsin; its Natural Resources and Industrial Progress; with a Map showing the General Geology, Climatology and Distribution of Timber. By J. W. Hoyt. Reprinted from Transactions Wisconsin State Agricultural Society for 1860, by order of Legislature. Madison. 1862. 8vo, pp. 68.
- The Great West; or the Garden of the World; its History, Wealth and Advantages. By Chas. W. Dana. Boston. 1861. 12mo, pp. 396.

- Wisconsin; its Resources, Condition and Prospects. By A. F. Carman. See Hunt's Merchants' Magazine, Vol. 28, pp. 444-453.
- Wisconsin and its Resources. By Josiah Bond. See Hunt's Merchants' Magazine. Vol. 10, p. 541.
- Emigrants' Guide to the West. By C. F. J. Moller. Madison. 1865. 8vo, pp. 14. (In Danish.)
- Statistics—History, Climate and Productions of Wisconsin. Published by order of the Legislature. 8vo., pp. 32, with maps.
- Wisconsin and the International Exhibitions of 1862 and 1867. By J. W. Hoyt, State Commissioner. Madison. 1869. 8vo. pp. 100. Also published in Transactions Wisconsin State Agricultural Society. Vol. 8. 1861-8.
- Reports of Wisconsin Fruit Growers' Association. Organized in 1853. First reports in pamphlet form; from 1859-1865 inclusive. In Transactions Wisconsin State Agricultural Society.
- Reports of Wisconsin State Horticultural Society, 1865-1870. See Transactions Wisconsin State Agricultural Society.
- Proceedings of the Wisconsin Sugar-cane Growers' Convention. Madison. W J. Park, State Printer. 1864. 8vo.

*The Fine Arts* had received some attention, but had made little impression upon the life and character of the people. The practice in Architecture, both in the construction of private dwellings and buildings for public use, gave here, as elsewhere in our country, painful proof of a prevailing ignorance of the principles of the art. Painting had been favored with many votaries of considerable promise, but no effort had been made to bring them into any sort of relations of associated effort, and there was nowhere in the State, even the beginning of what could be called an Art Gallery. Sculpture had been attempted by but two of our citizens, so far as we are aware, both of whom, however, were artists of high promise, and one of whom—Miss Vinnie Ream, a native of Madison—had already commanded the attention and confidence of the National Government and won for her name a more than national distinction.

*In Letters*, the product of our labor, though interesting, and in some cases of very superior quality, did not aggregate much

in amount outside of History. Even in this important branch, although a history of the State had been published, and important researches were steadily progressing under the direction of Hon. Lyman C. Draper, the accomplished and indefatigable Corresponding Secretary of the State Historical Society, comparatively little had yet been accomplished beyond the collection of material—an important work, to which the Historical Society has devoted itself with so much zeal and with such signal success that its library and collections fairly entitle it to rank second among the historical societies of the United States. So that the facts of Wisconsin history then accessible to the student, in printed form, must be sought for in a great number of works, of which, however, the somewhat extended catalogue herewith presented is believed to be very nearly, if not quite complete:

## IN LANGUAGE.

- Manual Latin Grammar. By Wm. F. Allen, A. M., and Joseph H. Allen. Boston: Edwin Glinn & Co. 1868. 12mo. [Also contained in foregoing catalogue of Educational Works.]
- A Latin Reader; with Copious Notes and Vocabulary. By same authors and publishers. [Also found in list of Educational Works.]
- The First Six Books of the *Aeneid*. Translation and Notes by F. S. Searing, A. M., Professor of Ancient Languages, Milton College.
- Phocylidis Poema Adminitorium. *Recognovit Brevibusque Notis Instruxit.* J. B. Feuling, Ph.D., A. O. S. S., Professor Philologiæ Compar in Universitate Wisconsinensi. Editio Prima Americana. Andoveri: W. F. Draperi. 1869. 8vo.

## HISTORY—ANTIQUITIES.

- Description of Ancient Remains, Animal Mounds, and Embankments, principally in the counties of Grant, Iowa and Richland in Wisconsin Territory. By Stephen Taylor. See Silliman's Amer. Journ. of Science, xlv., 21-41.
- Indian Mounds, etc. By Richard E. Taylor. See Silliman's Am. Jour., vol. xxx. Also Squier & Davis' Ancient Monuments, pp. 124 *et seq.*
- Observations on the Aboriginal Monuments of the Mississippi Valley. By Edward G. Squier. New York. 1847. 8vo.
- Ancient Monuments of the Mississippi Valley: comprising the result of Extensive Original Surveys by Edward G. Squier and E. H. Davis, with

numerous engravings. Vol. i. Smithsonian Contributions. Washington. 1848. 4to.

Ancient Mounds or Tumuli in Crawford County, Wis. By Rev. Alfred Brunson. *See* *Histor. Soc. Collec.*, Vol. 3, pp. 178.

The Antiquities of Wisconsin surveyed and described on behalf of the American Antiquarian Society, with drawings, maps, etc. By I. A. Lapham. Washington. 1855. 4to, pp. 95.

Traditions of De-coo-dah and Antiquarian Researches: comprising extensive explorations, surveys and excavations of the Earthen Remains of the Mound Builders of America. By William Pidgeon. New York. 1858. 8vo.

## EARLY EXPLORATIONS AND TRAVELS.

Voyage et Découverte de quelques Pays et Nations de l'Amérique Septentrionale en 1673, par le Père Jacques Marquette. Paris. 1681. 12mo.

Description de la Louisiane nouvellement découverte à Sud-ouest de la Nouvelle France, avec le carte du Pays, les moeurs et la Manière de vivre des sauvages. By Louis Hennepin. Paris. 1683. 1688; Amsterdam. 1680. 12mo.

Nouvelle Description d'un très grand Pays situé dans l'Amérique entre le nouveau Mexique et la mer Glaciale, depuis 1670 jusqu'au 1682; avec des reflexions sur les enterprises de M. Carvalier de la salle, et autres choses concernant la description de l'Amérique Septentrionale. Utrecht. 1687. Amsterdam. 1688. 1711. 1720. 12mo.

English edition of the above London. 1698. 12vo.

New Voyages to North America; containing an account of the several nations of this vast continent; their customs, commerce and navigation on the lakes; the attempts of the English and French to dispossess one another; and the various adventures between the French and the Iroquois confederates in England. Containing also a geographical description of Canada, etc.; to which is added a Dictionary of the Algonkine Language; with twenty three maps and cuts. Written in French by the Baron La Houton; done into English. London. 1703. 2 vols. 8vo. La Haye. 1703. 2 vols. 12vo. La Haye. 1715. 2 vols. 12vo.

Relations of the Jesuits: Contenant ce qui s'est passé de plus remarquables dans les missions des pères de la campagne de Jesus dans La Monville France. Ouvrage publié sans les auspices du Gouvernement. 1611-1672. Quebec. 1858. 3 vols. 8vo.

Voyage dans le Canada, et son naufrage en revenant en France. Par le père Emanuel Crespel. Frankfort. 1742-1752. Amsterdam. 1757. 12vo. and 18vo. Republished in English at London. 1797. 12vo.



- Quotations from, in Smith's History of Wisconsin. Vol. 1. pp. 339. (Crespel's visit to Green Bay in 1728.)
- Historical Journal of the establishment of the French in Louisiana. By Bérard de La Harpe. See French's Historical Collections Louisiana. Vol. 3. Also Smith's History of Wisconsin, vol. 1, pp. 321. (Le Sueur's visit to Green Bay and voyage up the Mississippi in 1693 and 1700.)
- Discovery and Exploration of the Mississippi Valley; with the original Narratives of Marquette, Alloues, Membré, Hennepin and Anastase Donay, with a fac simile of the newly discovered Map of Marquette. By John Gilman Shea, LL. D. New York. 1852, 1853. 8vo, pp. 268.
- Histoire et Description Generale de la Nouvelle France, avec le Journal Historique d'un Voyage fait dans l'Amerique Septentrionale. P. Fr. X. de Charlevoix. Paris. 1744. 6 vols. 12mo. 1744. 3 vols. 4to.
- The same translated, with notes by John Gilman Shea. New York. 1866-70. 4 vols. 8vo.
- History of the Conspiracy of Pontiac, and the war of the North American Tribes against the English Colonies after the Conquest of Canada. By Francis Parkman, Jr. Boston. 1851. 8vo. New York. 1853. 8vo.
- Diary of the Siege of Detroit in the War with Pontiac. Albany. 1860. 4to.
- New York Colonial Documents, published by order of the Legislature. Albany. 1855-1858. 10 vols. 4to. (Early History of Green Bay, etc.)
- History of Louisiana or the western part of Virginia and Carolina, with Descriptions of both sides of the Mississippi River. By Le Page du Pratz. London. 1763. 2 vols. 12mo.
- Journal of a Voyage to North America, undertaken by an order of the French King; containing a Description of Canada, Address to the Dutchess of Lesdiguieres. By P. Fr. X. Charle-Voix. London. 1761, 1763. 2 vols. 8vo. See also French's Historical Collections of Louisiana. Vol. 3.
- History of the War between the United States and the Sacs and Fox nations of Indians in the years 1827, 1831 and 1832. By John A. Wakefield, Jacksonville, Ills. 1834. 12mo, pp. 142.
- Synopsis of the Indian Tribes o. North America. (See Trans. Amer. Antiquarian Soc. Vol. 2. By Albert Gallatin. Worcester. 1836-38.
- Sketches of the West, or the Home of the Badgers; comprising an Early History of Wisconsin. Milwaukee. 1847-8. pp. 48.
- History of Illinois; (containing an account of the Black Hawk War.) By Gov. Ford, Henry Brown, Ex-Gov. John Reynolds.
- Various other works relating to the Black Hawk War, by the following authors: Orrin Clemens, Keokuk, 1866, 12mo; Samuel G. Drake, Boston, 1851, 8vo; Lieut. Gen. Winfield Scott, New York, 1864; Benj. Drake, Cincinnati, 1856 and '58, 12mo; Elbert H. Smith, New York, 1848, 8vo; J. B. Patterson, Cincinnati and Boston, 1833 and 1834 and 1845, 12mo.

- Annals of the West: embracing the principal events which have occurred in the Western States and Territories. By Jas. R. Albach. Pittsburg. 1857. 8vo.
- Historical and Scientific Sketches of Michigan (including information about Wisconsin), by Gen. Lewis Cass, H. R. Schoolcraft, John Beddler and others. Detroit. 1834. 12mo, pp. 215.
- History of Michigan, etc. By J. H. Lanman. New York. 1839. 8vo, pp. 398.
- Sketches of Iowa and Wisconsin. St. Louis. 1839. 12mo, pp. 103.
- Report on Indian Affairs: comprising a Tour in 1820 to ascertain the State of the Indian Tribes. By Rev. Jed. Morse. New Haven. 1822. 8vo, pp. 496.
- Communications relative to his Travels in the Northwestern Wilderness of Wisconsin. By Rev. Alfred Brunson. Wis. Leg. Doc., Dec. 19, 1843; House of Rep., 1844, appendix, pp. 30.
- History of Wisconsin from its first discovery to the present time. By Donald G. McLeod. Buffalo. 1846. 8vo, pp. 309.
- Sketches of the West; or Home of the Badgers: comprising an early history of Wisconsin and familiar letters on the country. Milwaukee. 1847. 8vo, pp. 48.
- Early Voyages up and down the Mississippi. By Cavalier, St. Cozme, Le Sueur, Gravier and Guiquas; with an Introduction and Notes by John Gilman Shea. Albany 1861. 4to, pp. 191.
- The Discovery of the Great West. By Francis Parkman, jr. Boston. 1869. 8vo, pp. 425.
- Historical Collections of Louisiana; embracing many rare and valuable Documents relating to the Natural, Civil and Political History of the State; compiled with Historical and Biographical Notes. Philadelphia and New York. 1846-1869. 6 vols. 8vo.
- History of the Catholic Missions among the Indian Tribes of the United States. 1529-1854. By John Gilman Shea. New York. 1855. 12mo, pp. 514.
- Travels through the Interior of North America in the year 1767 and 1768. By Jonathan Carver. Illustrated with copper plates, colored. London. 1778. 8vo, pp. 543. Many times re-published.
- Voyage in a Six-oared Skiff to the Falls of Saint Anthony in 1817, with an Introductory Note by Edward D. Mill. Philadelphia. 1860. 8vo, pp. 88.
- Report of Congressional Committee on the Petition of Sundry Indians of the Stockbridge Nation, comprising their Title to certain Lands. House Report, February 24, 1820.
- Narrative Journal of Travels from Detroit northwest to the sources of the Mississippi river in 1820. By Henry R. Schoolcraft. Albany. 1821.

- pp. 424. Map and Illustrations. Also a summary narrative of the same Expedition revised and completed in 1832. New York. 1834.
- pp. 308. Also an Edition under the direction of the United States, with Official Report and Scientific Papers. Philadelphia, 1855.
- Narrative of an Expedition to the source of St. Peters' River, Lake Winnepeck, Lake of the Woods, performed in 1823, under the command of Maj. Stephen Long; compiled by Wm. H. Keating. Philadelphia. 1824. 2 vols. 8vo. Map and Plates. London. 1825.
- Sketch of a Tour to the Lakes, of the Character and Customs of the Chippewa Indians and of incidents connected with the Treaty of Fond du Lac; with a Chippewa vocabulary. Baltimore. 1827. 8vo, pp. 493.
- A Pilgrimage to Europe and America, tending to the Discovery of the Sources of the Mississippi, etc., with a Description of the whole course of the same, etc. By J. C. Bettrami. London. 1828. 2 vols. 8vo. With Maps and Engravings. New Orleans. 1824. 8vo, pp. 328.
- Tour of the American Lakes and among Indians of the Northwest Territory in 1830. By Rev. Calvin Cotton. London. 1833. 2 vols. 12mo.
- The Ramble in North America. 1832 and 1833. By Chas. Joseph Latrobe. New York. 1835. 2 vols. 12mo.
- Dakotah; or Life and Legends of the Sioux around Fort Snelling. By Mrs. Mary Eastman. New York. 1849. 12mo, pp. 268.
- History of the Ojibway Indians. Boston. 1851. 12mo.
- Personal Recollections of a residence of thirty years among Indian Tribes on the American Frontier. By H. R. Schoolcraft. Philadelphia. 1851. 8vo, pp. 703.
- On the Northwestern Indians. By Alex. Ramsay. *See Pres't's Mess. and accomp. Doc., 1849-50, Pt. 3, pp. 1005.*
- History of the Valley of the Mississippi. By A. M. Hart. Cincinnati. 1853. 12mo.
- Report of Commissioner on Indian Affairs on the removal of the Winnebagoes from Iowa and Wisconsin to their Lands in Minnesota. *See House Doc. No. 510, 1st sess., 31st Congress, 1850.*
- Wau-bun: the Early Day in the North-West, with illustrations. By Mrs. J. H. Kinzies. New York. 1856. 8vo, pp. 498.
- Our Whole Country: Historical and Descriptive. By John W. Barber. Cincinnati. 1861. 8vo, pp. 1496. (Wisconsin portion, pp. 1167 to 1210.)
- History of Wisconsin in three parts, Historical, Documentary and Descriptive. By Gen. William R. Smith, under direction of the Legislature. Madison. 1854. 8vo. Vol. 1, pp. 432; vol. 3, part 2, pp. 443.
- Historical Collections of the Great West. By Henry Hare. Cincinnati. 1853. 8vo, pp. 440.
- Lights and Shades of Missionary Life; or nine years in the Region of Lake Superior. By Rev. J. H. Pitzel. Cincinnati. 1859. 12mo, pp. 431.

- Various papers relative to the supposed identity of Rev. Eleazer Williams (for a time resident at Green Bay) and Louis Capet, Dauphin of France, to-wit: In Putnam's Magazine for 1853, 4 and '68, by Rev. J. H. Hanson and A. H. Vinton; in *New York World* (September 19, 1867.)
- Military History of Wisconsin; a Record of the Civil and Military Patriotism of the State in the War for the Union. By Edmund B. Quiner. Chicago. 1866. 8vo, pp. 1022. Steel Engravings.
- Wisconsin in the War of the Rebellion; a History of all the Regiments and Batteries. By W. DeLoss Love. Chicago. 1866. 8vo, pp. 1136. Plates.
- The Army of the Potomac. Behind the Scenes; a Diary of Unwritten History. By Alfred L. Castleman, M. D., Surgeon of the 5th Regiment Wisconsin Volunteers. Milwaukee 1863, '68, pp. 288.
- Battle Fields and Camp Fires of the Thirty-Eighth Wisconsin Volunteers. By S. W. Pierce. Milwaukee. 1866. 12mo, pp. 254.
- A Soldier of the Cumberland; Memoir of Mead Holmes, of the twenty-first Wisconsin Volunteers. Boston. 1864, 1864, 12mo, pp. 240.
- Metomen, Springvale, Alto and Waupun in Fond du Lac Counties, Wis., during the late War. Brandon. 1837. 8vo, pp. 16.
- Statement of the Military services rendered by him to the government since March 1861. By Gen. J. C. Starkweather. Prepared at the request of the War Department, Milwaukee. 8vo, pp. 14.
- Opening of the Mississippi: or Two Year's Campaigning in the Southwest; a record of the campaign, sieges, actions and marches in which the Eighth Wisconsin Volunteers participated. By a non-commissioned officer. Madison. 1864. 8vo.
- History of the Wisconsin State (and Territorial) Medical Society, from the date of its organization in 1842 to 1868. See Transactions of the Society. Vol. 2, pp. 102. Beloit. 1869.

BIOGRAPHY AND GENEALOGY.

- Biographica, Genealogica Americana; an Alphabetical Index to American Genealogies and Pedigrees contained in State, County and Town Histories, Printed Genealogies and kindred works. By Daniel S. Durrie, Librarian of the Wisconsin State Historical Society. 8vo, pp. 296. 1868.
- Steele Family; a Genealogical History of John and George Steele, settlers at Hartford, Conn., 1635-6, and their Descendants, with general information respecting the families of the name. By Daniel S. Durrie. Enlarged edition. Sup. royal 8vo, pp. x., 168. 1862.
- Holt Genealogy; a Genealogical History of the Holt family in the United States; more particularly the descendants of Nicholas Holt, of New-

bury and Andover, Mass., 1634-1644, and of Wm. Holt, of New Haven, Conn. 8vo. By Daniel S. Durrie. 8vo, pp. 367. 1864.

Bibliography of Wisconsin. By Daniel S. Durrie. See Hist. Magazine for July, 1869.

Such is a pretty full record, so far as made public, of the labors which had been performed by and for Wisconsin in the Sciences, in the Arts, and in Letters up to the year 1870. If it shows that in the Practical Arts—in the rough work of civilization—we had achieved marvelous results for a State of but twenty-two years, it reveals, on the other hand, how little has been accomplished in those higher fields of human activity, the scientific, literary and æsthetic, whose cultivation, if more difficult and apparently less fruitful of immediate results, is nevertheless not only indispensable to them but also essential to those high intellectual achievements which exalt man as an individual and make of the otherwise half-civilized community an enlightened and refined commonwealth. And, in so far as this deficiency has been shown, to that same extent has it been demonstrated that the welfare of the State would be promoted by an efficient organization formed for the express purpose of supplying it.

2. On behalf of Science, Literature and the Arts, the reasons which influenced the founding of the Academy are briefly stated.

The sympathies and aspirations of a people should not be limited to objects which refer to the State. Every community is in duty bound to contribute something to the common stock of human knowledge. Nay, more; there is a sentiment higher than even philanthropy, namely, fealty to *truth* independent of all its relations. It can hardly be said, to-day, when the rule of might is not yet ended, that a state or nation is influential in proportion as it cherishes those higher sentiments and makes them the rule of its conduct. But it is certain that none can justly claim the respect of mankind from whose policy they are excluded.

In other words, a people become truly great, prosperous and powerful, and thus fulfil the ends of the State, in proportion to their loyalty to the best interests of the race.

It was in view of all the foregoing facts and considerations that so large a number of the leading citizens of the State united their efforts in the movement which resulted in the establishment of this Academy, and that, in the call issued by them for the convention at which the organization was effected, they used the following language:

“An institution of the kind in question would bring into more intimate relations many men, who, though already more or less engaged in original studies and investigations of various kinds, accomplish less than they would had they frequent association with each other, a common storehouse into which to bring their material collections, and some proper medium through which to publish the approved results of their scientific labors to the world.

“It would awaken a scientific spirit in all enquiring minds, and thus lead to a more fruitful intellectual activity among the people at large and to a wider diffusion of useful knowledge.

“Through a scientific and economical exploration of the State, to which it would early lead—and which it might with great advantage direct—as well as through the published results of independent investigations, conducted by its members, it would do much towards bringing the many natural advantages of our State to the notice of foreign populations, and especially to capitalists, both at home and abroad; thus promoting the more rapid and more economical development of our material resources.

“It would result in new and important applications of science to the practical arts, and thus advance the industry of the country.

“It would associate artists of every class, establish higher standards for the execution of works of art, and lead to the formation of an art museum.

“It would bring together men of letters and promote advancement in every department of language, literature and philosophy.

“It would also tend to promote the literary and æsthetic culture of the people, and by the quickening, invigorating, and elevating influence it would exert upon all our higher educational institutions, largely contribute to the social progress of the State, and the earlier insure to Wisconsin an advanced position among the most enlightened communities of the world.

“We further believe that the time has now come, when, with proper effort on the part of those who may be reasonably expected to aid in so important an enterprise, the foundations may be laid for an institution that shall be of great practical utility and a lasting honor to the State.”

## II.

## PLAN OF THE ACADEMY.

In view of the general objects to be accomplished, the great value of associated effort, and the relation of harmony that exists between the several departments of knowledge, the Academy was broadly planned, so as to embrace every important interest of the State and every department of investigation looking to the advancement of knowledge.

Its objects more specifically stated, are set forth in the terms of the Charter, as follows :

“SECTION 2. \* \* Among the specific objects of the Academy shall be embraced the following:

“1. Researches and investigations in the various departments of the material, metaphysical, ethical, ethnological and social sciences.

“2. A progressive and thorough scientific survey of the State, with a view to determine its mineral, agricultural and other resources.

“3. The advancement of the useful arts, through the applications of science, and by the encouragement of original invention.

“4. The encouragement of the fine arts, by means of honors and prizes awarded to artists for original works of superior merit.

“5. The formation of scientific, economical and art museums.

“6. The encouragement of philological and historical researches, the collection and preservation of historic records, and the formation of a general library.

“7. The diffusion of knowledge by the publication of original contributions to science, literature and the arts.”

The Departments named in the Constitution are these :

The Department of the Sciences.

The Department of the Arts.

The Department of Letters.

But with a view to subsequent development, the Constitution provides that, “any branch of these Departments may be constituted a Section; and any Section or group of Sections

may be expanded into a full Department whenever such expansion shall be deemed important."

By reason of modifications made under this provision, the present scheme of the Departments is as follows:

1st. The Department of Speculative Philosophy (not yet organized).

2d. The Department of the Social and Political Sciences—

Embracing:

Jurisprudence.

Political Science.

Political Economy.

Education.

Public Health.

Social Economy.

3d. The Department of the Natural Sciences—

Embracing:

Mathematics.

Physics.

Natural History.

Medicine.

4th. The Department of the Arts—

Embracing:

The Useful Arts.

The Fine Arts.

5th. The Department of Letters.

Embracing:

Language.

Literature.

History.

Each department has its own officers, while all are under the direction of a General Council.

The membership embraces Honorary and Corresponding  
D.



Members, Founders, Patrons, Members for Life, and Annual Members.

Three meetings are held annually for the reading and discussion of papers.

The proceedings of the Academy at these meetings, including brief abstracts of the papers read, are published, as soon as practicable after the adjournment, in a neat octavo periodical called the BULLETIN.

### III.

#### WHAT THE ACADEMY HAS DONE.

At the time of its organization, the attempt, in so new a State, to form an association whose active members must of necessity be capable of making either original researches and investigations or valuable contributions to the Arts, was thought by some cordial friends of the objects of the Academy to be a little premature. The results have shown, on the contrary, that the enterprise had been too long postponed. The presidents of our colleges as well as the professors connected therewith, distinguished scientists and members of the several professions, have heartily united in the inauguration of the enterprise and have since shown their deep interest in its welfare by giving to it not only their moral and pecuniary support, but also the fruits of their intellectual labor.

The present number of Life Members is, 12; of Annual Members, 55; of Corresponding Members, 29.

The report of the Treasurer, herewith submitted, shows the condition of the fiscal affairs of the Academy at the date of the late Annual Meeting.

[Copy.]

TREASURER'S REPORT.

WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS,  
OFFICE OF THE TREASURER,  
MADISON, Feb. 14, 1872.

HON. J. W. HOYT, *President of the Wisconsin Academy of Sciences, Arts, and Letters:*

SIR:—I have the honor to report the financial condition of the Academy as follows:

Total annual fees received from 44 members.....	\$480 00
To fees from life members .....	807 25
	<hr/>
	\$1,287 25
Disbursed in payment of warrants, as per vouchers hertofore and herewith furnished.....	332 75
	<hr/>
Leaving a balance in the treasury of .....	\$904 50
	<hr/>
Placed to credit of life members' permanent fund.....	\$807 25
To credit of general fund .....	97 25
	<hr/>
	\$904 50
	<hr/>

REPORT OF FINANCE COMMITTEE.

I have this day examined the foregoing report and account of the Treasurer, and compared the same with the vouchers and stub books, and find the same in all respects correct.

NELSON DEWEY,  
*Chairman Finance Committee.*

MADISON, Feb. 14, 1872.

As the duties of all officers have been performed without compensation, and the expenses of members in making their investigations and attending the meetings have been defrayed by themselves, the only expenditures have been for incidental purposes and for the printing of the BULLETIN, of which five numbers have been issued.

The Museum of Natural History and the Useful Arts has made considerable growth, and must eventually come to be exceedingly valuable to the State for scientific uses, as well as interesting to the general public. By favor of the Governor and of the State Agricultural Society, it occupies the larger

one of the elegant apartments in the capitol so generously assigned to Agriculture some years ago.

There are many private collections in the State which would make great gain in usefulness could they be brought together at the capitol, and which, it is gratifying to be able to add, their proprietors, in some cases, purpose giving to, or depositing with, the Academy, so soon as suitable preparations are made for them.

Field work in Geology and the other branches of Natural History, being necessarily attended with considerable pecuniary outlay, it cannot be expected that very great progress will be made therein until the Academy is in a condition to relieve its members of at least a portion of such burden of expense. It already includes gentlemen fully competent to thorough work in each of the departments; and when this condition of pecuniary ability is reached there is reason to believe that, under a well devised system, embracing a judicious division of labor, a good deal may be done by it towards a scientific survey of the State, with comparatively little expense.

It is of much practical as well as scientific importance that further work of this kind should be done; for as yet no single county has been thoroughly examined in its relation to all the departments of natural history, and much the larger portion of the State, as already intimated, has not been favored with so much as a general reconnoissance.

The construction of railroads now in progress through the centre and northern portions, which are believed, upon evidence already furnished, to be rich in mineral and other resources, will facilitate the needed explorations and should prompt the state, as well as citizens who have an interest—and what citizen who has not?—in the development of that region, to extend to the Academy all reasonable encouragement in its endeavors to institute and carry on such investigations as properly come within the plan of its scientific labors.

The nature and extent of the work actually performed by members of the Academy, in the field, laboratory, and private study, since its organization in 1870, will appear from the following titles of papers prepared for its meetings:

- On the classification of the Sciences. By Rev. Albert O. Wright, M. A. New Lisbon.
- On the importance of more attention to the Preservation and Culture of Forest Trees in Wisconsin. By Mr. P. Englemann, Secretary of the Natural History Society, Milwaukee.
- The Coniferae of the Rocky Mountains, and their adaptation to the Soils and Climate of Wisconsin. By Hon. J. G. Knapp.
- On the Origin of the Potsdam Sandstone. By Hon. John Murrish, State Commissioner for the Survey of the Lead Region.
- On the Importance and Practicability of finding a Unit of Force in Physics that shall be of Universal Application. By Prof. John E. Davies, M. D., Wisconsin State University.
- The Fauna of Lake Michigan off Racine. By P. R. Hoy, M. D., Vice President of the Academy, Racine.
- On the Age of the Quartzite of Baraboo. By Dr. I. A. Lapham, LL.D., General Secretary of the Academy.
- On the Formation of certain new Compounds of Manganese. By Prof. Jas. H. Eaton, of Beloit College.
- The Metamorphic Rocks in the Town of Portland, Dodge county. By Rev. A. O. Wright, M. A.
- The Metamorphic Rocks of Devil's Lake. By Rev. A. O. Wright, M. A.
- Some Observations upon the Fauna of Mammoth Cave. By Mr. P. Englemann, Milwaukee.
- On the Nebular Hypothesis in Astronomy. By Dr. R. Z. Mason, LL.D., Appleton.
- The Mineral Well at Waterloo, Wisconsin. By Rev. A. O. Wright, M. A.
- On the Classification of Plants. By Dr. I. A. Lapham, LL.D., Milwaukee.
- Metallic Veins and the Deposition of Minerals. By A. J. Finch, Esq., Milwaukee.
- On the Geology of the Region about Devil's Lake, Sauk county; being a Report of Observations made by request of the Academy. By Prof. Jas. H. Eaton, Beloit College.
- On the Relations between Social and Moral Science. By Hon. Charles Caverno, M. A., Secretary of the Department of the Social and Political Sciences, Lake Mills.
- The Mammalia of Wisconsin. By Dr. P. R. Hoy, M. D., Racine.
- On the Climatic Relations of the Flora of Wisconsin. By Hon. J. G. Knapp, Madison.

- Results of Recent Observations in the Lead Regions of Wisconsin. By Hon. John Murrish, Mazomanie.
- On the Laws which Govern the Configuration of Comets. By John Y. Smith, Madison.
- On the Kinetic Measure of Forces. By Prof. John E. Davies, M. D., State University.
- On the Duty of the State to its Idiotic Children. By Prof. O. R. Smith, Milwaukee.
- On the Place which the Indian Languages should hold in the Study of Ethnology. By Prof. John B. Feuling, Ph. D., Secretary of the Department of Letters, State University.
- On the Clay Deposits and the Fossils found therein in the Region about Appleton. By Dr. R. Z. Mason, LL.D., Appleton.
- On the Ancient Lakes of Wisconsin. By Hon. J. G. Knapp, Madison.
- Suggestions as to a Basis for the Gradation of the Vertebrata. By Prof. T. C. Chamberlin, State Normal School, Whitewater.
- Facts Relating to the Local Geology of the Whitewater Region. By Prof. T. C. Chamberlin.
- On the Rocks and Mines of the Upper Wisconsin River. By Hon. J. G. Knapp, Madison.
- The German Sunday. By Rt. Rev. Wm. E. Armitage, D. D., Vice President of the Department of the Social and Political Sciences.
- The Relations of Capital and Labor. By Dr. A. L. Chapin, D. D., LL.D., Vice President for the Department of Letters.
- Social Science and Woman Suffrage. By Hon. Charles Caverno, Secretary for the Department of the Social and Political Sciences.
- The Common Jail System of the Country. By Hon. D. S. Hastings, Secretary of the State Board of Charities.
- The Physical Basis of the Mineral Sources of Wisconsin. By Hon. John Murrish, late Commissioner for the Survey of the Lead Region.
- Insects injurious to Agriculture—Aphides. By Dr. P. R. Hoy, Vice President for the Department of the Natural Sciences.
- On the Age of the Quartzites, Schists and Conglomerates of Sauk county. By Roland Irving, M. A., M. E., Professor of Geology, etc., in the State University of Wisconsin.
- Observations on some of the Coal Deposits of Colorado. By Dr. J. W. Hoyt, President of the Academy.
- On the Potential Functions and their application in Physical Science. By Prof. John E. Davies, M. D., State University.
- On a Modification of Grove's Battery for a special Purpose. By Prof. John E. Davies, M. D.
- The Theory of Evolution illustrated by the Science of Language. By Dr.

John B. Feuling, Ph. D., Professor of Comparative Philology, in the University of Wisconsin.

The Rural Population of England, as classified in Domesday Book. By Wm. F. Allen, A. M., Professor of Ancient Languages and History in the University of Wisconsin.

Outline of a Plan for a National University. By Dr. J. W. Hoyt, President of the Academy.

While many of these papers were of such interest as to make their publication in full very desirable, the Council have limited their selection for this purpose to those herewith submitted, the important character of which must commend them to an intelligent public.

On behalf of the Academy, I have the honor to be, Sir,

Very respectfully,

Your obedient servant,

J. W. HOYT.

MADISON, March 10, 1872.



# DEPARTMENT OF THE SOCIAL AND POLITICAL SCIENCES.

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## THE RELATIONS OF LABOR AND CAPITAL.

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BY REV. A. L. CHAPIN, D. D., LL. D.,  
President of Beloit College.

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The problems respecting the relation of Labor and Capital which are now engaging the attention of all sorts of people in all parts of the civilized world, may be greatly simplified by a clear apprehension of a few elementary facts and principles. The presentation of these facts and principles is the object of this paper. I attempt nothing more than a brief digest of some matters familiar to all who are acquainted with the science of political economy. In this I follow mainly Mr. Mill's line of thought, and adopt often his own forms of expression, claiming no merit for the paper except for the putting of things together with a bearing.

We start with the simple fact that *all wealth is produced by the application of labor to natural objects*. In the case even of those objects which nature brings forth spontaneously in a form to gratify desire, some labor is necessary to find and appropriate them. In most cases some further labor is requisite to bring natural objects into a condition fit for use. Fig-leaves must be sewed together before they can serve for clothing. The fish and the deer, after being caught, must be divided, cleansed and cooked before they are fit for food. The dirty ore, taken from the bog or mountain, must pass through a succession of varied processes of labor before it takes the form of a knife, convenient for a thousand purposes. So it is with



everything which contributes to man's necessities, comfort or enjoyment. "All things are full of labor." In each we find a natural gift from God, with an added gift from man's labor. So long as there is found a desire of man ungratified, or an object of nature unappropriated or unexhausted of its capacity to gratify desire, there will be place for human labor to be applied to natural objects for the increase of wealth.

We advance a step and come upon another obvious fact. It is that in civilized society, *all the processes of industry require some accumulation of the products of former labor to begin with.* The blacksmith cannot begin his work without iron to work upon, and a forge and its fuel and hammer and anvil to work with. And, moreover, if he is to spend the day in his shop, the food which supports him must be provided beforehand. In other words, he must have materials, tools and sustenance. But these all come as the results of previous labor, his own or another's. So it is in every branch of civilized industry. To this necessary accumulation of the products of former labor the name CAPITAL is given. This is the radical idea of capital.

Now putting these two facts together, we have the universal fundamental principle that *the union of these two elements, labor and capital, is essential to the production and to the very existence of wealth.* Hence comes the obvious inference that the true relation of capital and labor is that of *partners—coadjutors* for a common end—*sharers* in a joint result. Each is indispensable to the other. Abstractly considered, they meet on an equality. Antagonism between them is ruinous to the interests of both. This view of the subject is fundamental to all sound political economy. It is so plain as to seem a truism which hardly needs a formal statement. Sound philosophy and common sense both sustain this view. Yet in practice it is very generally ignored, and in the sharp discussions of our times it seems almost lost sight of on both sides. Amid the din of the workshop and above the din of wordy contention this simple truth needs to be continually affirmed, elucidated

and reiterated. No labor reform movement can avail anything which does not start with the proposition that labor and capital are partners, not rivals, and write upon its banners, "What God hath joined together let not man put asunder."

For a better apprehension of the principle in all its bearings, let us linger a little on the questions—what is labor? what is capital? and what conditions most favor the harmonious and profitable union of these two forces of industry?

1. Labor is fitly defined to be "the voluntary effort of human beings to produce objects of desire." Since the human being is made up of body and mind, we must distinguish two kinds of labor, viz: physical labor, in which muscular exertion is the chief thing, and mental labor, which engages chiefly the faculties of the mind. I say *chief* and *chiefly* because in reality all human exertion combines some physical and some mental effort. The dullest laborer must think some about the work of his hands; and the profoundest thinker must task his muscles *some* to present to the world the products of his brain-work.

Recognizing this distinction, let us note what each kind of labor achieves. Mere physical labor only puts things in motion. The muscles of the body are made capable of contraction. This creates a pressure which when applied to a piece of matter, tends to put it in motion, or if it be already moving, to change or stop its motion. This is all that mere muscular exertion can do. But through this power of putting things into contact and relation with each other, man is able to command the hidden forces of nature to an unlimited extent. Man stirs the earth and drops a seed into it, then the forces of vegetation hid in the seed and in the soil multiply the seed a hundred fold. Man brings coal, places it in a furnace, sets fire to it, and at once a force of nature in the process of combustion turns the carbon into heat. He may add to the pile ore taken from the earth, and another force of nature by the action of heat makes the iron flow. Man's muscles grasp and wield the hammer only to enable nature's forces, gravitation

and density on the one hand, and tenacity and malleability on the other, to make the blow effective to shape the iron as he will. Man sets his poles and strings his wires and adjusts the components of his battery and arranges his machine so that by touching a key he can command that subtle force of nature, electricity, and make it the bearer of his thoughts to the ends of the earth. Yet in all this, physical labor only moves things; the forces of nature do the rest.

But how does the man know what things to move, what kind of motion to give and how to produce that motion so as to accomplish his purpose? Not every putting forth of muscular exertion is effective in producing desired results. Action must be suited to the nature of things and guided by methodical rule. Hence the constant necessity of *mental labor* to precede and attend the operations of all physical labor. The faculties of the human mind must be tasked in investigating the properties and laws of nature, in studying the philosophy of motion itself, to find the mechanical powers, in contriving in detail the means or instruments through which the force of nature may be made available, and various motions may be combined on philosophical principles for certain results, and in watching over the actual operations of both the human laborers and the natural agents in the complex combination of productive industry. It is plain on the bare statement of it that the mind-work of *discovery*, *invention* and *superintendence* is indispensable, an essential part of all productive labor, and that its importance and value, though often overlooked, cannot be overestimated. We say, therefore, of mental labor in this form, that it is *directly* concerned with all productive industry. We recognize, also, another kind of labor, chiefly mental, which is employed to develop and improve the physical, intellectual, moral and social condition of human beings themselves. The results of this kind of labor affect men individually and collectively, and determine very much their qualities as laborers and the circumstances

and associations in which they live and work. It is thus *indirectly* concerned with all departments of productive industry. Under this head may be set down the mother's nursing and training of her child, the teacher's efforts, the services of the physician, the lawyer, the minister of religion, the author, the editor and the greater part of the labor involved in the administration of government—all that is commonly called professional and official service.

This distinction of labor as directly or indirectly concerned in production is much more simple and better every way than the old distinction much insisted on by some writers on Political Economy and as strongly contested by others, of labor as *productive* or *unproductive*. The term unproductive can properly be applied to labor only when it is labor wasted through misdirection, as when a wag paid a man ten cents an hour to bail out the river, as its waters set up between two boats, or as a luckless inventor may spend years of brain-work and manual toil on a machine which has no practical use. Certainly we may not say of Morse's years of study and work in devising the elective telegraph, or of Webster's labor to bring under sentence of the law the murderers of White, or of Coan's preaching the gospel in the Sandwich Islands, it was *unproductive* labor.

Much exertion is put forth for mere recreation, as in hunting, boating, ball-playing, etc. If this really recruits mind and body, it puts the laborer in better condition for productive toil, and so indirectly aids it.

There are professions, such as those of the musician and the actor, in which labor is put forth only to furnish a passing entertainment—a moment's pleasure. Though after the entertainment is over, nothing is left which can be laid up and counted as wealth, yet is it for the time a real gratification, and the sweet memory of it will abide. The true end of labor is accomplished immediately. The satisfaction follows the effort instantaneously. The hearer of Nilsson has his *quid*

*pro quo* in the ecstasy of the hour. Why then is not this *productive* labor just as truly as if it had produced a ribbon for ornament, or a shoe for protection, or bread for food? Proper gratification of this kind cheers the spirits of men, and so increases their productive energy. If the recreation is, in kind or degree, exhausting, if the amusement is in its influence demoralizing, or if the taste be so fostered that amusement is made itself an end—then the economist and the moralist may fitly enter their joint protest against a waste and a wrong. But that labor which brings refreshing relief to wearied body and mind, or ministers a gratification to a pure and healthy taste, cannot be fitly called unproductive.

Still less properly can the term be applied to professional labor generally. It is a very common notion, which has been encouraged by some who would be esteemed philosophical writers on the subject, that the manual labor of the farmer, the carpenter, the cotton manufacturer, etc., is productive; but some are disposed to set down the mental labor of the doctor, the lawyer, the editor, the teacher, the legislator, etc., as unproductive. But the real difference is only that the labor of the latter class is directed in a general way to favor the essential conditions of effective labor universally. It is expended on the human beings individually and in their social state to fit them for labor, to protect them in their labor and to gratify and expand the wants which are to be satisfied by the fruits of labor. So long as physical health, intelligence, morality, security under good government and just laws, justly administered, and social refinement and good feeling are essential conditions of successful industry, all labor of the kind referred to must be set down as *indirectly* productive. Nor is labor in this form further removed from, or less essential to the ultimate result than is the labor of the miner in the ore-bed, with reference to the needle and the comfort of the coat made by its use. I have seen a pictorial sheet, the prominent object in which is a farmer standing in the centre, while around

him, in the margin, appear representatives of half a dozen different professions. The lawyer says, "I plead for all;" the merchant, "I trade for all;" the clergyman, "I pray for all;" the soldier, "I fight for all;" the railway manager, "I carry for all," and the physician, "I prescribe for all." But in letters of double size, the farmer is made to say with emphasis, "I *pay* for all."

Now I suppose this picture fitly represents the current popular notion on the subject. But according to the views just expressed, the notion is false. None can deny that agricultural labor lies at the foundation of human society, at the beginning of human industry, because it is busy producing the necessaries of life. For that very reason it is sustained, stimulated, and *paid by all*. It gives no more than it receives. Its interests are all identified with the growth of diversified society, organized, protected, enlightened, refined. In well ordered society each branch of honest industry is tributary to every other, and all are mutually dependent. For, to quote the words of holy writ, "the body is not one member but many, and the eye cannot say to the hand I have no need of thee, nor again the head to the feet, I have no need of you; nay much more those members of the body which seem to be more feeble are necessary and those members of the body which we think to be less honorable, upon these we bestow more abundant honor; and our uncomely parts have more abundant comeliness." There is necessity fixed in the nature of things that the greater part of men must be occupied with agricultural labor or other forms of manual labor. Let the intrinsic worthiness and dignity of all such labor be recognized and honored. But, at the same time, let it be understood that with this labor is closely interwoven all the busy brain-work of the minority who, though they seem to stand aloof, are efficient partners in both the toil and its results. The correction of the false and substitution of true views respecting labor itself, is the first step in every wise and sincere movement for labor reform.

2. Next we have to study Capital. It will serve for a general definition to say *Capital is that part of wealth which is actually employed in production.* Wealth is a broader term. Capital is a part of wealth. It is not synonymous with *money*, for money itself does not go into production. More specifically *Capital is the sum total of the products of former labor employed to provide shelter, protection, tools and materials for the processes of the production and to feed and otherwise to maintain the laborers during the process.* This threefold classification of capital should be particularly noticed. There are the *instruments* of production—as land, buildings, tools and machinery—the *materials* on which labor is expended, such as wheat, iron, cotton, leather, etc., and also *houses, food and clothing* for the safety and support of the laborers while engaged in productive operations. The items last named are usually provided for by the laborers themselves out of the wages paid them. *Wages* therefore represents this form of capital, whether paid in money or in rent and groceries and dry-goods.

Capital is not *money* but *things* in one or other of these forms. What a manufacturer wants is not money but a steam engine and gearing and spindles and looms and cotton. Laborers look at their money-wages only as means for procuring food and raiment and the protection of a home. Money is but the convenient instrument of exchange. The same money may go out of the bank in the morning, run around a busy circuit and get back in the afternoon. In its circuit, perhaps, it sent a machine to the shop and a load of wool to the mill and a load of potatoes to the laborer's home, but it comes back just what it went out; money is nothing else, though its value is represented threefold in as many forms of capital. So far as money has in itself real value it is a part of the products of former labor, saved and set apart for this specific service in the exchange of products. So it is capital in the form of an instrument which aids production. Banking capital is thus a portion of the wealth of a community appropriated to this ob-

ject. It renders a very important service. Yet the benefit it confers may all be resolved into the greater facility it furnishes for the transfer of values in the form of tools and machinery—materials and the means of sustenance—into one or other of which all capital must be brought in order to be made productive. The proper and legitimate business of a bank is to furnish just these facilities for the productive industry of the community in which it is located. When the banks of New York permit their funds to be absorbed in the gambling speculations of Wall street, they work mischief rather than benefit to productive industry. The wealth represented by their capital stock is withdrawn from production. It forms no part of *capital* in the true sense of the term. They are, for the time, so far, turned into nothing better than faro-banks, mere reservoirs of wealth, to be played with and shifted from hand to hand at the turning of cards. Wealth so absorbed can by no possibility come into union with labor. It is of the highest consequence to the clear understanding of our subject that the term *capital* be held strictly to its technical meaning, and that it be conceived of as existing mainly in the instruments, the materials, the wages, directly or indirectly provided for the employment of labor. Apprehending thus the nature of capital, I must content myself with the bare statement of a few fundamental propositions laid down and illustrated at length by Mr. Mill.

1. *Industry is limited by capital.* Every increase of capital may give additional employment to industry. Industry cannot go beyond the limit of capital; it may not, through lack of laborers, come up to it. This recognizes the mutual dependence of these two elements, labor and capital. It says, simply, that the most stalwart or skilled laborer can do nothing until he has tools and materials and something to live on while he is working, i. e., capital. If he has acquired these by former labor, then is he owner of the needed capital, and in a sense independent; if he has not these he must wait the will and



pleasure of some one who can come into partnership with him by finding these things for him to begin with.

2. *Capital is the result of saving.* To consume less than is produced is saving. Saving is simply laying up the difference between what one spends and what he earns—between wealth produced and wealth consumed. The amount saved and so added to capital may be increased by either consuming less or producing more, or both. There is no other source of capital.

3. *Yet capital though the result of saving is actually consumed in the very process of production.*

The wealth saved goes at once into implements, materials and provisions for the daily wants of laborers, and there is subjected to consumption, quick or gradual. It is withdrawn from all other possible uses. Investment for production and spending for enjoyment coincide in the first stages of their operations. Both begin with the destruction of a portion of wealth. But in the spending the first is the final stage. In the productive investment a second stage is reached, when an equivalent of what has been consumed is returned with increase. Thus capital is kept in existence from age to age, not by preservation, but by perpetual reproduction. The greater part of the present capital of England was produced within the last twelve-month. The growth of capital is like the growth of population. Every individual who is born dies, but in each year the number born exceeds the number who die. The population increases while the individuals pass away. So with capital; out of the productive consumption of one year comes a greater product available for the next.

4. *What supports and employs labor is the capital which sets it at work, not the demand for the completed product.* The demand for commodities determines the *directions* of labor, but not the amount of labor itself. That depends on the amount of the capital devoted to the sustenance and remuneration of labor.

One does good to laborers not by what he consumes on himself, but by what he does not so consume. This corrects the very common error that the lavish expenditure of the rich is a benefit to laborers. The distinction of wealth is in itself an injury or loss. The only qualification of this view needed is in the case of a class of rich persons who have no disposition themselves to turn their wealth into capital. Their lavish expenditure may bring their wealth into other hands, so that it may be used productively. The whole community, laborers most of all, are interested in the accumulation of wealth as capital. Saved and so employed, it is multiplying ever the sum of comforts in the world.

It is very obvious that the principles stated confirm the general view with which we started, that the true relation of labor and capital is that of partners. We are prepared now, in a few words, to define the conditions most favorable to their harmonious union. They meet most advantageously in the same person, i. e., when the laborer is owner of capital enough to employ his labor. This brings both the elements under the control of one and the same will, to be governed by one self-interest. All rivalry and antagonism is excluded, and according to the measure of his capital and his capacity, the man will multiply products.

But this adjustment cannot be made universal, because—

1. Such is the tendency of capital to increase that the man will soon find in his hands a surplus, to employ which he must either bring in another who has only labor to work under him, or lend it as capital to another independent worker, and so a distinction between capitalist and laborer is sure to begin.

2. But a greater difficulty comes from the fact that the capacities and tastes of men differ greatly. Some efficient laborers lack managing skill and tact in saving so as to keep and accumulate capital independently. Others peculiarly endowed in these respects lack physical strength for labor. ¶ To some,

manual labor is irksome, and they will seek exemption from it as soon as their increase of capital enables them to do so. Others find the care of managing business no less distasteful and so put their accumulating capital into other hands. Then,

3. Many forms of production, most essential to a state of highest civilization, must be carried on in large establishments which shall combine great capital and great numbers and divers grades of laborers. The most economical division of labor can be secured only through such establishments.

Hence there is a strong tendency to a separation of the two elements, so that the capital will be the chief concern with some and the labor with others. This disturbs the abstract equality and mutual dependence just spoken of. Perhaps with respect to actual increase, capital alone is most helpless. But in the meeting of persons to enter into contract, the capitalist has the advantage because *he can live* on his capital without labor, but the laborer cannot live except he earns his necessary food by working with somebody's capital. Under the sway of short-sighted self-interest, therefore, capitalists are inclined to use this advantage to domineer and oppress laborers. I say short-sighted self-interest, for in the long run and in the broad view, such oppression reacts upon the oppressors. When laborers are held down to starvation wages, capital must be heavily taxed for the support of paupers, and in time there must come an insurrection which will make capital insecure. On the other hand, the consciousness of dependence tends to make laborers sensitive to the least real wrong and suspicious of wrong where none exists. Against their own true interests on both sides the parties are thus led into a partial antagonism. The fact of these tendencies must be recognized. They are not so strong in our country as in England. Yet enough is apparent here to awaken thoughtful consideration. The problem is to guard the rights of both parties so that they shall be bound by their natural common interest in harmonious union with each other.

It is a hopeful sign that the minds of philosophers and philanthropists and practical working men and capitalists are just now intently engaged upon this problem. The surest way to reach the true solution of the problem is to enlighten the people generally respecting the elementary principles involved. By these both rights and interests are to be defined, and when they are distinctly apprehended, both parties will be drawn by natural affinity into harmonious union.

We may deduce from the principles, already stated, three leading circumstances which favor the most profitable union of labor and capital.

1. *First to be named is the general distribution of capital.* I mean such a condition of things that the capital of a country shall be in many hands rather than few—that laborers themselves shall have some capital. Whatever in the social organization creates or sustains privileged classes is opposed to this and needs to be removed. Whatever in legislation or usage by the easy allowance of public opinion tends to create or maintain monopolies, is opposed to this and needs to be especially guarded against. If no hindrances are in the way on the one side and no special protection accorded on the other, the natural working of things on the principles of self-interest will secure a pretty general distribution of capital. The end will be promoted by all measures which encourage saving on the part especially of laborers. Savings banks, such as New England has had and profited by for a century, or perhaps better yet a government savings bank through a modification of the postal order system, on the plan now in use in England, will be of great service in this matter. In large manufacturing establishments the stock may be divided into small shares and brought within the reach of the employes so as to induce them by their savings to become owners in part of the capital and so entitled to dividends from the profits in addition to their wages. Such measures elevate labor and give it inde-

pendence, and also increase capital by devoting much wealth that would be spent, to production. And capital thus distributed stimulates energy, develops talent, comes closer to labor, better defends itself and superintends operations by having in each operative an interested observer of both his own and others work.

2. A second circumstance to be considered is *the ratio of the whole amount of capital to the whole number of laborers and the ratio of the increase of capital to the increase of labor*. This only recognizes the principles before stated that industry is limited by capital and every increase of capital demands increase of labor.

No universal rule can be given for this proportion. It will vary somewhat according to the circumstances of each country and the spirit of its people. Here the age of a country must be taken into account—its natural advantages—the general occupation of its people. In a new country, occupied by a thrifty people, capital increases faster than labor, and there we see always the highest stimulus to production. For all countries and all people, the general principle is, that there should be labor enough to employ the capital and capital enough to employ the labor. A perfect balance is perhaps nowhere realized. Yet, if labor and capital are free, the flow of each under the law of competition towards an equilibrium is as natural as that of the waters of the ocean under the action of gravitation. In the order of nature undisturbed, there is provision for the steady increase of both capital and labor in something like a defined proportion. There is no danger of a surplus of either, for the whole world, nor for any one country, if only the passage is open for the outflow and inflow of either.

3. The third circumstance to be named is *the certainty that labor and capital shall each be made sure of a just reward*. The partners join hands each for an expected reward. Men will not

labor for nothing, nor will capital be put out in uncertain risks. To ensure this certainty of reward to each, there must be,

1. Division of property, personal ownership in everything that can by labor be made an object of value and appropriated. Without this capital can not be. On common property men will not labor except on the compulsion of force or stern necessity.

2. There must be also, security to all property-rights by both prevalent moral sentiment and just laws, equitably applied and faithfully executed. When governments invade or are weak to defend property-rights, capital withdraws itself into secret places as hoarded wealth, and labor is stinted and reduced to the lowest degradation. It is a terrible mistake to suppose that existing wrongs under which labor suffers can be relieved by that greatest of all wrongs the invasion or subversion of the rights of property.

3. And once more: there must be for both capital and labor, perfect freedom, unrestricted by monopolies or special legislation of any kind. A special favor in these relations of labor and capital involves an infringement of freedom on one side or the other, and that is an interference with natural law—a hindrance to the best results. The world is opening its eyes, after centuries of wrong and mischief, to the fact that the business of governments respecting these relations of capital and labor is simply to protect the rights of each and hold other things in even balance for the free working of natural law—to let both alone, giving neither any advantage, but both the utmost freedom. They are natural partners, and if not interfered with, will spontaneously seek each other as birds mate in the spring for a happy fruitful union.

There is not time, nor is this the place to discuss in detail *measures* for the better harmonizing of labor and capital. I will however, as we leave the subject, suggest a few thoughts which come as corollaries from our main proposition. It must

be acknowledged that through greater facility for organization, through false views which have gained acceptance in the current usage of business and through mistaken legislation in some things, capital has been unduly favored; it has the advantage and inclines to oppress labor. Laborers have some reason to complain and ask for relief. Justice and philanthropy require that every man who fears God and loves his fellow-man should consider the rights involved and lend a helping hand to the weak. But admitting this, it is obvious, from the views we have considered, that any measures which directly increase the antagonism between the parties, any organization which contemplates open war between labor and capital will only aggravate the evil and work damage to both sides. Combinations of employers on the one hand to set the prices they will pay—or of laborers on the other to agree upon what they will demand, and, in general, strikes and trades-unions are in this light positively mischievous. The great interests of both are common, and the true relief must come from the better understanding of those common interests.

On the other hand, all measures which tend to increase the intelligence and promote the thrift and independence of laborers and so inspire them with self-respect and confidence as they come into contact and union with capitalists are helpful. Co-operative associations which gather up the scattered capital of many laborers, to be used in the employment of their own industry, under their own management, may fitly be commended and encouraged. If capital has gained an advantage by special legislation, this is to be counter-balanced, not by special legislation to favor the other side, by attempts to fix the hours and the wages of labor, but by earnest united protests against all special legislation—by insisting on *freedom* as the fundamental law of productive industry. From the study of principles and the observation of facts within the range of my opportunities I am convinced that prominent among the sources of wrong to labor is the use of an unreal, ever fluctu-

ating currency. The control of that whole matter has been in the hands of capitalists. They profit by it, not through its relations to legitimate productive industry, but through the chances and stimulus such a currency gives to speculation. Capital invested in real production, and labor both suffer from it, but labor most of all; for in the ever recurring fluctuations wages are slowest to rise and quickest to fall, and all the mischiefs of deranged industry touch the very seat of life with laborers. Honest capitalists and laborers are alike interested in urging by all practical measures the correction of this crying evil. Freedom to work and honest pay for honest work well done is the universal maxim of wisdom for genuine thrift. The mischief is that thousands are studying and struggling all the time to thrive by the opposite rule, reaching on the one hand after the fruits of honest work without rendering honest pay, and on the other reaching after dishonest pay for dishonest work. The grand correction for this condition of things is a more sacred regard on all hands to that great command uttered by Jehovah at Sinai some few thousand years ago, "*Thou shalt not steal.*"



## THE GERMAN SUNDAY.

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I venture to present, as a topic of social science, one on which it would be easier for me to *preach*. But while I do not for an instant concede that the Divine authority, and the teaching and practice of the Christian Church, are not to be quoted here, I recognize the wisdom and the value for our present purposes of rather choosing authorities and proofs from human and social history and experience. And, therefore, I shall hold in reserve what to many of us would be more conclusive than what I offer; but with the conviction that if on this, as on any other subject, we could *perfect* our social science—give the result of the widest induction and the soundest deduction—we might expect it in the language of that marvellous Book with which no *perfected* science has ever found itself in discord.

Europe inherited, no matter whence or how, the custom of marking one day in seven from all the others. And immigration brought that custom from Europe to our shores. It brought with it also two distinct modes of observance, which we may call the "English Sunday," and the "Continental Sunday." The influx from the Continent during the last twenty years, and the consequent strengthening of the latter mode, seem to have caused many of those disturbed by it to overlook some very obvious facts. The two modes of Sunday observance were brought here in the earliest period of settlement. While the English colonies, some of them under exacting religious convictions, enacted and practised the English mode, the French

and other European settlers were equally attached to the Sunday of their own old homes. And it was, indeed, a result of the old French war, as our fathers used to call it—the most momentous of all our wars in its results—I often think that the English Sunday was established as the custom of the country. In Lower Canada the French left their Sunday with their religion at that period, but every where else, in Canada and in the future United States, England planted her own usage as to the observance of every seventh day.

Unhappily however the importation of this English custom took place just at a period when the custom itself was a subject of controversy in the mother country. The Puritans had made it one of their leading purposes to reform the national habits of Sunday observance; had recalled from the Bible the name of Sabbath for the day; and were enforcing, as far as they could, the substitution of a strict Sabbath, like that of the Jews as they understood it, for the Sunday which the Reformation had left to the English people. Our sympathies in all parts of the conflict between the Church of England and the Puritans are likely to be biassed by our own present affinities, but it seems to me that any fair-minded man ought to look back to the two parties with a readiness to interpret the action of either in the light of the provocation of the other. They were about as wrong-headed in those days, as we are now, with the difference that it was a more earnest age than this in the maintenance of principles, whether civil or religious. The enormity of the "Book of Sports" on the one hand, is only explained by the the aggressive strictness of Puritan books and enactments on the other, and vice versa. Hence it came that when a Puritan commonwealth was founded on our shores, the Sabbath was imposed with all the greater strictness because it had been fought for in England. The rulers and people would have it and enforce it, and prove their doctrine about it by a demonstration. I need not quote the blue-laws which even made Sabbath-breaking a capital offence, and then by prohibiting

walking in one's garden, cooking, making beds, sweeping house, kissing one's wife or child, must have tempted men even to risk the halter. Those laws were soon repealed, but the Sabbath, down to the childhood of some of us, burdened men, women and children, specially the latter, with a load almost too grievous to be borne. And the natural result has followed, a reaction so complete, that thousands of the descendants of the Puritans have either given up the pretence of keeping the day holy, or are content with an observance for which their fathers would have put them in the stocks.

But meanwhile, during the progress of this history of the Sabbath, our population was being steadily recruited from the old world. And the new comers did not usually bring the Sabbath with them, unless they came from Scotland, where the Puritans had succeeded in planting it. But finding here either the New England Sabbath or the English Sunday, with which most of them were familiar, they confirmed and aided in the establishment of Sunday observance as the national custom and law. The immigrants from the continent, greatly in the minority, more or less conformed to American usage; and all over the land Sunday was marked from other days by the cessation of business, the public worship of God, and the general quiet and rest of our whole people. Within the last quarter of a century events on both sides of the ocean have turned the tide of continental immigration to us, and great changes have resulted in many directions. And one of these has been, that the continental Sunday has been brought to us by thousands, fresh from its own home, accompanied with such associations, and sustained under our universal suffrage, with such political power and other influence, that it threatens to usurp the established American custom and to reign in its stead.

I can but regard it as unfortunate for all who are rallied against it, that the reaction from the Puritan Sabbath has lost them so many allies. I do not mean allies in talking, but in

action and influence. The advocates of the continental Sunday may say to those on the other side: Your custom has had two centuries of possession of the land; it should be strong enough to stand; but we find thousands of your own people, if not welcoming our mode, at least weary of yours. Had all our English-speaking citizens been firm for our own custom, the new comers would have accepted it, in spite of their increasing numbers, as their predecessors had done. But having lost that vantage-ground, the friends of the old mode are disposed to strike very wildly and unreasonably, I must be allowed to say, in its defence and in attack upon the strange Sunday. Into the theological aspects of the question we do not enter here; but the most strenuous advocates of the Puritan Sabbath, or the one most shocked by the continental innovations, may well be advised not to waste breath, and risk his cause by surveying the field from no point of view but his own. There may be in the annals of human folly precedents enough for announcing, "Thus saith the Lord," with one's own interpretation of the saying, and then proceeding to style all who don't agree and obey, infidels and unbelievers. But I think it will be wiser to consider what is to be said on the other side before you band together against you all sorts of opponents, many of them of your own making by your process.

Here in Wisconsin our conflict on the question has been brought about chiefly by our large *German* immigration, and I shall speak therefore, henceforth, of the *German* rather than the Continental Sunday. If we inquire into the history of the German Sunday, we shall find that it has the highest sanctions of Luther and his brother-reformers. Those great men were but human, and could no more restrain the reformation-pendulum at once in its proper arc, than the rest of us can in minor-matters. They found the LORD'S day included in a great number of church festivals and fasts, all put on a like ground of obligation, and burdening the people. Their reforming zeal undertook to discriminate between the Sunday

and the other days, among the latter retaining certain great festivals, but very jealous for the paramount authority of the Sunday. They were not agreed among themselves about the ground of its obligation, and as discussion went on about it, Luther, and even Calvin, and others were drawn into giving their authority to what seems to us lax observance of the day, in their fears of the people's relapsing into unreformed practices, or adopting views of their own opponents. For instance, Luther's saying, quoted from his Table-talk, "If anywhere the day is made holy for the mere day's sake, if anywhere any one sets up its observance on a Jewish foundation, then I order you to work on it, to ride on it, to dance on it, to feast on it, to do anything that shall remove this encroachment on christian liberty." And what he counselled, he seems to have done—and as it was a convenient mode of proclamation of reformed views and practices, one in harmony with the national instinct for outdoor enjoyment, whatever the previous Sundays have been among the throng of holy days, the German Sunday now was established with all the honors, and with all the earnestness, of the leaders of the Reformation.

Very sad, sometimes, are the evidences of human weakness, even in the case of great men, and of whole nations. We may wonder and lament that they did not reach the divine truth, instead of supposing that they found it in the contradiction of errors; but so it was. The religious earnestness of the time probably prevented immediate evils from their laxity, if we so regard it. But they bequeath it to less earnest generations, with the sanction of their great names, and with national pride associating them with it. So when you undertake to waive away, or condemn the German custom as a mere instance of infidelity, or actual hostility to the christian religion, you are very likely to array in its defence every German who hears you, from the mere instincts of patriotism. Whereas the Germans in this country are as much divided on the questions about the day, as we are divided ourselves between the Puri-

tan Sabbath and the English Sunday. Thousands of them not only are not infidels, but are contending for the Lord's day against infidel associations whose avowed object it is to desecrate and destroy it. And it is not more honest to confound friends with foes, than it is politic to make them all foes by indiscriminate attack. The custom is hallowed to them by education, by associations of their childhood, of their friends living and dead, their home and the fatherland. It is no more than plain common sense to look at it with their eyes, to admit what ever good there is in it, and to enlist their aid with some other argument than that our Sunday is of the Lord, while theirs is of the devil. And that is actually what they constantly have to hear upon the subject.

The love of out-door life I have referred to as a natural trait of the German race, and it is one which we Americans may well envy and imitate. I have seen a little bit of yard in a crowded city, containing a small grass-plot and a shrub or two made the chief scene of family recreation, despite the large and well-furnished parlor. And let it also be borne in mind that it is always *family* recreation which they seek; that in their simple amusements and pleasures, men, women and children participate. It is not their way to leave home and all its affections and influences and go to places and entertainments to which they cannot take their wives and sisters. All who have seen them in their own country will testify to the quiet and well behaved crowds which assemble in the gardens and parks, evidently not for entertainments—for in many of the most frequented none are allowed, still less for hard drinking or other vice, but for the enjoyment of their friends and of out-door life. I am not prepared to pronounce a Sunday afternoon so spent intrinsically less innocent than that of nine-tenths of our native population in which a special dinner, a lazy sleep, after the children have been sent to the convenient Sunday school, and the Sunday papers, are the chief employments, even when conscience, personal and traditional, forbids riding and

visiting and walking out. Let us make no naked issue with the Germans. In the Fatherland men whom all honor for their Christianity have followed the custom we condemn. To us, with our habits and opinions it would be wrong, but to them attending circumstances will make it right or wrong, and those circumstances I think we need to press upon them, waiving the question of difference of custom, until we can convert their judgments and consciences to our views of obligation and duty.

I have made no apology for the German Sunday, but only urge that it should have the full weight of the fact that our adopted citizens like it, not because they are sinners but because they are Germans. Feeling an intense anxiety that our English and American custom should prevail, I wish to point out the injustice and impolicy with which the matter is commonly treated. And now granting all that has been admitted, let me urge some reasons why the German innovation should be resisted in all proper ways.

That some consideration is due from them to the feelings and habits of the country which so heartily welcomes them, the intelligent among them would readily admit. You cannot imagine an American crowd invading the rights and customs of a German community, as they have done ours. It would not be tolerated for an instant. The day we reverence as God's appointment, the quiet and order we desire for it, the undisturbed houses of worship and burial places of our dead to which we are surely entitled, the influence and moral atmosphere we would keep about our children—all these are invaded by strangers within our gates. We give them citizenship and all its privileges, even suffrage and political power, and they trample on our ways and feelings, saying that they have rights as well as we. I have known a beer-garden to be opened almost at the door of one of our churches, and the services broken in upon by the blasts of a brass-band. I have buried the dead to the music of a waltz and the laughter of a

merry crowd while the mourners were almost jostled at the side of the grave by other Sunday idlers. Our Sunday Schools, on which we depend, foolishly enough, I grant, for the religious teaching of thousands of our children, are commonly depleted of the boys during the summer months, because of the attractions and excitements of the gardens. The vicious of all nations, our own included, find on Sunday both their strongest temptations and their best opportunities. Thousands of men, women and children are robbed of the rest of one day in seven to minister to the pleasure-seekers. The moral sense of the community is debased and weakened by the example of the violation of law, and the victory of pleasure over restraint. Nay more, it has come to be the settled and avowed determination of associations of men to compel the day's desecration; to choose it for public celebrations, to repeal all restrictions and restricting ordinances; to release the American people from the superstition of Sunday observance.

Now for these evils, which justify my subject on the present occasion, for these evils who are responsible? Not we, say many of our Germans. If we were left to ourselves, many of these excesses would not occur. We never had them in our own land, we have no desire for them here. Vicious Americans, Irishmen, and others interfere with our quiet; so much so that many of the gardens we never visit, nor can we take our wives and children to them as we used to do at home. This has been often said to me by respectable Germans who at the same time were offended by the denunciation of their custom as all evil. And they were right, and yet admitted all the charge. Granting all that they can say as to the harmlessness of the Sunday in the Fatherland—for that is not the point of discussion—it cannot be harmless here. They exchange a society of one race for one made up from all the nations of the earth; a society, of defined ranks and orders, for one in which



all men, from the highest to the lowest, have equal rights; a society under strict law absolutely enforced, for one whose police regulations and administration are swayed by the popular breath; a society accustomed for centuries to the Sunday, for one in which it is an innovation, a step of decline, a liberty which instantly passes into a license for immorality and vice. And good citizenship—may I not say, sound social science—demands that they should look upon the custom as one that cannot be transplanted from the Fatherland. There it may continue as they have known it; there they may enjoy it when they return to visit or to dwell. But here, in return for American opportunities and rights, which, they would acknowledge, repay for all such sacrifices, they must be content to give up the custom, or be held responsible for the flood of evil to which it opens the gates.

As, however, my opinion and advice are not likely to bring all the Germans at once to give up their Sunday, I think there are some measures that we Americans should take for our own protection. Every city and large town should have its own public gardens and grounds conveniently situated in the outskirts where it will interfere with no worship; made as beautiful and attractive as possible, and on Sunday under special police regulations and oversight. The Germans at home have their beer gardens, private establishments, and also palace gardens and such public parks where no beer is sold no amusements provided, nothing but the heightened beauties of nature and convenient seats and look-out places, and so on to enable all to enjoy them. Now let the public provide the the latter kind of resort here. Our own mechanics and laborers need it, shut up as they are on all working days, and having but confined and close homes. Suppress with a strong hand the sale of liquor, and indeed all buying and selling on the grounds and in the vicinity, and everything like disorder. Then all that is innocent and valuable in the German custom will be within reach, while the vicious of their own and other

nationalities will be kept down. And the only servants of the crowd who will lose the day of rest which mere human experience, apart from the Divine Law, has pronounced to be absolutely necessary, will be the police, whose apportionment of duty may save them even that loss. If any are disturbed by the suggestion of allowing and encouraging such laxity as this, I have only to say that having made this provision to prevent a great abuse, it will then be the field of effort of all christians of all names in this free country to bring the people up to the standard of religious observance, which they may severally regard, as a matter of obligation under Divine Law. It does not follow in every instance that a man's view of the Sabbath, or the Lord's day, is such that he can win the others to its adoption. And it may be that the reason is in the view itself.

I have wished, in this paper, to indicate what seems to me the right line of argument on a difficult question, and to condemn the one which is usually taken as impolitic and unjust. It is one of a great number of topics belonging to this section of the Academy, growing out of the relations of our American and foreign born citizens. And on all those topics I venture to lay down a proposition by no means new, and yet being constantly forgotten, in legislation and in social problems, one under which all that I have said, when restraining myself from religious arguments, might perhaps have been included—that foreigners, on becoming citizens, should become Americans as far as possible—that neither in language, nor schools, nor churches, nor in other social or political relations, should they be encouraged to perpetuate their nationalities. It is true that they must mingle with us in a generation or two, but no little evil is caused by their efforts to keep themselves apart and by the politician's concessions to this natural but mistaken desire.

## SOCIAL SCIENCE AND WOMAN SUFFRAGE.

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The English periodical, *Nature*, reviewing an essay of Huxley's on what it calls "the irrepressible woman question," makes the following statement. "We are confident that this question is one which must be ultimately settled mainly upon physiological grounds. and it is just because the conventions of society very rightly do not admit of the full and fair discussion of those grounds before mixed audiences that the extreme emancipationists have been enabled to obtain for their theory the amount of currency which has fallen to its lot." It would seem, however, if the conventions of society forbid the discussion on the platform and in the parlor of the most fundamental aspects of one of our gravest social problems, that there ought to be some method devised by which such material matters may be brought prominently before the public mind. Human society cannot be preserved if matters which are of primary import cannot somehow be subject to open and general consideration. Social Science, if it is to have any value at all, ought to adapt itself to such exigency. The object of this essay will be to suggest thought mainly upon the physiological features of the question of suffrage for woman.

So far as the advocates of political franchise for woman have gone, their position seems, in the main, to be correct. We accept the most radical theories of "rights" that have been propounded. We maintain that "governments derive their just powers from the consent of the governed."

We have no confidence in the distinction so often sought to be made between natural and political rights. Political rights grow only out of natural rights, and of these latter woman has as many and as comprehensive as man. And if the agitation which we are having on this subject shall explode the notion that man has some royal political prerogatives over woman, it will have done a good work toward settling a basis of correct ideal of the relation which should exist between the sexes.

We challenge also another of our political aphorisms commonly regarded as axiomatic; to wit—that rights and duties correspond. This is only ideally true. It cannot be pressed in practical life. We may have rights by the score without duties attached. The man who stays by the bedside of a sick wife or child, may have the *right* to vote. The *duty* may be not to vote. So long as it is a question of “rights,” we are convinced that the *right* of a woman to vote is as good as that of a man. But we have not solved the problem of society when we have thought along the single line of personal rights.

When in practical life all questions are considered, it may not appear to be the duty of woman to assume active participation in politics. With the same inherent right to have share in political affairs as man, woman may nevertheless refuse to consider it to be her duty, either from the consciousness that nature has assigned her sufficient duties of another character, or that she has already assumed a sufficient number of her own choice.

We see no insuperable obstacle why government may not sit firmly in the “consent of the governed,” though half of the governed be women without the ballot, not even if the statute gives the ballot to males exclusively. That statute may and ought to express the consent and conviction of woman as well as of man. We hope the discussion respecting “rights” will be continued till this result is attained. Let no government over woman rest on the suspicion of might or of

prescription. If man retains the sole agency of society in political affairs, let it be only upon assent by woman after examination of the whole matter had. We predict that such assent will ultimately be given.

We discard all theories of woman's inferiority. We believe that woman *can* do what man can do. Possibly man may have some advantage in power of brain or brawn, and in endurance. But the advantage is not so great that woman cannot keep near enough to him in any kind of activity to be a helpmeet for him. And it is a matter of common observation that the helper is often in all respects superior to the helped. If in anywise woman be inferior to man, we regard her as having also compensating superiorities. We do not oppose the entry of woman into politics, because we suspect her of incapability for its emergencies. Given a common field to woman and to man, and we will grant substantially equal results.

But if woman is to be a wife and mother, the inquiry arises: Does she want a common field? Is it wise or prudent to attempt to cover the ground of all man's activities, and discharge the functions of motherhood beside?

Marriage constitutes a special condition for woman, as it does not for man. Yet the vast majority of women pass into this special condition. Married woman is the dominant and representative element in the class woman. A social scheme for woman, founded on her condition as *femme sole* would be playing Hamlet with the part of Hamlet left out. The bearing which the assumption of political duties by woman will have upon this special condition, needs to be closely scrutinized. Suffrage, and all the burdens that follow with it, will be opened to woman near the years in which, as a rule, she enters upon the responsibilities of marriage. The question is, does woman, as she enters upon those responsibilities, want to assume the department of politics beside? If the *married* woman does not, is it wise to open the department to women at all?

The cry of the mother from an average home now is of over work. Grant that this comes from the ignorance and sin of man, yet woman's assumption of the right of suffrage will not put the millenium in his heart. It will not take an ounce from the burdens already pressing. It will simply add the distraction of one more. The great source of misery to a married woman now is that her maternity is regarded as only an incident in her life, while during the months and years in which her vitality is consumed by it, it should be regarded as the sole end. Maternity is duty assigned and enough of duty. Instead of asking if woman cannot assume some other duty, the attention of society should be directed to devising methods of relief from the necessities that now press upon her. Beyond what nature imposes, a mother's duties should be optional. And yet she is asked to assume another duty which ought to be inexorable wherever it falls.

We see often in the high quarters of the advocacy of suffrage for woman an ignorance or an ignoring of the physiological bearing of the question that is astonishing. A far-famed and much respected supporter of the so-called reform hails the good time coming when "marriage and motherhood no more complete a woman's mission to the world than marriage and fatherhood complete a man's." We grant that a married woman may have other aims in view besides what maternity imposes, *but she cannot have such aims on equal footing with man.* If she is to be a mother, these other aims must be held by her in a comparatively subordinate position to that in which they may be held by man. Marriage and motherhood *do* complete a woman's mission to the world more than marriage and fatherhood can complete the mission of a man. It would be impossible to secure equality between the sexes here, even with "just men made perfect." God has drawn the fiber of woman around motherhood with a tension he has not put upon the paternity of man. Marriage assigns function and destiny to woman as it does not to man. What kind of wild reason-

ing may we not expect when the enormous difference between the physiology of maternity and of paternity is sunk from sight?

The entry of woman into political life means burden, if the event is to have any significance at all. If woman is not going to reform politics and government, she might as well let them alone. But if she is going into the work of political reform, she will find there is something to be done beside the holiday sport of riding to the polls at elections in gaily-bedecked carriages, with streamers flying,

“All the while

Sonorous metal blowing martial sounds.”

If she is to improve the present condition of things, she must master the science of government and the arts of politics; she must attend caucuses, and plod through the weary work of the investigating committee. Unless she does this with an energy and purpose not now practiced by men, where will be the gain to society from her advent into politics? Remember now the fact that the strain in politics comes in just those years when the functions of maternity make their demands. If woman is to be a helpful element in political affairs, she must be a *constant* element in it. One of the most serious portents of our politics now is the lack in men of steady and persistent action. Senator Wilson, of Massachusetts, in a late review of the situation of affairs in the city of New York, puts the responsibility for the disgraceful condition of things there existing upon the men who were entitled to the right of suffrage and did not use it. But all motherhood ought to have no sense of care or responsibility for politics. It is idle to say that those upon whom the burdens of maternity are actually resting, either prenatal or post natal, may be allowed the privilege of retiracy. If from time to time, as she emerges from retirement, a mother is to be of any help in politics, it must be because she has the while carried it along with her.

Two years of dismissal of it from the mind in these days is to take a Rip Van Winkle sleep upon it. It may be said that men neglect politics when they please; and it may be asked why women may not do so also. The answer is, men do neglect it; mothers ought to.

The appearance of woman in politics then means her constant agency in it. It must take that form or our politics will be swept by the lower stratum of society with majorities such as we never heard of before. The mothers there will be governed by neither reason nor delicacy. They will appear at the polls let what will of maternity betide. And then must come our appeals to the mothers of culture and refinement not to allow our system to be swamped by the votes of the stolid and ignorant. Now remember that woman is particularly impressible to duty. Remember that motherhood from its peculiar physiological conditions is especially sensitive to excitement; then think of a presidential campaign and ask if the considerations from physiology alone are not sufficient to warrant shutting the gate against the possibility of bringing the sense of duty to bear on the mothers of our land, in such times of passion and agitation? The *Independent*, a firm and reasonable advocate of woman suffrage, says with respect to suffrage as it now exists: "Not to vote is an offence against society as stealing is an offence." That is right. And that is bringing the sense of duty home to men as it ought to be brought. But will you lash motherhood to political action with any such scorpion? Yet it must be done if she is to step into the political arena to take equal responsibilities with man. Voting is not all of the matter. Behind the vote must be planning and care and anxiety and effort that the election go rightly.

The physiology of this matter must somehow be brought to the front in the public consideration, unless we are willing to take a Niagara plunge on folded oar.

To ask woman to take up the department of politics ought to be considered an imposition upon her.



Our civilization or our barbarism has already added too much to her duties. We have added now so much that she has to let department after department of culture and social activity drop from her grasp when she takes up from nature the great office of maternity, and they lie in neglect and confusion around her. And yet we have the coolness to ask her if she could not possibly stagger under an additional burden.

"The harp that once through Tara's halls  
The soul of music shed,  
Now hangs as mute on Tara's walls  
As if that soul were fled,"

is the requiem that almost every young mother has to sing over many a discontinued accomplishment. With no time now for music, art and literature, we propose to ask her if she will not spend a few days on an investigating committee, on the accounts of the keeper of the house of correction, or prepare a speech for the next ward caucus in favor of vacating an alley in somebody's addition.

The matter seems ridiculous. But just where ridicule seems now to come in it is more than possible that a cleft might be made for the entrance of the sense of duty if suffrage be opened for woman.

Woman must stop somewhere or break. She cannot discharge the functions of maternity and assume all the departments of man's activity beside. This is as sure as the doctrine of the conservation of force. In fact that doctrine underlies the whole matter. When the forces of the system are taxed to their utmost in one direction, if severe efforts in other directions are assumed, it is in vain to expect to avoid catastrophe.

Right here is the place to look at the bearing of this matter of suffrage upon the question of the education of woman. We are now attempting to carry up the public education of our young women to the same grade as that of young men. We believe with due care for health and physical development, this

may safely be done. But even this will be physiologically defensible only on the ground that the young woman's competition with the young man shall cease when she enters the marriage relation and the forces of her system are directed by nature to maternity. Woe betide the day to her offspring if she attempt to carry it on then. There is exhaustion in any system of education. It may be but healthy exhaustion if we stop where nature has marked a pause. Your high systems of culture for women will take their place only as part of a general system of physical debilitation, if the struggle for equality with man is to continue under the extraordinary tax of maternity.

Why woman needs a culture equal with man before marriage, is *because* she must or ought to cease when she comes to motherhood, from the efforts he can continue to make. If the same tension that he can endure is kept on her continually, and then she assume maternity beside, her thread will part.

By and by, if we are not wise, we shall have a rebellion against the attempt to open our higher systems of education to woman, when the real trouble may not lie in this preliminary work of life, but in the attempt to run an equal race, carrying double burdens afterwards.

Now if there is any one department of man's activity that woman can afford to let him bear alone, it is this one of politics. She ought not to be so alien to her own nature but that the sweet influences of maternity can compensate her for anything man finds in political life. Politics is but pure drudgery to the mass of *men*. So much is this so, that the great difficulty is now to get *intelligent men* to endure its irksomeness. Doubtless almost anyone would be willing to accept some office high in rank and flush with salary. But these places are only for one in hundreds of thousands of men now, and a mother would rarely or never see them if woman had suffrage and was eligible to office. Motherhood in solid phalanx would be remanded to the wearisome, distasteful tug of

work to which most educated men are bound only by a sense of duty. It is not the highest style of manhood that is led captive by politics; and how a woman can become enamored of it is "passing strange."

Politics represents rather the friction of society than its conserved energy. It is a low state of civilization where much of social power is turned into its channels. When you hear a great din in politics you are only listening to the *creaking* of the wheels of state. When politics runs high, arts, industries, sciences and education are apt to be running low. You can see this illustrated in the difference between the south and north divisions of our own union. The south for generations has consumed its energies in politics. It has simply been burnt up in its own excitement, and it has nothing to show for it. The great unfilled vacancies of the south on a railroad map, are testimonies to the desolation that results when society makes politics a prime ambition. Viewed as an industry, it is the most precarious of all methods of meeting the problem of subsistence. What chances it offers could scarcely be open to *mothers* at all.

Neither need unmarried women look in this quarter for any hope of solution of their difficulties. One of the most pitiable objects among men is the stranded politician. If a woman has failed to secure a life companion, she need not give her heart to politics. Politics can jilt as well as an individual. It is proverbially fickle. Heaven forefend an unmarried woman from adding to her man-forsaken plight the condition of a bankrupt politician, forsaken of the gods. Politics is not an industry. As an industry it has done nothing for man. It can do nothing for woman. At any rate it has nothing for motherhood but burden.

The prizes which a few women might possibly draw in politics cannot compensate the disaster of precipitating the incubus of its dull, repugnant, fruitless toil on the great mass already oppressed.

Why should women attempt to carry along everything? Men cannot do it. The advocates of woman suffrage often attempt to ridicule woman because of her ignorance of politics and related subjects. They attempt to constrain her to demand suffrage, to save the point of their lampoons.

But why may not women let a department go as well as men? Why may there not be some departments that they may not care to assume just because they are women?

In this age we are making our great strides in progress because we are respecting the principle of the division of labor. Is it inconceivable that that principle should sometimes fall between woman and man as it does between woman and woman and man and man? A genius cannot prosecute everything in these days. It was no disgrace to Senator Carpenter, to say, as he did the other day, that he knew nothing of chemistry. A professional man cannot cover the ground of all the outside knowledge there is in the world. Nay, even a man cannot carry all that was once reckoned as belonging to his own profession or handicraft.

We are gaining success in our civilization just because we are specializing so much.

One of the foremost lawyers in Boston recently remarked that he hardly knew the meaning of facts in admiralty. He had devoted himself largely to the law of patents. "The dog that ran after two hares caught neither," is the expression of some very old wisdom. But opportunities for its application are multiplying every day in the increasing complexity of civilization. Suppose woman is ignorant of politics! It is just possible that it may not be worth her while to know much about it. It is possible she can put her mind and energies to some other matter to better advantage to herself and society.

We do not believe there can be any very serious conviction among women that they *need* suffrage for their political or legal protection. Certainly the legislation of this country for the past generation has been swift to enact every well defined wish

of woman. If not every wrong which the clearest minded can see that legislation can touch is instantly righted, all can see that there is a tendency in legislation in the hands in which it is now placed, to rectify all known injustice to woman. But legislation has not yet managed to anticipate all the wants of man. It will hardly be able to do so in the case of women. If women have wrongs that are subject to remedy by legislation, let it be remembered that the general law is that wrongs must be endured till they are smitten into the general sense of society as wrongs, before it is wise for legislation to meddle with them. We have been so hasty to execute any wish of woman that the wisdom of some things done is questioned. If any thing has appeared clear, it is the right of a woman to dispose of her own property. But even the wisdom of that was challenged by a woman the other day in a prominent periodical.

It was claimed that the right of a widow to dispose of her homestead, in practice brought evil, and that such right should be taken from her. Let it be generally felt throughout society that it is an evil, and does any one doubt that its correction can be secured through the present system of legislation; though to do so would be just to box the compass in the attempt of legislation to meet the wants of woman. The question recurs, do women to secure fitting legislation for themselves as a class *need* to assume the burdens of suffrage?

There is one other respect in which the physiology of motherhood is seen to have even a more important bearing upon this suffrage question than in the matters already considered. What has thus far been treated relates almost entirely to the welfare of the mother herself. We shall look now to the welfare of her offspring. The Saviour, on an important occasion in his teaching, took a little child and "set him in the midst." If we oftener imitated his example in social questions, we should less often commit blunders. The child is the key to the whole position. If we are worthy the name of Social

Scientists we shall look to the well-being of the coming generations. If we do this we shall see why it is that the *mother* comes to the fore front in the consideration of the question of suffrage for women. The next generation is the gift of the motherhood of this. We need to scrutinize this movement for suffrage to see if it does not have more particular reference to those who are not mothers, than to those who are—to woman out of the ordinary family relation rather than to those in it. If it does, the probabilities are decidedly against it as a movement in the interest of posterity. The very first claim that one generation has upon that which precedes it, is the transmission to it of sound physical constitutions. Unless this is done, the gift of being under ever so favorable a condition of "rights," will hardly be worth thanks.

The question is one of direction of vital force. Where shall a mother's energies, go—to politics or to her children? Is our politics in such need of the efforts of mothers in it, that to rectify it we must rob our children of the flush of vitality? Of course this argument is good for nothing if no power is to be put forth in politics. But if power is not to be put forth, again we ask what significance there is in woman's entry upon it? This argument too has no validity, unless the mother in an average home is already an over-burdened factor in society.

We desire here to give credit to Gail Hamilton as the only writer whose works we have read who seems to have a proper conception of this matter we are now considering. To the often asked question why the women of this generation cannot do the work of their mothers, Gail Hamilton replies "We cannot do the day's works our mothers did *because* they did them." We regard that reply as containing philosophy enough to cover this whole suffrage question. The spinning wheel and loom of our mothers consumed vitality that should have come to us. There is an everlasting weariness on us all who came out of the average well-to-do homes of the past generation—the legacy of the over-work of our mothers. The mothers "ate

sour grapes and the children's teeth are set on edge." Not only the iniquity but even the frugality and industry of mothers may appear in curse upon their offspring. You cannot cheat the law of the conservation of force. You cannot break the line of continuity between generations. Nature goes down through all and if she cannot collect her forfeitures of the guilty she will of innocent offspring. We are convinced that before suffrage is taken up by woman we need a great deal more of consideration given to the probable influence of the assumption by motherhood of greater work than she now performs upon the well-being of posterity.

It is not simply the "personal rights" of the generation on the stage that is concerned in this matter. We stand in thoughtful pause before a question Coleridge asks: "Can anything be more dreadful than the thought that an innocent child has inherited from you a disease or a weakness, the penalty in yourself of sin or want of caution?"

We question whether our social or domestic life would gain anything in value from bringing forward politics as a more prominent element in them, as must be the result if woman is compelled to take up this new department.

After a mother has performed the home duties which the day imposes, we question whether it would be profitable for her to spend her time in studying and expounding to her family questions pertaining to tariffs or civil service. It probably is important to determine how much a sheriff's fees should be or whether the government duty on indigo should be two shillings or two and six per pound. But we question whether it would be a step upward for a mother and her children to pass to these matters from the music, art and literature which now adorn or ought to adorn our homes.

There is one collateral matter to which we desire to allude, and that is the matter of inequality of wages. Now we do not for a moment argue that there cannot be nearer approximations made to justice in this matter than we now make.

But as a general rule, is there not justice in the present arrangement that a man should receive more pay for the same work even, than a woman? Ought not *family* wages to be more than the wages of an individual? And ought not a husband to be charged with the responsibility of earning the family wages? The working factor of the family ought not to be the wife. The line of labor through which the family living comes, ought not to be prosecuted by the wife. Saying nothing of sentiment, physiology forbids it. The *man* who goes forth to work, represents not only his own needs, but those of wife and children behind him. He must receive more wages for his work than an unmarried female who is his competitor, or the possibility of maintaining the family relation in society is at an end. It may be asked, why speak of his competition with an unmarried female? why not look at the case of a widow with children to support? The reason is because the case of a widow with a family to care for, is an exception to the rule in the case of families. We should occasion more misery than we should relieve if we were to equalize wages to meet her difficulty. Her case must be met in some other way than by putting all the families of the land down upon the footing of competition with those who have only the needs of a unit to supply.

If it be asked, why not give the unmarried of each sex equality of wages? The answer will be that this in effect will only be to make them both competitors against families at lower rates than those on which families can be supported. And a further answer is because the adumbration of marriage is over them both. If man ought to earn the money from which the support of families comes, it is difficult to see how the general rule can be otherwise than that the wages of man ought to be greater than those of his female competitor. The main work of life for which wages is paid is done or ought to be done by married men. If young men unmarried, as against young women unmarried, so far as wages are concerned, are

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reckoned with married men, it is because "coming events cast their shadows before." They may both be reckoned now for what, as a rule, they are to be. The injustice is not great in reckoning man from the beginning as the wages-producer and compensating him as putatively responsible for the maintenance of a family. The wife at marriage enters into the enjoyment of any surplus the husband may have gained. If this discussion is not understood, we would like to ask a question which, we think, can be understood.

When the wages of women are everywhere equal to those of men, how can a mechanic hire the female assistance which his wife again and again in her motherhood must need? His day's wages can only offset the wages of the help he hires and then where shall the family subsistence come from?

Unjust as the present system of wages may often seem to be to woman, it is questionable where we can put our hand in to remedy it, without doing more damage than benefit. We are convinced that no system of reform respecting wages can be sound which does not plant itself immovably by the side of woman *married* and regulate everything primarily in the light of her highest interests.

We are pushing the principle of individuality to a destructive extreme. It is a surface question in sociology to ask simply if the wages of one individual ought not to be equal to that of another for the same work. Behind this lies the question "ought not families to be supported, and how can this be done?"

Business with its great motto, "You buy best where you buy cheapest," has respect only to this principle of individuality. But the interests of business are a narrow foundation on which to rest a social system. A society that followed business maxims only, would be barbarous, infernal. If social science desires to be of service to humanity, it must impress society with the idea that the necessities of *families* must be looked to in settling the principles of compensation for work. When this is done, other things being equal, we shall find that

in competition for employment, preference will be given to married men, and that there will be discrimination in the rate of wages in their favor. Thus shall we render aid to the greatest number of women, and to the class most sorely needing it. Here let it be said that the great social question before us is not how units of either sex can take care of themselves. The subject of prime importance pressing upon us is not the matter of opening new avenues of employment to women who are out of the ordinary family relations. So far as the "struggle for existence" is concerned, there is no one now in our society more favorably situated than an unmarried female willing to work, no one who has less difficulty in maintaining an honored social position. *The great social question is how to lighten the burdens of women in an average home, how the wives of farmers, of mechanics, of laborers, of men on small salaries and men with moderate incomes may assume motherhood, without the grave or an insane asylum in the near prospect.* In other words, the great question is how a *married man* can properly provide for his family.

We want to enter a protest against the philosophy of John Stuart Mill respecting the social position of woman. He asserts that because woman has never been on practical, political equality with man, that therefore we know nothing about her or about her appropriate social position and function. That we have nothing for it but to try her in every new position as it is proposed. But if all human experience has gone for nothing, all human experience will go for nothing. If the human race has not hit the *high road* of nature in this matter hitherto, there is little likelihood of its *ever* striking it, or of ever knowing it if it did. If something like the great law which has prevailed in all time, across the whole social scale, from the wigwam to the palace, by which the exoteric duties of a home have been assigned to man and the esoteric to woman, we may despair of being able to find any regulative principles whatever. It has not yet become folly in other depart-

ments of our social life to be guided mainly by experience and to attempt the untried only with circumspection.

The great body of our liberties stands in common law. Our special charters have added little or nothing to them. There is little in Declarations or Bills of Rights or constitutions that would not have been law without them. These great documents that we invest with so much of historic interest were but little more than codifications and reaffirmations of existing liberties. Yet our common law so rich for us in its beneficent privileges is based on the fundamental principle of respect for past experience. Its first motto has been and always will be "stare decisis." Its first principle of philosophy has been that human experience is a safer guide than human speculation. True it has adopted new principles under new exigencies, but never without an examination that sifted the elements of the case to the bottom, and subjected the finest comminution to inspection. A man who thinks he has a new principle to engraft on common law may look upon himself as one of the elect of the ages. So thoroughly are our liberties grounded in experience. Yet in a social matter of as much importance to our happiness as anything the common law secures, Mr. Mill advises us to launch out on an "unknown sea" without chart or compass from experience and make what port we may. And there seems some danger that we may follow his wild philosophy. So far the question of suffrage for woman has had little but superficial treatment. The fundamental questions involved have hardly caught the public attention. That there are evils attending the adjustment of the social relations of the sexes we do not deny. That some of these evils may be removed and perhaps all mitigated, we do not deny. But we can hardly expect to remedy all at once by an inversion of the foundations on which society has hitherto rested. We shall do better to do as has been done in common law—(and by the doing of which it has earned the name of common sense), look at our specific evil and apply a specific remedy and then stop. The most daring

innovator in common law, Lord Mansfield or Byron Paine, never dreamed of revolutionizing the whole legal fabric when it was necessary to reverse a former decision or lay down a new principle. He pruned simply what was effete. He introduced just what was required for the case in hand. He did not try to make his reform so broad as to cover all possible contingencies of the need of reform.

The evil of this suffrage movement for woman is that it asks for more than is needed. In the attempt to relieve certain evils it brings greater calamities than it cures. It prays for the deluge, to carry on irrigation. The question of woman's wrongs needs to be divided and considered item by item. Remedies can then be devised that will meet intelligently the case in hand. If it seem best, we can advance so far as to make woman eligible to all office. We can do this without compelling the whole class to take up suffrage. If a woman wants to enter political life let it be a matter of option with herself without compelling all womanhood to drag through the drudgery of politics for her sake.

While society exists in anything like its present conditions, suffrage ought not to be imposed upon woman. The only result will be to add to an already oppressed class the heavy burdens of our political system.

## THE PRESENT CONDITION OF THE COMMON JAILS OF THE COUNTRY.

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BY SAMUEL D. HASTINGS,  
Secretary Wisconsin Board of Charities and Reform.

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The questions as to what shall be done with the criminal classes? how can society be best protected from their depredations? how can their numbers be decreased? what can be done for their reformation? how can their condition be improved? and others of a similar character have occupied the thoughts of not a few of the statesmen, philanthropists, and christians, not only of our own country but of all the civilized countries of the world. Prison associations have been organized in different States of the Union and in different countries of Europe; able reports have been made by these associations and by legislative committees; a national prison congress was held in the city of Cincinnati, in the month of October, 1870, from which emanated papers prepared by some of the ablest and most learned men of this country and of Europe. Through these various instrumentalities, and through these different sources, much valuable information, in answer to the important questions suggested, has been spread abroad, and much has been done to enlighten the public mind touching these great matters.

One of the results of the national prison congress held at Cincinnati was the adoption of initiatory measures for the calling of an international congress.

The Rev. Dr. E. C. Wines, for many years the corresponding secretary of the Prison Association of New York, was appointed a commissioner or agent to make the necessary arrange-

ments for the holding of such an international congress. He has since visited the different governments of Europe, and has everywhere found an entire willingness on the part of these governments to co-operate in the movement, and, as a result, arrangements have been made for the assembling of such a congress in the city of London, on the 3d day of July of the present year.

There is but little doubt that all the governments of Europe will be represented in this body, and it is earnestly hoped that representatives from all the States of the Union will also be present.

As one of the results of the investigations which have been made in relation to the condition and wants of the criminal classes, some most astounding developments have been made as to the condition and influence of the common jails of the land.

In a brief paper of this character, I shall attempt nothing more than to present, chiefly in the language of others, a few facts and suggestions touching the matter under discussion.

In the report of the "Special commissioners to examine the penal reformatory and charitable institutions" of the state of Michigan, made to the Governor of that state during the past year, is found the following :

"Ours has been the experience of all who have undertaken to examine the actual condition of county jails, whether in this or in other states.

"Their condition is wretched beyond all power of description, and beyond all conception of those who have not had the experience of their own senses in the matter.

"There are, of course, marked differences in the condition of the jails; some few, *a very few*, are subject only in a slight degree to the sanitary objections made, but we speak of their condition in general.

"The defects in them are not owing so much to the manner in which they are kept, as to inherent defects in their construction, their dilapidated condition, and a fatal vice in the common jail system.

"For the most part, our sheriffs are both humane and competent men, and as a general rule the prisoners are well fed, and treated with a reasonable degree of personal kindness.

It is an acknowledged fact, that light and fresh air in generous measure are absolutely essential to a healthful condition of both body and mind. For the most part, our jails seem ingeniously constructed to exclude as much of these essential elements of health as is possible without destroying life.

“Nor is any proper provision made for cleanliness of person. Many prisoners come to the jail filthy in person and in clothing. They are thrust into long, narrow, dimly-lighted, badly ventilated corridors, from which open the cells. There are no bathing requirements or facilities, and prisoners are not always required even to wash their hands and faces. This corridor is used as the sitting and eating room of all the prisoners, clean and unclean, and is often also, the privy and water closet of all; and if not, the privy is closely adjoining, and the corridor is filled with its fetid and sickening odor.

“The cells are very small, usually not exceeding in size four or five feet by eight, and seven feet in height; without ventilating flues, and with absolutely no light or air except such as steals through the iron grates of the narrow doors opening into the corridors. No breath of pure, fresh air ever reaches the inmates. Yet in these cells, alive with vermin, poisoned with the stagnant, fetid air, the prisoners spend one half of their time; and when too sick to creep out into the corridor, the whole of it. \*

“The larger proportion of the persons confined in our county jails are confined awaiting trial, and they are often detained month after month.

“They are not convicts and the law presumes them innocent. Experience shows that a portion of them *are* innocent of the crimes with which they are charged, while a much larger portion of them are never convicted.

“The power to arrest and detain persons charged with crimes is one essential to the public good, but it is one that is often abused by the malice of accusers and the reckless carelessness or corruption of officers; and innocent persons are not unfrequently the victims. But we submit that whatever right the state may have to punish convicts by depriving them of sunlight and pure air, thus destroying health of body and mind by such incarceration, it has no right thus to treat persons who are simply accused of crime and are awaiting trial. *They*, at least, are entitled to such of the decencies and ordinary comforts of life as may be consistent with safe detention.

“The moral condition of our jails is infinitely worse than their sanitary condition, and after a full examination and careful consideration, we have come to the clear and painful conviction, that they are the very hotbeds and nurseries of vice and crime, and that the state is directly responsible for a large share of crime which it seeks to punish.

"The general plan upon which jails are constructed is that of corridors, with cells opening therefrom. The prisoners are locked in their cells at night, but during the day they congregate in the corridors, without employment and without oversight or restriction as to intercourse.

"There is no separation of the convicts from persons merely accused of crime. Here, often, are gathered those old and hardened in villany, lost to shame, proud and boastful of their crimes; those who have committed their first crime under the influence of some strong temptation; those who have committed some venial offense while under the influence of intoxicating liquors or some sudden passion; mere children in the paths of vice; those who are accused, but are entirely innocent of any crime; and those who are arrested on civil process and are unable to find bail.

"If the wisdom of the State had been exercised to devise a school of crime, it would have been difficult to devise a more efficient one. Here are the competent teachers, the tractable pupils, the largest opportunities for instruction, with nothing to distract attention from the lessons. Those merely accused and those guilty of a first offense, however venial, are taught that the mere fact of an imprisonment has shut them out from all the avenues of respectable industry; that there is no hope in that direction; that society has become their enemy; and that the only course open to them is to become the enemy of society. They are taught how to do this most effectually, and that the chance of detection and punishment decreases just as one becomes skilful in crime; and all the arts, devices and exploits of the experts are taught in detail to listening and wondering ears, who soon learn to admire the audacity and skill described, and to long to imitate and excel such display of them.

"Gambling is a common amusement, and the tricks of professional gamblers are learned. The jails are often so arranged that the male prisoners can converse with female prisoners, and occasional access to the rooms of the latter has been obtained. \* \* \*

"As a rule, the prisoners have access to no books, no efforts of any kind are made for their intellectual or moral improvement, and no interest shown in their welfare. \* \* \*

"Can it be wondered at that the universal experience is that this treatment tends to make men criminals instead of reforming them? These evils are not peculiar to our own State. They exist elsewhere, and all who have turned their thoughtful attention to the subject, whether as practical men or philanthropists, unite in the opinion that our present county-jail system is an unmitigated evil and ought to be abated."

Such is the testimony as to the condition and influence of the jails in the state of Michigan, as given after personal



examination, by gentlemen every way competent to form correct opinions.

In the report of the State Board of Charities of the state of Illinois we find the evidence that the jails in that state are equally obnoxious to unfavorable criticism. This Board in their report say :

“The prisoners, in nearly every instance, are absolutely without employment for mind or body. There are no libraries in the jails; even a Bible is ordinarily wanting; papers are rarely furnished, and no work is provided for the prisoners, much less required of them. Idleness is a fruitful source of vice; and enforced idleness has developed, and always will, the most debasing passions and habits. \* \* \*

“The efforts made at reformation of criminals in the jails of this state are unsystematic, unintelligent, fitful, and in the most of the counties wholly wanting. \* \* \*

“There are three objects in view in all criminal legislation—*first*, the satisfaction of justice; *second*, the protection of society; *third*, the reformation of the offender.

“As to the first of these ends, vengeance is a divine prerogative. The second and third are the only ends which society has the right to seek to accomplish. But be it so. Admit for argument's sake that the public has a right to torture the criminal in its power, simply because he deserves torture. What then? Then let the law prescribe what and how he shall suffer. If he is worthy of death, hang or behead him; but do not, without color of law, kill him by inches by refusing him air to breathe. If he has taken his neighbor's goods, let him by hard labor atone for the act. Let him make restitution. But do not deny him the light of day; do not compel him to be idle, for weeks and months; do not disgrace our boasted christian civilization, by forcing him to live over an open privy-vault used by a score of prisoners. But a county jail is not solely or principally a place of punishment. It is more properly a place for safe-keeping of persons awaiting trial, about one-third of whom are, upon trial, declared to be innocent. The jail is also used for the detention of the insane and of witnesses—persons not suspected of crime. That a person guiltless of crime should be forced into such a place, and there confined for weeks or months, his health destroyed, and all his finer feelings outraged, is itself a crime against humanity. Such a policy makes great criminals out of little ones.”

We have testimony from Ohio showing that the common jail system in that State is similar in its developments as in other States.

The Ohio Board of State Charities, in their second annual report, in speaking of their county jails, use the following emphatic language :

“It is a startling and terrible proposition, sustained by this report (the report of their secretary), that Ohio is to-day supporting, at public expense, as base ‘seminaries of crime’ as are to be found in any civilized community. Children, youth, the young man, the middle aged, the old, all at the first simply accused of crime, and more or less wrongfully accused—many for their first offense, some old offenders, some debauched, cunning corrupters of men,—representatives of each of these classes are found congregated in our jails. And to perfect the wrong they are crowded often into an ill-ventilated, dirty, dark prison, where the whole being, physical, mental and moral, is soon fitted to receive all ‘uncleanness with greediness.’ With bad air, vile quarters and depraved associates, little can be added to hasten the perfection of the student in crime. And these schools of crime are to-day found in every county in the State, sustained under form of law, and at the expense of the public.”

The Committee on Prisons, of the late Constitutional Convention of New York, in a report to that body, sum up the result of their investigations as follows :

“That there is no one of the sources of crime which is more operative in the multiplication of thieves and burglars than the common jails of the State, as at present organized.”

The Committee of the Prison Association of New York, in their report for 1867, speaking of the jails of that State, say :

“They are, indeed, as now constructed and managed, nothing less than seminaries of vice and nurseries of crime.”

Miss Dix, the eminent philanthropist, after an extended observation, says :

“If it were the deliberate purpose of society to establish criminals in all that is evil, and to root out the last remains of virtuous inclination, this purpose could not be more effectually accomplished than by incarceration in the county jails, as they are, with few exceptions, constructed and governed.”

From the report of the Prison Association of New York for 1870, we find that but little improvement has been made in the condition of the jails of that state, although the attention

of the legislature and the people was called to the matter several years. Abraham Beale, the General Agent of the Association, in his report to the Executive Committee, says :

“That he is more than ever confirmed in the opinion that the *best side* of a prison is the outside, and that there exists but little within calculated to make men better; and this applies especially to our county jails. \* \* Nothing is done to elevate the moral condition of the prisoners—not a friend to visit them; not a book for their perusal; not a rebuke or admonition; not a word to the innocent; not a moral lesson given; not a sermon preached; not a prayer offered; no anxiety or solicitude expressed either by the church or the world, for the reformation and salvation of those unfortunates; hence so few reform.”

John D. Guscom, M. D., in his report to the same body of his inspection of the jails of several of the counties in the state of New York, during the year 1870, says :

“They remain much the same as heretofore; and it would be a waste of time and paper to repeat details, which have been given, again and again, on former occasions. Their internal arrangements are for the most part inconvenient and unsatisfactory; old and young, novices and professional criminals, the innocent and the guilty, are generally huddled together in the day time, and imperfectly separated at night; there is but little in jails of what may be called discipline, and less of moral agencies for the benefit of their inmates; the prisoners have no regular employment, no secular instruction, no libraries, and generally, no provision is made for a due supply of their religious wants; \* \* such is the detail—by no means an exhaustive one—of the imperfections, defects, and objectionable features of our system of common jails.”

One more brief quotation from a report of the New Prison Association—one of the highest authorities on the subject in the land :

“In the association of prisoners in our common jails the promiscuous intercourse of all classes, all ages, and to a certain extent, we are sorry to add, of both sexes, we have the great evil, the very Pandora's box of the system; the fountain head of pernicious influences, not simply to the inmates themselves, but to the whole community as well, in the midst of which the jail happens to be situated. If an institution should be established in every county of the state, with the inscription over the door “Vice and crime taught here” and the processes within corresponded to the announcement without, this committee is impressed with the convic-

tion that the work of manufacturing criminals could scarcely be more effectually done than it is by our jail system as at present organized and managed. This is strong language but it is not lightly used. There is we think, no proposition more true, than that our present jail system is deeply depraving to the prisoner, and a positive evil to the community."

Were the inmates of our jails the worst of criminals, were they in all cases persons who had been charged with the most heinous crimes, who had been fairly tried, found guilty and justly sentenced, it would be an outrage upon their manhood, a disgrace to the people of the state, and a reproach to the civilization of the nineteenth century to confine them in such places as are many of our jails; but when we remember that the occupants of our jails are mostly persons simply charged with crime, and that too of the milder types, and that the trial often shows them to have been innocent, that sometimes they are merely witnesses, or persons sentenced for a few days or a few months for some minor offence, sometimes mere boys and girls, the outrage, the disgrace and the reproach seem a thousand fold intensified. The chief trouble seems to be inherent in our present criminal system as connected with our jails. The whole system is a relic of the barbarous ages of the past, and the great wonder is that it should have been allowed to remain so long unchallenged.

I have briefly called attention to the condition of the common jails of the country. Their real condition must be understood and appreciated before any great improvement can be made. The remedy for the evils and defects which have been pointed out, will form an appropriate subject for another paper on some future occasion.

## DEPARTMENT OF NATURAL SCIENCE.

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### DEEP-WATER FAUNA OF LAKE MICHIGAN.

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BY P. R. HOY, M. D., RACINE.

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At a distance of sixteen to twenty miles off Racine the water in Lake Michigan is from fifty to seventy fathoms deep. The bottom, at these depths, is composed of an impalpable, dark-colored mud, interspersed with depressions containing quantities of partially decayed leaves intermingled with the muddy deposits. It is on these "mud flats" that the fishermen capture, in gill-nets, the largest and finest white-fish and trout.

The food of the white-fish had never been ascertained. In order to solve this problem, I secured large quantities of the stomachs of fish caught in various depths; by diluting the ingesta I was enabled to determine on what the fish subsisted. During these investigations I became deeply interested in the new forms of animal life that swarmed in the deep water—fish that never visit the shore; crustaceans, that live only in the profound depths of the lake. I discovered three species of fish, four species of small crustaceans and one mollusk—all new to science. The fish I sent to the Smithsonian Institute at Washington. They were placed in the hands of that accomplished naturalist, Prof. Theodore Gill, who described and named them.

When I sent the fish to Prof. Baird I asked him to whom I should send the crustaceans? Who was the best authority on that branch of natural history? His answer was we had in the West the very man, the best authority in America on the

crustacea, Dr. William Stimpson, Secretary of the Chicago Academy of Science. I record here this fact in justice to Prof. Stimpson and the West.

Two of the fish belong to the genus *Argyrosomus*, a genus proposed by Agassiz to include that section of white-fish having a projecting under jaw.

The *Argyrosomus Hoyi*, Gill, is the smallest of the white-fish so far found in any of the great lakes, it being only about eight inches in length, and weighing one-fourth of a pound. The *Mooneye*, as called by the fishermen, is an excellent pan-fish, but its small size renders its unsuitable for market. Trout devour large numbers of these little beauties, as they constitute a large share of their food. The *Mooneye* is only found in water over forty fathoms.

The black-fin, *Argyrosomus Nigripinnis*, Gill, is a large and beautiful fish, having black fins. It has never been caught in less than sixty, and does not occur abundantly in less than seventy fathoms. During the summer of 1871 there was not a single black-fin taken off Racine, as the fishermen did not go as far into the lake as they did the previous season.

The third species of fish was taken from the stomach of a trout, caught in the deepest water. It belongs to the *Cottus* family, and is closely allied to *Trigloopsis Thompsonii*, Girard, if not identical. *Trigloopsis Thompsonii* was taken from the stomach of a *Lota Maculosa* (by Prof. Baird) caught in Lake Ontario in 1850, since which time not a specimen has been taken, I am informed by the Professor, unless this be the same fish taken now from the trout, as before mentioned. Prof. Gill thinks it is probably an undescribed species, near *T. Thompsonii*. If this prove so on further investigation, it will be named *Trigloopsis Stimpsonii*. What is peculiarly interesting about this small fish is, that it is a salt water rather than a fresh water form. Judging from the quantity of fragments belonging to this species, obtained from the stomachs of trout caught in the deep water, it must by no means be rare.

I submitted the minute crustaceans to Dr. Stimpson, who detected three species of fresh water shrimps, belonging to the genus *gammarius*, and one species of *mysis*, a marine genus, many species of which are found in the Northern Atlantic and Arctic oceans. The small shell found with the crustaceans, in the stomachs of the white-fish, proved to be an undescribed species of *pisidium*.

These discoveries were considered of sufficient importance to justify the undertaking of a dredging expedition. Professors Stimpson and Andrews, with Mr. Blatchford, of Chicago, represented the Chicago Academy of Science, while Drs. Lapham and Hoy represented the Wisconsin Academy of Arts and Letters.

On the 24th of June, 1870, we steamed into the lake, out of sight of land, and spent the entire day in *dredging* in a most enjoyable, and to science profitable, manner. We procured living specimens of those crustaceans which I had previously obtained from the stomachs of white-fish. But, with every exertion, we were not able to keep them alive above a few hours. Fitted, as they are, to sustain the great pressure of from fifty to seventy fathoms of water, when this was taken off death was the inevitable result.

I here subjoin a catalogue of all the animals thus far known to inhabit the deep water off Racine :

- Salmo amethystus—Mitchel.
- Coregonus sapidissimus—Agassiz.
- Coregonus lator—Agassiz.
- Argyrosomus Hoyi—Gill.
- Argyrosomus nigripinnis—Gill.
- Trigloopsis Thompsonii—Girard.
- Gammarius Hoyi—Stimpson.
- Gammarius brevistilus—Stimpson.
- Gammarius filicornis—Stimpson.
- Mysis diluvianus—Stimpson.
- Pisidium abyssomus—Stimpson.

Also one species of parasite leech, found fastened to whitefish, and a small white *Planaria*.

In conclusion, the occurrence of *marine* forms (*mysis* and *triglopsis*) go far to prove that Lake Michigan was once salt; had direct communication with the ocean. As it gradually became elevated above the sea it would naturally take many years to expel the salt water, especially as its greater specific gravity would cause it to sink and remain long in the lake—time sufficient for the animals to become acclimated to the changed condition of things. It is barely possible that salt springs at the bottom of the lake may have materially retarded the change; and that even now there may be brackish water in the greatest depths. This seems the more probable since the salt-bearing strata occurs in Michigan. We made an effort to solve the query, but owing to the imperfection of the apparatus I am not certain that the negative was proved.

## H.



## ON THE CLASSIFICATION OF PLANTS.

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BY I. A. LAPHAM, LL. D.,  
Milwaukee.

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Animals in the hands of Cuvier and Agassiz, and minerals by Dana and others, have been well and scientifically arranged into natural divisions with their proper order of succession. But plants, especially in the higher divisions of classes and their subdivisions, still need the attention of a systematist.

It has been supposed that since De Candolle introduced into botany the idea of EXOGENS, (outside growers), and ENDOGENS, (inside growers,) the classification of plants was complete. It is proposed to show that this supposition is erroneous, and has led to incongruous results needing reformation. It may be claimed as true that, so far as regards the description of species, and their grouping into genera and families, botany is the most advanced and perfect of any of the natural sciences; but as regards the limitations of classes and orders it is the least advanced. It is only in relation to these larger divisions of the vegetable kingdom that any suggestions will be made in the present paper.

The most important of all plant-products—important to the very life and continuance of the plant is the seed, the organ in which one individual plant terminates, and another begins. It is the ultimate product, and the one towards the perfection of which all other vegetable organs and processes seem to conspire. Near the close of the growing season, the whole plant-energy is concentrated upon the seed; the seed is perfected and the plant dies.

As the grand divisions of the vegetable kingdom must rest

upon the most important characters, it is quite obvious that we must look to the character of the seed for this purpose. Less important characters will do for the minor divisions, but not for the higher.

The seed contains, as its most important—most essential part an *embryo*, consisting of the radicle, cotyledons and plumule.



Fig. 1.

This is usually surrounded with a store-house of food for its future use in germination, called albumen. Two envelopes or coverings protect these more essential parts of the seed. These several parts are subject to various modifications; the cotyledons may be single, double, or many; the albumen may be stored within the body of the embryo, etc.—though thus modified they are essentially the same. Thus the seed contains, already, a little plant that only requires the proper conditions to be enlarged into an oak, a lily, or some other plant.

But seeds are not the only reproductive bodies among plants; there are others, not so familiarly known to us, called spores.



Fig. 2.

They are simple cells filled with minute dots, and have the power of sending out little shoots, which grow and become new plants. All spores send forth these little tubes, almost exactly alike, apparently, and yet one will grow to be a mushroom, another a moss, and another a fern.

There are essential differences between seeds and spores; while one has buried in its substance an embryo, which is enlarged in germination into a perfect plant, the other contains no embryo; the seed always grows from a definite point, but the spore sends out its tube from any part of its surface; in the seed, the new plant has already made considerable progress; in the spore, re-production has not yet taken place. The seed, then, is a more advanced body than the spore and indicates a higher order of plants. All plants produce either seeds or spores.

Fig. 1—a seed with its embryo.

Fig. 2—a spore, magnified.

Here, then, we have the basis of our first grand division of the vegetable kingdom into two very distinct and easily recognizable parts; the one contains the spore-bearing plants (SPORIFERÆ), the other includes the seed-bearing plants (SPERMIFERÆ). This corresponds exactly with the division generally adopted, into flowerless and flowering plants. But these names are objectionable, especially for the higher orders of spore-bearers, the mosses, ferns, etc., which have organs so analogous to true flowers that we cannot say they are really flowerless. Recent botanical writers are hardly consistent in describing the inflorescence, or mode of flowering of these so-called flowerless plants. They all produce and are propagated by spores, and hence we not only avoid this absurdity but follow nature more closely by calling them spore-bearing (SPORIFEROUS) plants.

Just in proportion as we value a thing, so do we provide for its care and protection; and so in nature the seeds and spores of the higher classes of plants are provided with coverings for their protection, while those of the lower classes are left almost or quite naked. We thus have not only a basis for the next subdivision of the vegetable kingdom, but a sure indication of the relative position of these subdivisions in rank and importance.

I. The lowest class of spore-bearing plants—the Algæ, Fungi and Lichens—produce spores directly upon or within the body of the plant, without special provision for covering or inclosing them; hence these may be called GYMNOSPORÆ or naked-spore-bearing plants. The *asci* in which spores are found are mere openings or sacks, and can hardly be called capsules or spore covers. These are the lowest and most simple plants; they stand at the bottom of the scale of vegetable life.

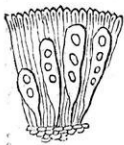


Fig. 3.

II. The second class of plants we will call ANGIOSPORÆ, because the spores are covered or provided with little cups



Fig. 4.

with lids in which they are closely packed away. This class of the spore-bearers includes the Liverworts, Mosses, Ferns, Lycopods and Equisetacæ. They are the higher families of the Cryptogams.

III. The seed-bearing plants we may divide in the same way: first we have the GYMNOSPERMÆ, or naked seeds, in the Coniferæ, (pines, etc.,) and in the Cycadaceæ, tropical plants, but little known here.



Fig. 5.

In all these plants there are no proper seed vessels. They are, therefore, the lowest class of the seed-bearers, SPERMIFERÆ.

IV. Next and last we have the ANGIOSPERMÆ, or plants with seeds that are covered, such as the pea and most of our familiar fruits. This is the most highly organized class of plants, standing at the head of the list in all modern botanical works.

We have, then, two grand divisions and four minor divisions or classes of plants, all based upon the reproductive organs: thus

SPORIFERÆ, Spore-bearing.	{	<i>Gymnospora</i> , Naked spores. <i>Angiospora</i> , Covered spores.
SPERMIFERÆ, Seed-bearing.	{	<i>Gymnosperma</i> , Naked seeds. <i>Angiosperma</i> , Covered seeds.

The beauty and simplicity of this arrangement is apparent, and may be deemed a sufficient proof that it is in accordance with nature, which is always simple, methodical, and progressive; and yet it differs essentially from any heretofore adopted, in placing the Gymnosperms (conifers, etc.) below all the Angiosperms, whether of exogenous or endogenous structure.

Fig. 4—theca or capsule of a moss.

Fig. 5—scale from a pine cone showing the two naked seeds.

It remains to be seen whether this classification, so simple and logical, is sustained by the consideration of other characteristics.

*Spores and Seeds—*

Class 1. Has spores only.

2. Same.
3. Cotyledons indefinite in number.
4. Cotyledons definite ; either one or two.

In all proper systems of classification the indefinite is deemed inferior to the definite, and hence our 3d class, the plants with naked seeds, falls below the whole of class 4.

*Flowers—*

These also show a regular progression through the several classes :

Class 1. Flowers obscure or none.

2. Without proper stamens and pistils.
3. Without pistils, (stamens only.)
4. With both stamens and pistils.

*Leaves—*

Class 1. Leaves none.

2. With the venation dichotomous.
3. Venation both dichotomous and parallel.
4. Venation parallel and netted.

*Structure—*

Class 1. Cellular.

2. Cellular with a few woody fibres.
3. Cellular with woody fibres ; cells with discs.
4. With woody and vascular fibres.

*Mode of growth—*

Class 1. Irregular ; no distinction of stem and leaf. *Thallogens.*

2. A regular ascending axis ; growth at apex. *Acrogens.*
3. By external layers. *Exogens* (in part).
4. By both internal and external layers. *Endogens* and *Exogens*

*Geological age—*

- Class 1. Found in the Lower Silurian age.
2. First found in the Upper Silurian.
  3. First in the Devonian.
  4. First in the Carboniferous.

So it will be seen that whether we regard the character of the seed, the flowers, the leaves, the structure; whether we regard the mode of growth or the relative age of the world at which each class was introduced, we equally find that, with this arrangement, there is a regular progression from the more simple to the more highly organized; and from the oldest to the most recent. It is therefore the most natural and proper classification of plants.

But to find this regular progression we have been obliged to disregard one character usually deemed of the highest importance. Plants with the exogenous mode of growth are divided and placed in two different classes. We are thus compelled, in this new classification, to consider the mode of growth or internal structure of stems as of only secondary importance.

The Gymnosperms are shown to be inferior to all the Angiosperms by their indefinite number of cotyledons; by their flowers without pistils; by their dichotomously veined leaves, which allies them with the ferns; by their want of vascular fibres in the structure of the stem; and by the earlier epoch of their creation. Hence it must be right to reduce these plants to a position below that of the palms, the lily, and the orchids.

When Cuvier found that the anatomy, the internal structure of animals indicated their relative position in the scale of animal beings, the conclusion was very natural that the same law existed with regard to plants; and hence the prominence given by De Candolle to the exogenous and the endogenous structure in his classification. But this must be regarded as one of the most unfortunate ideas ever introduced into botany; for it requires that we rank the Gymnosperms above the Monocotyledonous plants, though their affinities are thus clearly shown

to be more nearly with the Angiosperms, (the Lycopods, etc.) Botanical writers generally, admit this defect in the present arrangement, and yet persist in perpetuating it; such is the disposition to follow authority without examination. The doctrine that "the king can do no wrong" is equally deleterious in botany and in politics!

If the more simple forms of plants were first created, to which were added, from time to time, those of more complicated structure; and if the arrangement of classes must correspond with that of their introduction in geologic time, we must adopt this new classification; for it is found that the Coniferæ existed in the Devonian age, while the Monocotyledons extend back only to that of the Carboniferous.

By thus removing the Gymnosperms from between the Dicotyledonous and the Monocotyledonous plants we bring these two nearly related grand divisions of the Angiosperms together; thus while we separate the Exogens, part into one class and part into another, we at the same time unite and bring together the Angiosperms, which have been unnaturally separated. By the divorce of an unnatural union we secure another, more congenial.

In the following table an attempt is made to represent, in a compact form, the ideas I have thus attempted to explain; and also to show how each class may be divided into two well characterized groups.

## THE VEGETABLE KINGDOM,

*Organic bodies, living and subsisting upon the Mineral Kingdom, and affording subsistence to the Animal Kingdom.*

SPORIFERÆ. Plants bearing spores; no true embryos; no cotyledons.				SPERMIFERÆ. Plants bearing seeds; an embryo; one, two or more cotyledons.			
GYMNOSPORÆ, Spores naked.		ANGIOSPORÆ, Spores covered.		GYMNOSPERMÆ, Seeds naked.		ANGIOSPERMÆ, Seeds inclosed.	
Spores (without embryos).		Spores (without embryos).		Seeds with embryos; cotyledons indefinite, usually more than two.		Seeds with embryos; cotyledons definite, either one or two.	
Flowers, obscure, or none.		Flowers, without proper stamens and pistils.		Flowers with stamens only, (no ovary, style, or stigma), the pollen falling directly upon the ovules.		Flowers complete, having both stamens and pistils.	
Leaves none; (stem and leaves confounded.)		Leaves distinct from the stem; venation dichotomous.		Leaves with the venation Dichotomous or Parallel. Ex. Salsburia. Ex. Zamia.		Leaves with the venation Parallel, or netted.	
Structure cellular.		Structure cellular, or cellular with a few woody fibers.		Structure cellular, with woody (no vascular) fibres; cells with circular discs.		Structure cellular, with fibres both Woody and Vascular.	
Growth irregular; no axis; no stomata or breathing pores. Thallogens.		Growth at apex of an ascending axis; stomata present. Acrogens.		Growth at the apex (no axillary buds) and external. Exogens.		Growth from terminal or axillary buds, either internal or external. Endogens. Exogens.	
First appears in the Lower Silurian Rocks.		First appears in the Upper Silurian.		First appears in the Devonian.		First appears in the Carboniferous—Cretaceous.	
Aquatic. Marine and fresh water Algæ.	Aerial. Fungi and Lichens.	Cellular. Liverworts and Mosses.	With Woody and vascular fibre. Ferns, Lycopods, etc.	Seeds at the mid- dle of the scales. Coniferæ.	Seeds at the mar- gin of the scales. Cycadacæe.	With but one cotyledon. Monocotyledons.	With two cotyledons. Dicotyledons.



## INSECTS INJURIOUS TO AGRICULTURE.

APHIDES, (PLANT LICE.)

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BY P. R. HOY, M. D., *Racine.*

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Entomology, the history of insects, their metamorphoses, habits, relation to plants, etc., is a branch of natural history which has peculiar claims on the agriculturist. In view of the millions of dollars annually lost to the state by the depredations of insects, it becomes an interesting problem how to distinguish in all stages of growth, our insect friends from our insect foes, that we may be better fitted to cherish the one and destroy the other.

When will the representatives of the people understand that Wisconsin can ill afford to dispense with the invaluable services of a state entomologist? We have a host of insects, peculiarly destructive, waiting for careful study, the better to enable us to counteract their evil work. Not the least of the advantages to be derived from the labors of an active, enthusiastic state entomologist, is the education of the farmers by personal contact; thus teaching them how to distinguish the various insects by which they are surrounded, in their different stages, so that this practical knowledge may be of value to themselves and to their neighbors.

PLANT LICE.—Small, green, brown, black or white, soft bodied insects, with or without wings; crowding together on leaves, stems, bark or roots of various trees and herbs. Many species are covered with a white cottony substance, hence called Woolly Aphides. The number of species is very large, not a genus of plants that has not its peculiar species; many, more than one. The apple alone, according to Fitch, has not less

than five species of plant lice. One of the most common infests the tender leaves of the apple, the *Aphis Mali*, Fab. This species is green, egg-shaped, one-tenth of an inch in length; it is either with or without wings. They are provided with two spurs, or nectaries, which originate near the center of the body. These nectaries secrete a fluid as sweet as honey. So astonishingly prolific is this insect, that the increase of one single egg, it has been estimated, in seven generations, would be 729 millions! If it were not for the good offices of those animals which prey upon plant lice, every thing green on the face of the globe, would, in a short time, be covered with these voracious insects. They crowd as thick as they can stand, their long suckers inserted into the succulent young shoots and leaves, pumping up the juice. If disturbed, they jerk up their bodies in a comical way and emit, from their nectaries, a shower of honey, apparently to bribe the intruder with this sweet fluid. Not unfrequently they kick up their hind feet in unison, impelled by an excess of animal spirits, from very joy of existence.

The history of this species is extremely interesting. In the spring, as soon as the young leaves appear, the eggs hid away in the crevices of the bark, hatch. The young creep to the extremity of the branch and fasten on the young shoots. In a few days the louse is fully grown. All the eggs laid in autumn produce wingless females, and these females do not lay eggs, but bring forth *living* young which are also females.

The young when first born are milk white, but change in a few hours to the color of the parent. In a very few days these young lice produce living progeny also. And so on for from fifteen to twenty generations, each individual louse producing from five to ten each day, all without the presence of a single male; for in fact there is not a male in existence! A few winged females appear occasionally, which take wing and plant new colonies. Thus goes on this remarkable form of reproduction till fall, when there appears a brood of winged

males and females which pair, in the usual manner. The result of this union is not living aphides, but eggs, which in the month of October the females deposit in the crevices and cracks on the bark of apple trees. Soon after this the lice all perish. The eggs remain securely hid away during winter, to be called, by the warm days of another spring, into life, again to repeat this wonderful phenomenon.

**APHIS PROTECTORS.**—Ants are almost always seen busily running up and down trees and plants infested by the aphid. These ants take charge of the lice, guard them from harm with zealous care; for which good services they are amply paid in honey, by the plant lice. The ants approach the lice, and if there is not an accumulated supply, they touch them with their antennæ by way of reminding them of their wants; at once the lice respond with a drop of their sweet fluid. For this reason plant lice are humorously called *Ant Cows*. It is a well known fact, that colonies of aphides attended by ants thrive better and are more prolific than those which the ants have not found.

**APHIS ENEMIES.**—Now for the Aphis foes, and consequently our friends. We place first on the roll of honor, the larvæ of the Lace-wing flies, which are called Plant Lice Lions, a name well deserved. Lace-wings belong to the family *Hemerobdia*, order *Neuroptera*. There are many species of Lace-wings; they are mostly not over half an inch in length; color, pale green, or yellowish brown, with conspicuously prominent golden eyes, for which reason they are sometimes called Golden Eyes. They are provided with four large wings, which expand a little over one inch. These wings are netted in a beautiful manner, resembling the finest lace, hence the name. These flies may be met with during the entire summer, in the vicinity of trees infested with lice. They are nocturnal in their habits.

The manner in which the female Lace-wing deposits her

eggs challenges our admiration at the beautiful adaptation of means to the accomplishment of important ends. Nature has furnished this insect with a fluid analogous to that of the spider for spinning her web. When ready to deposit an egg, this insect touches the end of her body to a branch or leaf, and then elevates the abdomen, drawing out a pure white thread, half an inch in length, which hardens instantly, on the summit of which she fixes an egg. This being repeated, from 10 to 20 eggs are thus placed on slender threads. The eggs when first deposited are pale green, becoming opaque before hatching. Now the object of thus placing the eggs on these hairs is evident. Were they placed in reach the first larva that escaped from an egg would devour the remainder. So nature has well guarded the continuance of the species.

The larvæ of the various species of Lace-wings differ considerably in color. They are mostly of a reddish brown, lighter on the sides, with a dark line down the back. The body is long, wrinkled, short hairs projecting from each segment; has six legs, and is armed with a pair of formidable, sickle shaped jaws, which project conspicuously in front. Thus armed these lions hurry about in one continual state of activity day and night in quest of plant lice, their legitimate prey. They seize the lice with their tongs, and elevate them, till they have sucked every particle of substance from the bodies, then giving the skins a toss, resume their search for more victims. It is astonishing how many lice are destroyed by a single aphision.

Having attained its growth, the lion make the last meal an excessive one, remains torpid for a day or two, then spins a circular cocoon in which the insect is entombed during the winter. The first warm day of spring calls them out. So opening a small door, in this temporary grave, emerges a beautiful Lady Lace-wing, dressed up in the most extravagant finery.

LADY BIRDS.—Family *Coccinellidæ*, order *Coleoptera*, small,

nearly round beetles, ornamented mostly with spots of various colors on the elytra.

There are about one hundred species described as belonging to the United States. In my collection alone there are no less than twenty species, obtained near Racine. So Wisconsin is not deficient in these valuable insects. These beetles deposit their eggs in clusters on the under side of leaves on various plants. Their eggs are of a shining, golden yellow, resembling those of the Colorado potato beetle. In a few days they hatch out six legged, dark colored, long bodied larvæ. Their jaws are short, but sufficiently long, however, to be of good service in killing aphides.

These larvæ are nearly, if not quite, equal to the *aphis lions* in destroying plant lice. Dr. Fitch, New York state entomologist, so faithfully describes the habits of this *plant lice wolf*, as it might appropriately be named, that I adopt his language. When first hatched, "it walks about with much animation, and coming to a plant louse, much larger than itself it may be, the little hero, though only a few minutes old, boldly seizes the louse, which, like a cowardly poltroon, makes no resistance except trying to pull himself away. But the little assailant hangs lustily to him, preventing his advancing a single step further, and using his anterior legs as arms, he commonly raises the louse off from the leaf and leisurely devours his body, leaving only the empty skin remaining. As he grows, the sides, and in some species the whole surface, becomes diversified with bright red and yellow spots with rows of tubercles or elevated points. He is a most active voracious little creature, running briskly over the limbs and leaves in search of his prey, and consuming hundreds of aphides. He grows to about a quarter of an inch in length in the course of two or three weeks; he then fixes himself by his tail to a leaf, or the limb or trunk of a tree, and hanging with his head downwards the skin cracks open along the middle of his back, and the smooth back of the pupa protrudes partly out of the prickly skin of

the larva, and thus remains, the old larva skin continuing to cover the pupa on each side and beneath. The insect remains dormant in its pupa state about a fortnight, when its hard exterior shell cracks open, and from it crawls a small shining beetle nearly the shape of a half pea, though often much smaller than this."

THE AGENTS WITHIN OUR CONTROL FOR DESTROYING PLANT LICE.—The smoke of tobacco, when it is possible to confine it for a time, is undoubtedly one of the most efficient remedies for extinguishing these pests. In green houses, graperies, conservatories, etc., the smoke is always potent. Small out-door plants can be covered with boxes, barrels, or even umbrellas, or anything that will form a temporary cover, will answer, and insure the destruction of the aphides with tobacco smoke. But on large trees, and vines, smoking is not practicable. The next best thing is a thorough drenching with strong tobacco water; say one-fourth of a pound of tobacco to one gallon of boiling water. Soap suds has been used with good results. A strong decoction of quassia wood has also been attended with some benefit. But of all remedies for out-door trees and vines, I prefer collecting, with a net, by sweeping bushes and coarse weeds, the several larvæ described in this article—*aphis-lions* and *aphis-wolves*.

Several years ago a fine balsam fir, fifteen feet in height, standing in my grounds, became overrun with a species of woolly aphis, which deformed the leaves, and there was danger of the tree being destroyed by them. With a net I collected a brave lot of the larvæ of lady birds, and placed them on the lousy tree; at the same time I noticed several packets of lace-wing eggs. The combined labors of these soon destroyed every single louse. The tree, now sixty feet in height, has never, to my knowledge, had an aphis on it since.

Last year my out-door grapes became badly infested with lice; I secured many *aphis-wolves* and *aphis-lions*, which I

transferred to the vines ; in less than two weeks the grapes were entirely free of these pests, without resorting to other means.

I know of many incidents illustrating the woful ignorance of persons otherwise intelligent, who were waging an exterminating war against insects and birds, at the very time they were engaged in the good work of devouring noxious insects.

## CONIFERÆ OF THE ROCKY MOUNTAINS.

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BY J. G. KNAPP, ESQ., MADISON.

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*Mr. President and Gentlemen:*—I have the pleasure of presenting you some seeds—nuts you may call them—which as you perceive are somewhat irregular in form, one-half inch in length, and one-third in thickness. Generally they are of a pale brown color. The testa, outer shell, of a very peculiar texture, is neither woody nor leathery, but a mixture of both, and about .02 of an inch in thickness. It is easily broken in fragmentary pieces, though in germination it parts in two equal valves. When this testa is removed, the inner integument of a slight drab color, and gauze-like texture is exposed. Beneath this is formed the kernel. The body is of a pearly whiteness, cylindrical, two and a half times as long as thick, with a light brown apex. On cutting this through the centre longitudinally, the cylindrical embryo or embryos, are seen occupying nearly the entire length of the albumen, and one-third the face of the hemi-cylinder. The cotyledons vary from three to twelve, and are arranged around and cover the apex of a central shaft, the radicle occupying the opposite extremity. This nut is therefore the fruit of some acrogens, or is nearly allied to such plants. The whole of this kernel is gorged with a remarkably sweet oil, and is perhaps the most delicately flavored of any nut in North America, if not in the world. When the inner integument is eaten with the kernel, it imparts to it a balsamic flavor.

These are the nuts of a pine tree, although there is no trace of the fragile wing with which the nutlets of the coniferæ are



usually furnished. Such a wing in this case, unless it were very large, would answer but a poor purpose in floating these nuts from the tree. These nuts came from New Mexico, and are the produce of the *pinus edulis*, or the *piñon* of the Mexican. I shall ask you to receive and preserve these in your cabinet.

I think I see in this kernel and embryo another evidence of the necessity of revising the botanical classification of our plants, and of separating the coniferæ from the dicotyledonous plants, since they do not agree with the condition, two in the number of cotyledons; or from the exogenous trees, where they disagree in the form of the fibre of the wood; and arranging them in a class by themselves, between the exogens and acrogens.

The tree on which these nuts grow is botanically named from the edible nuts; but one is at loss to know why the Mexican has called it the piñon, large or big pine, unless we are to suppose he has transferred the large or big nut of this pine [pineo] to the tree itself. It is usually a small tree, short-bodied, with numerous crooked branches, and a dense foliage. The wood is very hard and full of pitch, compact and brittle, and when dry is equal to the best of hickory for fuel.

Observers must have discovered that many of the evergreens in cultivation in this region, are failing for some cause not apparent to everybody. I attribute much of this failure to a want of sufficient moisture in the atmosphere. The native habitat of our cultivated coniferæ is in regions of great moisture, where the mosses abound. The climate here is different; and as our fruit-growers have been taught lessons in the expensive school of experience, so the grower of evergreens must expect to pay dearly for knowledge, when he seeks to transplant the trees of damp Europe and wooded America, to the dry regions of Wisconsin, and its sister states. We are not yet prepared, nor need we ever be, to give up the idea of growing evergreens; but it becomes the thoughtful inquirer,

in seeking to remedy the difficulties of rearing the evergreens now under cultivation, to look toward the dry cold mountain region on our west, and see if he cannot there find trees more suitable for his wants—trees that can endure the great extremes of heat, cold and droughts of this climate. This consideration induces me to describe these evergreens of the Rocky Mountains with a little more minuteness.

The *Pinus Edulis* is first seen near the foot hills of the mountains, on rocky points, and ridges, and in the out-lying hills, where it can receive but a scant supply of moisture. Grain in its neighborhood is only grown by irrigation. Here the summers are only long enough to ripen beans, and the smallest, and earliest variety of corn. The best trees are found in regions too elevated to produce any cultivated crop. It avoids the beds of the streams, and is seldom found in the bottoms of the valleys, where water from melting snows or rains may run. On the high table lands, ridges, and steep rocky mountain sides, it takes its strongest hold, and flourishes best. The leaves are in pairs, two inches long, dark green, coarse and ridged, and are persistent for two or more years. The tree gives a dense shade, and makes an excellent wind breaker. It is of too slow growth for general use, as an ornamental or forest tree; but on hard, rocky, dry ridges, and at the brow of steep table lands, it would thrive well. When at the end a hundred years, the tree has reached thirty or forty feet in height, and as many in the diameter of its rounded top, it possesses great beauty, and gives its biennial crop of nuts, and would then be greatly esteemed. It would never suffer from the droughts of summer, or be likely to perish from the cold, or winds of winter as it thrives to the very highest limit of the pines, and nearly to the line of dayly frosts.

*Pinus Englemanni*, Engleman's pine is most deserving of attention. This is also found in the foot hills and out-lying mountains, but it is within, and high up the steep and precipitous snow-capped ranges, where it grows in greatest per-

fection. From a resemblance in the color of bark, and the general configuration of the tree, when seen at a distance to the *pinus resinosa*, it has been named by the immigrants from the eastern states, yellow and pitch pine. The trees grow tall and straight, with smooth stems, and produce a yellowish wood not unlike the wood of the *p. Resinosa*. Though the wood is hard, the tree has but little sap wood, and in most trees it is tolerably clear of pitch. When sawed the timber is applied to all purposes where white pine is used by us, and it may be reckoned as a good building material. The cones are about the size of the pitch pine of the south, three inches by two. The nutlets are armed with a wing an inch long, that floats them to a great distance from the parent tree. The leaves are short, dark green throughout the year, grow in pairs, and are often six inches long. It is a rapidly growing tree, and more ornamental than the Austrian, or the red pine. Thousands of these pines have been peeled by the Indians in times of famine with them, for the sake of the cambium, which is sweet and nutritious, and used by them for food. In this respect it seems allied to the *pinus Lamberti*, sugar pine of California. This species has been the great source from which the ties, bridge and other timber for the Pacific railroad have been obtained.

*Pinus flexilis* is the white pine of the Rocky mountains. In contour it resembles the white pine of the northern states, *pinus strobus*. The dark green leaves grow in fives, and are six inches in length, fine, and flexible, hence its name. The bark of old trees is dark, and deeply furrowed. The cones are beautifully formed, four inches long and three in their greatest diameter; seeds are large as peas, sweet, oily and edible. The wood is white, but the tree produces so much sap wood, that it is of less value than the *pinus Engelmani*, for building timber, and is as hard, hence it is not often sawed into timber. The tree is a large one, often reaching one hundred feet in height, with limbs starting out at about twenty feet from the ground.

It grows in the same dry lands as the other pines of the region, and reaches from the foot-hills to the line of daily frosts. This would make a highly ornamental tree where a dark shade was desired, and its long flexile leaves, and large cones give it great beauty when near at hand, and its conical formed top and dark green foliage make it a graceful feature in the landscape. It would make an excellent shelter as a wind breaker to protect buildings, crops and animals, from the effects of the wind.

*Abies Douglassi*, Douglas spruce, is a tall straight tree where it grows in thickets, or has a fair supply of water, as in the cañons of the mountains. In dry and open grounds, it holds its long horizontal limbs near the ground, and with these forms a perfect conical top, with a diameter nearly equal to its altitude. The foliage is dense and dark green. The leaves are one and one-half inches long, growing in two ranks as a slender spray, much like the Hemlock, *Abies Canadense*. The bark is thicker and rougher than the hemlock, and contains a larger percentage of tannin. The cones are cylindrical, three inches long and three-fourths in diameter, and being colored during the first year are highly ornamental. The timber resembles the other spruces, and is strong and elastic; a good building material but not as durable as the pines. I know of no spruce that would be as valuable an acquisition to our ornamental trees and tree belts, as this would be, especially for dry situations. The wood burns with great heat when dry, but crackles badly, in an open fire. The long periods of drought in its native habitat do not affect it; and it flourishes above the pines; thus proving incontestibly its hardy character. We may therefore safely conclude that the Douglas spruce, would thrive, where all the other species of the family would fail from the effects of drought and cold.

*Abies Nea Mexicana* (?) Rocky Mountain fir, so I have ventured to name this beautiful species. The leaves are twice the length of the *Abies balsamea*, and the cones bear the same increased proportions, being often two inches long. I have

ventured to give it the specific name of *New Mexican*, since I do not find it described by any of our botanists, and when the spray and leaves were shown to Torrey in 1857, he doubted its identity with the *balsamea*, but retained that name on the authority of Bigelow. This tree is associated with Douglas spruce, in its growth, and is in all respects the most beautiful of the fir tribe. I first observed it on the 19th of Sept., 1861, near the summit of the *Sangre de Cristo* pass in Colorado, at an elevation of about 11,000 feet above the level of the sea, and thus wrote of it the time: "I passed through the yellow pines, (*Pinus Englemanni*), and turning a sharp angle in the road, saw such a balsam tree as would have been the making of a Wisconsin nurseryman, or the pride of the most ornamental park in an eastern city. Its leaves were twice as long and three times as dense as any tree of the family I have ever seen. A little further up all of the trees were of this same beautiful species. Another half mile and the firs gave way to spruces, (*Douglassi*) of equally brilliant foliage." The timber of this fir is like the whole tribe, of little value, except as fuel; and even in the dry climate where it grows, is durable only under cover.

Four species of the juniper grow among these pines and spruces, which show great ability to endure the greatest extremes of heat, cold, droughts and severe winds. These are found on rocky points furthest out on the dry, windy plains, of all trees. Though dwarfed and stunted, they sometimes attain a diameter of two feet; but commonly they produce clumps of a dozen or more trees springing from a common root, which spread out laterally as far as high, forming a hemisphere of yellowish-green foliage, and pale blue berries. All are densely leaved, and yield an abundance of berry-like cones, which are sweet and greedily devoured by the bears and birds in winter. Hunters and Indians have been known to subsist upon these cones, for several days at a time. At least two valuable species might be selected from these junipers, well

adapted for wind breakers, if not for live hedges on dry, hard lands.

*Juniperus pachyphyllea*, thick bark cedar, is the best species of the red cedar I ever met with. I found this tree growing in the spurs of the White mountains of New Mexico, at an elevation of about 10,000 feet. Could it be introduced, it would be not only a decided curiosity, but a worthy acquisition to our list of evergreens. The coriaceous bark is cracked and seamed into cubical forms of two inches. The fibrous exfoliation of the other junipers is entirely wanting in this tree. The trees were growing among the Engleman pines, with smooth straight trunks, often thirty feet to a limb, clear of knots and three feet thick. The wood is close and compact, of a rich mahogany color, otherwise it resembles the wood of our red cedar, *Juniperus Virginiana*. From its habitat, where I saw it, I should think it would thrive in Wisconsin.

REPORT ON THE GEOLOGY OF THE REGION  
ABOUT DEVIL'S LAKE.

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BY PROFESSOR JAMES H. EATON, A. M.,  
Of Beloit College.

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TOPOGRAPHY.—The formation of Sauk county is the Potsdam sandstone. (Potsdam epoch of the N. Y. Survey.) It lies nearly horizontal, with a gentle dip to the southeast. The higher elevations, especially in the southern part of the county, are capped with conformable layers of the lower magnesian limestone. (Calcareous epoch of the N. Y. surveys.) Running east and west through the center of the county are two parallel ridges, with an average elevation of 400 to 500 feet, and a base of two to four miles. The distance between them is three to four miles. The Baraboo river runs in this valley and empties east into the Wisconsin. A north and south valley cuts half way through the eastern end of the southern ridge, and then trends east towards the valley of the Wisconsin. In the north end of this valley lies Devil's Lake.

LITHOLOGY OF THE RIDGES.—They are a compact, crystalline sandstone, without cement, or *quartzite*. The predominant colors are pink and red, often banded with straight or contorted parallel lines of lighter and darker colors. In some places the rock is an homogeneous white quartz, with distinct and well formed crystals.

ORIGIN OF THE QUARTZITE.—Both the nature of the rock and its position give evidence that it is metamorphic Potsdam sandstone. The rock presents all gradations from the simple sandstone to the perfectly crystallized quartz. The Potsdam

sandstone consists of small rounded grains of quartz, and is very loosely cemented. It can easily be crumbled with the fingers. Hand pieces of the quartzite may be obtained in all stages from this friable sandstone to that where the grains are apparent and the rock is less friable, to that where the homogeneity is here nearly approached but the small grains can still be seen, and finally to the perfect homogeneous quartz. No sharp geographical line of demarcation between the sandstone and quartzite, and no gradation in any direction was observed.

The homogeneity of the colored quartzite is not as perfect as it appears. Whenever a surface has been subjected to the weather, the small grains come to view again.

The bandings of the quartzite are very similar to those in the undisturbed sandstone. These bands sometimes consist of layers of fine grains of sand.

Some of the great blocks of quartzite, which have fallen down the sides of the valley are most beautifully covered with regular ripple marks. They must have been first made in the moving sands.

The layers are nearly as perfect as in the sandstone, and have a dip equal to the inclination of the ridges. The dip on either side can be seen best from the opposite side. The anticlinal ridge on the east side of the lake is removed by the valley, which trends to the east, and on the west by another valley, which comes down to the lake. Vertical joints also lead to the conclusion that the ridge has been formed by the upheaval of the horizontal layers of sandstone. The layers were not traced north and south to determine whether they are continuous horizontally.

HOW WAS THE SANDSTONE CHANGED?—Both the nature of the rock and its position forbid the idea of aqueous fusion or *active* volcanic agency. The change must have taken place by the purely wet way of partial solution and crystallization, or



by a low degree of heat, working for a long series of years through the moisture in the sandstone, probably aided by the pressure which lifted the ridges. If the latter, the change and elevation of the rock took place at the same time, and both effects were produced with extreme slowness.

WHEN WAS THE RIDGE RAISED?—Before the glacial epoch, Wm. H. Canfield, Esq., of Baraboo, has found abundant proofs of the movement of glaciers over the rock since it has been metamorphosed. In many places on the elevated portions smoothly polished surfaces of quartz of great extent have been exposed by removing the soil. Before the glacial epoch, there seem to be no data for fixing the time of the elevating and metamorphic action. There has therefore been ample time for metamorphic action of the most extreme slowness.

WHERE AND HOW WAS THE VALLEY OF DEVIL'S LAKE FORMED?—At a previous meeting Dr. Lapham, Secretary of the Academy, advanced in a paper the view, that Baraboo river once ran through this valley on its way to the Wisconsin, and was turned from its former course into its present one by glacial drift. If this view is correct, as the facts seem to warrant, this valley may have been made at any time from the Lower Silurian up to the glacial period. It is not necessary to introduce any great convulsion. The regularity of the layers would forbid any sudden and violent upheaval and cracking of the rock. During the slow process of upheaval, a greater extent than the others, perhaps of nearly the present width of the valley, may have been made. The slowly acting agencies of the atmosphere and of water can have widened the fissure and thrown down the great mass of debris which lies on the south of the valley. The valley is about half a mile wide. The sides slope up from 200 to 300 feet, as steep as the large blocks will lie upon each other, and the remaining height is a perpendicular wall cut by vertical fissures into most fantastic shapes, with natural fortifications and castles,

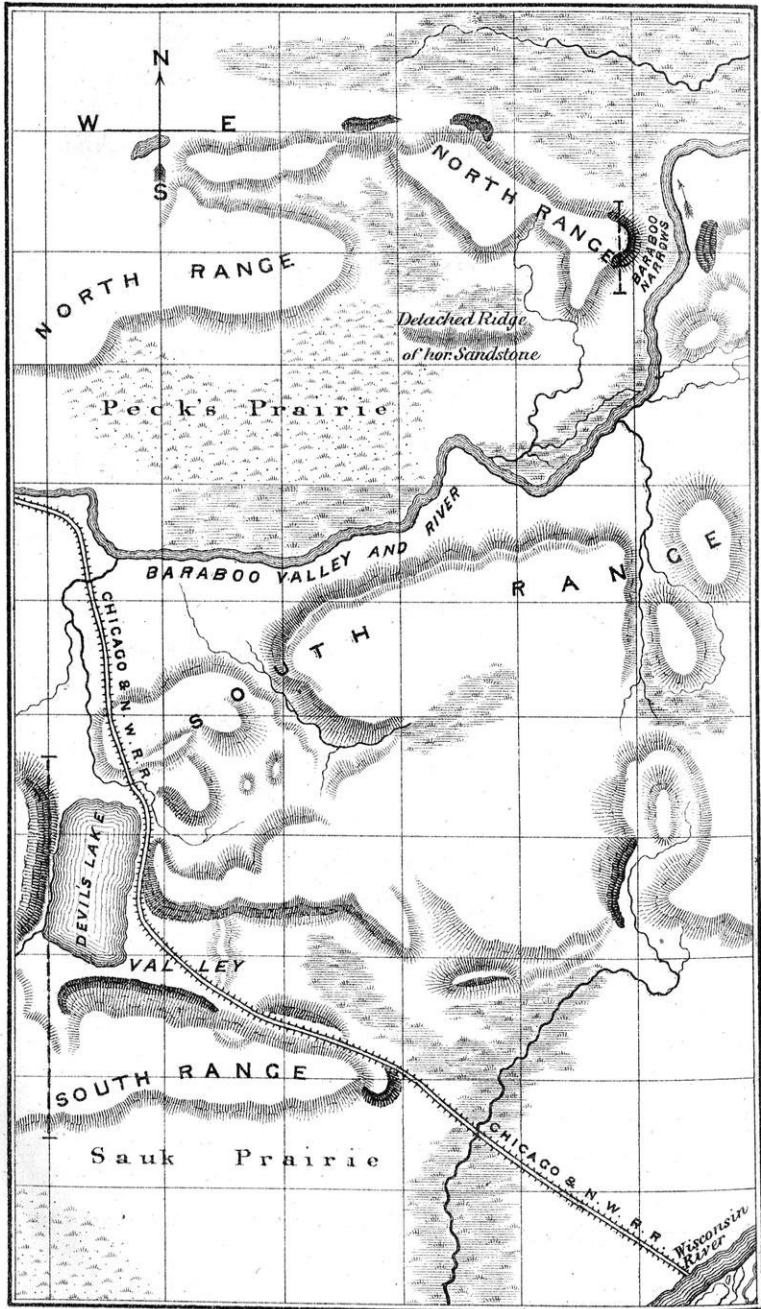
turrets and towers, making one of the most charming bits of landscape in our state.

CHANGE IN COURSE AND BED OF BARABOO RIVER.—A word in evidence that the Baraboo river formerly ran through the valley and was turned aside by the glacier drift. The surface of the lake is thirty feet above the court house at Baraboo, and one hundred and sixty feet above the Wisconsin river to the south. (These figures are Mr. Canfield's.) The lake is more than thirty feet deep and has a bottom of sand. There is therefore a sufficient descent. The valley is a natural course for the river, and running water would have given it some of the features of its present form. In the valley, both north and south of the lake, there is an abundance of drift. In a few hours a large variety of northern rocks was collected, granite, syenite and Lake Superior rocks. They, with sand, have filled up a deeper valley to such a height that the river finds a new course to the Wisconsin.

There is another point of great interest in this region, which does not appear to be easy of solution. On the top of the ridge and in lines running north and south are conglomerated boulders. These are local and do not extend far to the south of the southern ridge. They consist of rounded, water-worn pebbles, and large boulders of quartzite imbedded in a friable sandstone. Some of these conglomerated boulders weigh many tons. They are evidently deposited at a very little distance from the place of their origin. Evidently, in this immediate neighborhood, pieces of quartzite have been for a long time subjected to running water, and have found themselves in a bed of sand, which has been hardened, and some moving cause has carried them into their present positions. The place and time and agencies which have produced these effects, demand a more careful and close study, such as it is the object of the Academy to encourage. There are also signs of a sec-

ondary metamorphic action in some of the quartzite. A number of specimens were obtained which were homogeneous, but contained large numbers of rounded pebbles, of the same quartzite or of white quartz, firmly imbedded in them.





## THE AGE OF THE QUARTZITES, SCHISTS AND CONGLOMERATES OF SAUK CO., WIS.\*

BY ROLAND IRVING, E. M.

Professor of Geology, Mining and Metallurgy, at the University of Wisconsin.

Through the central portion of the county of Sauk, Wisconsin, run two ranges of hills or ridges, having an east and west trend, and a height varying from a mere rise above the general prairie to an altitude of five hundred feet. The width from north to south never exceeds three or four miles, and in places is much less than one mile. The total lengths from east to west, or rather, the exact points at which the peculiar rocks which make up the ridges give place to the ordinary country rock, are not as yet accurately known. These lengths, however, seem to be from fifteen to twenty miles.

The rock material of the ridges is mainly a hard dark-colored quartzite; with this in some places are siliceous and talco-siliceous schists, and two or three kinds of conglomerate. The dip of the strata, which, though in some places obscure, is in others very marked—and can *everywhere* be determined by careful observation—is *uniformly* toward the north. The angle varies from 20 deg. to 25 deg. in the south range, to 75 deg. to 80 deg. in the north.

The occurrence of these bold ridges in the midst of a prairie country, together with the marked contrast between their upturned and metamorphosed layers and the entirely undisturbed strata of the Potsdam and Calciferous epochs, which for miles around form the country rock, has caused much speculation and discussion. From time to time, during the past twenty

\* This paper has already been published, with some slight differences, in the *American Journal of Science and Art* for February, 1872.

years, brief notices have appeared in various journals and reports, but no careful investigation of the localities in question seems ever to have been attempted. In most of these notices, or rather in most of those that are not absurdly inaccurate in their statements and wild in their ideas, the main point under discussion has been the relative age of the metamorphic strata. Do they, or do they not, antedate the Potsdam period? Are they the results of local metamorphism on the Potsdam sandstones, or are they the remnants of pre-existing rocks? The advocates of the former theory have had the last word in the discussion.

The facts recorded in the present article are the results of a series of visits made to the localities by the writer, during the months of September, October and November of this year (1871,) and they will, I think, be seen to prove beyond all doubt or cavil, that the quartzites and schists antedate entirely the Potsdam epoch, i. e., are either Huronian or Laurentian in age.

Of all of the notices mentioned, none are more than brief mentions and only a few seem to have any value at all. Dr. Shumard, in Owen's report on Wisconsin, Iowa and Minnesota, makes the first mention of the quartzite. He gives no opinion. Dr. James G. Perceval, in the report of progress of the Wisconsin survey for 1856, refers again to the quartzites, calling them merely "metamorphic sandstones," but intimating that they result from a change on the Potsdam sandstones. Mr. James Hall, in his report of progress to the Governor of Wisconsin for 1860, gives by far the most accurate description I have been able to find. He refers the quartzites unhesitatingly to the Huronian—but gives no proofs whatever. His pamphlet did not fall into my hands until after my own investigations were entirely completed. In the first volume of his final report, Mr. Hall again mentions the quartzites, but still more briefly, expressing the same opinion as before, and still giving no proofs. In 1864 there appeared in the *American Journal of*

Science and Art (II, vol. XXXVII, p. 226) an article by Mr. Alexander Winchell of Michigan, in which he describes, among others, some fossils from the conglomerates overlying the quartzites; and upon them bases his claim that the quartzites are a downward continuation of the Potsdam sandstones. He himself never visited the localities. Finally, Mr. James H. Eaton of Beloit College, in a paper read before the Wisconsin Academy of Science, in February, 1871, expresses the same opinion though on somewhat different grounds. The foregoing list includes everything of any value that has been published on the subject.

The accompanying map includes those portions of the two ridges where most of my observations have been made.

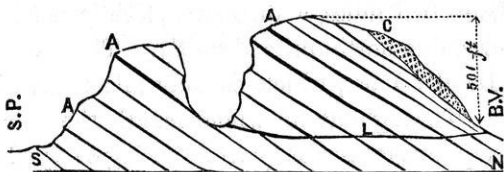
I. The South Range, to which my attention was first directed, presents, on approaching it from Sauk Prairie on the south, a bold, and, in places, precipitous rise from the plain of from 350-450 feet. The northern side of this ridge has however, in all places as yet studied, a much more gradual slope down to the valley of the Baraboo river, this slope being in many places determined by the northward dip. Running entirely through this ridge is a deeply cut valley, which has at first for about two miles, a direction slightly north of west, and then turns due north quite abruptly. This northern end holds the Devil's Lake, which entirely fills the valley from side to side. Throughout its whole length the sides of this cleft are precipitous masses of quartzite rising everywhere more than four hundred feet above the bottom, and reaching at the lake an altitude of 501 feet above its level, and of 1,474 feet above the sea. The bottom of the valley is covered with a heavy mass of Drift material, and the lake is held in its position by low Drift hills at its northern and southeastern extremities. The bottom of the lake itself seems to be in a Drift sand, and is over most of its area about thirty feet below the surface of the water. The lake has no outlet; but draining as it does a very small amount of surface, the extraordinary evaporation



caused by reflection from the cliffs above, together with the high winds of Wisconsin, is quite sufficient to account for its maintenance of level; whilst the character of the surrounding rock shows readily the reason for its not becoming saline.

The great exposures of cliff at this locality, and the deep rock cuttings on the newly-opened railroad, afford most excellent opportunities for study. The change of direction, too, of the valley, gives facilities for approaching the rocks from different sides, not elsewhere easily obtainable.

The rock here is mainly a hard, dark-colored, very compact quartzite, though the colors vary from a very light grey in places to deep brownish-red. The bedding joints of the quartzite are in some places rather obscure, but the railroad cuttings have so far exposed them, that with a little care I was able readily to ascertain the dip. This on both sides, and throughout the whole length, of the valley, is uniformly about 20 to 25 degrees a little west of north. Some of the writers mentioned, and notably Winchell, have described this valley as corresponding to an old anticlinal axis, but the uniform dip of the strata throughout its length proves, of course, that this is not the case.



SECTION 1.—North and south through the south range on section line 1 of map. A, quartzites; A', quartzites with some schists; C, conglomerate; S. P., Sauk Prairie; B. V., Baraboo Valley; L, level of lake.

The quartzite, although often looking massive, shows in many places, on weathered surfaces, the lamination and cross-lamination of more modern sandstones. Many of the fallen masses show, too, on exposed surfaces of lamination, the most distinct ripple markings I have ever seen. On the shallow sandy bottom at the north end of the lake below, may be found their very counterparts. Between the beds of quartzite, in

many places, are thin layers of a schist principally siliceous, but having always some talcose material. These correspond apparently to the clayey or shaly layers between the beds of sand now represented by the quartzite. In some places these layers seem to be merely a thinly laminated quartzite, with talcose films covering the laminae; in others, the talcose material pervades and gives character to the whole mass, the siliceous material, however, always being present.

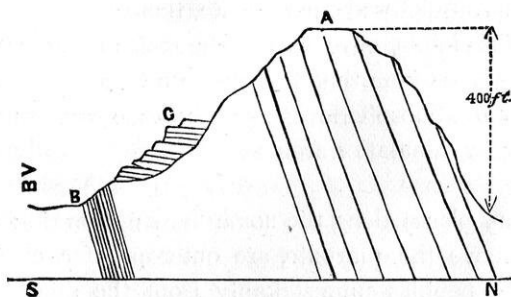
The most remarkable feature of this locality is, however, the very striking system of vertical joints which everywhere intersect the quartzite. The bearings of these joints, taken in some fifty or sixty different localities, I found to be uniformly N.E. and S.W. and S.E. and N.W., the variations in a few places being evidently due to local displacement. On the cliff sides, and more especially about the lake, these joints, together with the bedding joints, have so cut the rock into separate blocks, that these have from time to time been thrown down the bluff by frost and atmospheric agencies in huge rectangular masses, weighing by calculation from seventy-five to two hundred tons apiece.

In many places along the north flank of this ridge and lying always above the quartzite, are outcrops of a conglomerate, containing pebbles unmistakably from the quartzite below, always rounded, and in size varying from a few lines to four or five inches in diameter. In some few places there seems to be a second conglomerate in which the sandy cement itself appears altered to a quartzite. This is a point, however, deserving of further investigation. There are also places where distinct layers of coarse and fine conglomerate occur, the latter always above and graduating into a simple sandstone.

In this conglomerate are found in one locality just northeast of the lake, the Potsdam fossils described by Mr. Winchell in the article referred to, viz. : *Scolithus linearis* Hall, *Orthis Barabwensis* Hall, *Delphinocephalus Minnesotensis* Owen, etc. I have examined a collection of these fossils from the above locality,  
J.

in the possession of Dr. Lapham, of Milwaukee, and have seen the fossils and quartzite pebbles in the same fragments side by side.

II. The observations on the North Range were made about the Lower Narrows of the Baraboo river and westward from there about half a mile. This north range seems to be less continuous both as to elevation and as to the character of its rock material. I am told by Dr. Lapham that it seems rather to be made up of detached masses of metamorphic rocks. The rising ground, however, never entirely disappears, and the quartzite seems to be found as far to the east and west as in the south range. At the Baraboo Narrows the metamorphic rocks are in great force, the cliffs on either side the river, which here makes a direct cut through the range from south to north,



SECTION 2.—Through North range at W. Bluff of Baraboo Narrows. A, thick-bedded dark colored quartzites, with some talco siliceous schist; B, siliceous schist; C, horizontal sandstone; B. V, Baraboo Valley.

being as much as four hundred feet in height. The body of the bluff on the west side is made up of heavy beds of quartzite, with, in places, intercalated beds of metamorphic conglomerate, and of a talcose schist like that in the south range. These beds all stand at a very high angle, between 75 and 80 degs. from the horizontal, the dip being north, with possibly a slight inclination to the east. At the bottom of the hill on the south side is an exposure of a peculiar light-colored siliceous schist, entirely different from any of the other rocks of the series. An old shaft sunk some thirty feet on the schist, affords most

excellent opportunity for examination. The total thickness seen was about twelve feet, the layers varying in thickness from a few lines to four or five inches. Very thin films of a talcose material sometimes appear between the layers. Directly above this schist, I found a horizontal undisturbed sandstone, laid open for some distance by quarrying. The beds are generally a foot or two in thickness. In the loose pieces near by is found *Scolithus linearis*. The sandstone is, of course, the Potsdam of the surrounding valleys. Section 2 will serve to give a clear idea of the structure of this bluff.

The narrow detached ridge just to the westward, represented on the map, is also made up of horizontal Potsdam sandstone. There are many other such detached ridges along the Baraboo valley, bearing the same relation to the quartzite ranges, and showing the same horizontality of strata.

The following arguments in favor of the priority of these rocks to the Potsdam period will, I think, after what has been said, be admitted as valid. I give them in the order in which they became apparent to me.

1st. *The limited area of disturbance*; the undisturbed Potsdam and Calciferous strata being found north, south, and between the ridges, and in close proximity to them.

2d. *The absence of any anticlinal axes*. Dipping as the rocks do uniformly to the north, in order to place them in the Potsdam category, we must imagine a metamorphism of the strata, accompanied by a great fault, having on one side the unchanged sandstones, and on the other the tilted quartzites and schists, an idea new, I think, to geology.

3d. *The occurrence of rounded pebbles of quartzite in the conglomerate on the south side of the south range*. To suppose this conglomerate, which by its fossils is unmistakably Potsdam, to be of the same period as the quartzites below, we must suppose that period to have lasted long enough to cover the deposition of the quartzites as sandstones, their metamorphism, and the rounding of the pebbles by beach action, before the forma

tion of the conglomerate; not to speak of the time sufficient to erase all signs of an anticlinal.

4th. *The occurrence of horizontal sandstones resting unconformably on the flanks of the tilted strata.* This last is, of course, absolutely conclusive as to the *north range*, but lest it might be claimed that the two are independent, I have given the others.

Mr. Winchell argues that, since Mr. Hall states that the fossils I have mentioned as occurring in the conglomerate are restricted to the Middle Potsdam, either this statement must be untrue or the quartzite must be the downward continuation of this formation. This argument, however, loses all force when we regard these ranges as high ridges in the Potsdam seas, never having been entirely covered by these seas, but having merely had the new sandstones and conglomerates deposited about their flanks. The place where these fossils were found must be *at least* 200 feet above the base of the sandstones of the surrounding country. A single glance at Dr. Lapham's geological map of Wisconsin will show this. The conglomerate is by no means necessarily the *base* of the Potsdam because it rests immediately on Huronian or Laurentian rocks.

In the final report of Mr. Hall already referred to, he mentions a low hill north of Baraboo, in which the middle of the hill is quartzite, and the flanks conglomerate and sandstones graduating upward into calcareo-sandy layers, without giving any further explanation. This statement, before somewhat unintelligible to me, now throws further light on my own results.

To my mind these ridges were unquestionably islands in the Potsdam sea, and a more beautiful illustration than is furnished by the sandstones and conglomerates of wave action on a rocky coast, can hardly be imagined.

There are many very interesting details of structure in these ridges which would repay thorough study. The points pre-

sented in the present paper are only those necessary to show the age of the rocks.

There are several more of these scattered quartzite ranges in Wisconsin, all but one of them occurring within the Potsdam and Calciferous areas. During the coming season I hope to be able to make a connected study of them.

UNIVERSITY OF WISCONSIN, November 18, 1871.

## SUGGESTIONS AS TO A BASIS FOR THE GRADUATION OF THE VERTEBRATA.\*

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BY T. C. CHAMBERLIN, A. M.,  
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Some of the leading principles stated in this scheme have been advanced by others, and form important considerations in the several classifications advocated by our leading naturalists, yet the author has seen no systematic scheme embodying them *as a basis for gradation as distinguished from classification*, and some of the principles have not, to his knowledge, been previously stated. To whom credit is due in reference to particular facts or principles cannot readily be stated. The author advances it with deference, because he cannot command that multitude of facts that are necessary to *establish* the claims of any system in zoology. Great difficulties arise to the amateur student away from the great libraries from the state of zoological literature, and under any circumstances from the want of sufficiently full and accurate observations on the nervous system. It is not intended to advance assertions, but suggestions. The suggestions here made, if of value at all, may be of value beyond the vertebrata.

This scheme differs from most others in being founded on a single organism, the nervous. This, at first thought may seem a fatal objection. But it must be remembered that there should be a clear distinction drawn between *rank* and *classification*. It will doubtless be conceded that a cephalopod ranks

\* This subject was originally presented to the Academy in the extemporaneous style from notes and diagrams. The notes, which were not closely followed, constitute the abstract which appeared in the BULLETIN. As it is impossible now to reproduce the actual presentation, and as it is of no importance in preparing this article for publication here, I have taken all the liberties of original presentation.

higher than an annelid, and on the other hand that the insectea outrank the bryozoa. Yet the first is classified with the last and the second with the third, the rank and the classification resting on entirely different grounds. While it must be admitted that a classification based upon a single portion of the physical system would be of little value, it does not follow that this is true of gradation. It is true, a classification may be made on the basis of rank, but it is manifest such a classification would be most arbitrary and unnatural. Array all the animal kingdom in a line according to rank from the lowest to the highest, and then cut that line into as many or as few pieces as you please, and cut it where you please, and it is evident that the classes thus formed would be heterogeneous and unnatural. Radiates, mollusks, and articulates would be mingled confusedly with each other, and, doubtless, even with the vertebrata. And even though a classification be based upon rank, it would not make the two synonymous. Classification would then simply be founded on rank as it is commonly founded on structure. This distinction between gradation and classification does not seem to have been apprehended in its full force. *A true classification must be based upon differences in kind, a true gradation upon differences in degree, differences in kind being reduced to a common standard by some system of equivalents.* In establishing this system of equivalents lies the great difficulty of gradation. The manifest problem when we attempt to determine rank by specialization or otherwise in the various organs, lies in determining the *comparative value* of such indications. How much will a *modification in locomotion* weigh in the scale of rank when set over against a *modification in respiration*? How much a *mental characteristic* compared with a *physical adaptation*? How much of *superior specialization in a limb* will counterbalance a *given amount of intellectual, moral or social development*? It is true, this difficulty arises to a certain extent when we take for our basis the nervous system; yet, I think, here *nature has*



*largely done this work for us, has made the comparison and given us the results*, and herein lies its especial fitness to be our guide. A mental power and a physical form are so diverse in their nature that, considered independently, it is not apparent how they can be rationally compared at all. But the nervous system is a common medium for their action and furnishes the means of comparison. Where two organs of diverse natures act by means of separate and exclusive ganglia, those ganglia, it must be admitted, furnish the true means of comparison. And though the ganglia presiding over the various organs may not be thus distinct and exclusive in general, that does not vitiate the principle, but only affects its application.

Furthermore, the objection to this single organism as a basis is very much answered, so far as it has any bearing on gradation, when it is remembered that the nervous system is *comprehensive* in its nature. It is headquarters and source of co-ordination for all the functions of the whole system. It in a sense comprehends them all. This is a fact of supreme importance in gradation though it may be valueless in classification.

The nervous system is likewise *representative* in its nature. Complication in any other system of the body implies corresponding complication of the nervous system, *and implies it in terms of the common standard.*

Moreover, the nervous system comprises the highest form of organized matter. We should then expect its forms to be most indicative of rank.

And further, while it is generally conceded that intellectual characteristics have little value in classification, if indeed they should not be entirely ignored, they must from the very nature of the case form a most important element in the estimation of rank. Classification should be based upon structural affinities, gradation upon functional power. Classification, if true, is but an interpretation of nature; gradation is a judgment passed upon it. Classification is natural; gradation is

artificial. Gradation being thus a judgment must have its basis. Whether it has been distinctly recognized or not, the same one has been instinctively and universally adopted, viz: *power*, physical and psychological, qualitatively as well as quantitatively considered. This is made prominent in Prof. Dana's articles on "Cephalization as a Basis of Classification," and is a clearly recognized ground-work of his ideas, so far as they are gradational in their nature. Most writers, while consciously or unconsciously recognizing the basis, have looked to the principle of "division of labor" for a decision. While this is an important element of power, it is not the sum total nor any sure indication of it. But the point I wish to make in this connection is this, power is by no means all physical. Intellectual and moral forces cannot be ignored. A gradation that does not recognize these is as false as a classification based exclusively upon them. Now the nervous system is the especial instrument of mental manifestation. Its forms indicate, so far as they can be interpreted, the mental characteristics. Are we not compelled then to seek in its forms, and in its developments, that natural co-ordination of mental and physical indices of rank which alone can form a rational basis of gradation? That the systems commonly relied upon do not give us the truth approximately and in a general way is by no means asserted. The general truth of their results is assumed, and is made the basis of what arguments are here presented.

The following are suggested as indicative points :

*1st. Position of the general line of the cerebro-spinal axis.*

This is essentially horizontal in fish, acknowledged to be the lowest of the vertebrates; perpendicular in man, the highest; intermediate in a general sense in the intermediate orders. These facts have been frequently noted and appealed to as indicating rank. Some difficulties in application and sources of error exist, owing to modifications due to habits of life and

variety of posture. It is to be regarded as of only general value. Stated as an affirmation, the first principle will be :

*The nearer the approach of the general line of the cerebro-spinal axis to the perpendicular, the higher the rank.*

*2d. Angle formed by the axis of the spinal cord with the axis of the encephalic ganglia.*

The lines coincide approximately in fish, are nearly at right angles in man, are intermediate in the intermediate orders. This principle, like the preceding, can be regarded as of only general value. The angle of these axes is manifestly dependent in many cases upon the form and habitual position of the animal. The angle is large in the mole, rat, and similar burrowing animals for obvious reasons, and on the other hand when the habits of the animal require the longitudinal axis of the face to be more or less transverse to the cervical vertebræ, the angle is modified accordingly. The facts under these two heads then are rather representatives of the position and form of the body in general, and of positional relations of the nervous system to it, than characteristic of the functional relations of the system itself. Hence their inferior utility. Yet they are not without their value, and they show the representative character of our basis. Stated as a conclusion, the second principle will be :

*The nearer the approach to a right angle, the higher the rank.*

*3d. Degree of separation of the encephalic ganglia from each other.*

Ready and prompt inter-communication, with efficient co-ordination are necessary to the higher complex mental and physical manifestations. Positional concentration facilitates this. So long as the nervous action is of the simple reflex nature, the nearer the several ganglia are to the organs with which they are connected, the more favorable their position for performing their functions. But when co-ordination and combi-

nation of nervous action become predominant, the greater the concentration, the more efficient the action. This co-ordination will depend partly upon positional and partly upon commisural relations. One element of position is degree of separation. We should then, beforehand, expect to find those portions of the nervous system which are devoted to local and, in a measure, independent functions of the simple reflex nature scattered more or less, their position being determined rather by that of the organs whose action they control, than by their relations to other parts of the nervous system; while on the other hand we should expect to find those parts whose office is the organization of thought, feeling and co-ordinated motion, or whose function is closely related to these, collected together, forming a great nervous center, more and more concentrated and compacted as the co-operation of parts becomes more prompt and efficient. We find it to be so. It is but a common observation of naturalists, and to a greater or less extent its gradational value has been recognized.

The scattered situation of the sympathetic ganglia is marked as well as their separation from the encephalic centres. So of articulata, mollusca and radiata. The spinal cord, regarded as a nervous centre and performing functions a grade higher, has a better relationship but not a close one. In the lowest vertebrata the encephalic ganglia are markedly separate. As we proceed upward the separation is less and less marked, till in man aggregation reaches its highest state.

*The less the separation the higher the rank.*

#### *4th. Relative position of the parts.*

This is intimately connected with the preceding principle and has the same general import, but yet is in a measure distinct from it. In the amphioxus the arrangement is purely linear, and in all the cyclostomes there is little variation from it. In the higher fishes there begins to appear what may be termed a *two-ranked* arrangement, the cerebrum and cerebel-

lum being super-imposed upon the sensory ganglia and the medulla oblongata. This two-ranked arrangement is persistent in a more or less marked degree through all the higher orders, rank being indicated by advance from a rectilinear to a curvilinear arrangement. In the lowest orders in which this arrangement appears, lines drawn through the two series of ganglia are approximately parallel straight lines, in the highest they are approximately concentric semi-circumferences. This curvilinear arrangement has a double significance. It is the combined result of *a tendency to a compact arrangement and a relatively large development of the upper series.*

Much has been said on the relative position of the parts, especially of the cerebrum and cerebellum and more or less significance attached to this principle, yet observation in this direction seems to have been special rather than comprehensive.

Position with reference to the head of the spinal cord is worthy of especial attention. From a strictly posterior position, the spinal axis passes, as we ascend in rank, through almost a quadrant to a sub-central position beneath. The import of this, as facilitating co-operative intercommunication is apparent.

Embryology furnishes striking facts bearing upon this subject as it does upon other points discussed in this article. But I shall not here insist upon them, for we are, perhaps, not safe, as yet, in assuming that embryological development is along a line of uniform gradational advancement, however true this may be as a general fact. Until there shall be greater uniformity of opinion as to the origin of species and the relations of embryology to that subject, arguments based upon it must be regarded as questionable to a certain extent. But its general indications must be allowed considerable value, whatever views of development may be entertained.

Stated as a deduction, the fourth principle will be,

*The more compact the arrangement of the parts, the higher the rank.*

5th. *Presence or absence of certain parts, especially connecting parts.*

The corpus callosum, which in the higher mammalia is the largest and most important mass of commissural fibers, is wanting below that class and has a markedly varied development within it. The pons Varolii and other commissures are wanting in many of the lower forms, the anterior commissure being the only one traceable in fishes. The absence of these parts indicates want of association in action and consequent want of power to perform the higher complex functions, either mental or physical. A single illustration from Dr. Carpenter: "It is interesting to observe that in many Lepidoptera and Hymenoptera, which are remarkable for rapid and powerful flight, the nerves supplying both pairs of wings, are united at their origins. On the other hand, in many insects which are not remarkable for velocity or equability of motion, the nerves supplying each wing originate separately, and have little communication, just as in the larva of the Sphinx; and in the Coleoptera, in which the upper pair or elytra are motionless during flight, the nerves frequently remain entirely separate."

*Absence of commissural parts indicates low rank..*

6th. *Relative size (a) of ganglia of the same animal (b) of a single ganglion to the whole body, (c) of the encephalon and of the entire nervous system to the whole body—(d) of the parts of the same ganglion, (e) of connecting parts.*

(a) It will not be questioned that the several ganglia perform different functions, that some of these functions are higher and some lower, that size, with modifications, indicates their functional power, that the cerebrum performs the highest functions, that there is a scale of rank for the others, whatever it may be. It is almost axiomatic then to state that the larger the ganglia of high functions the higher the animal's rank. The cerebrum in the lowest vertebrates is entirely wanting, in all the lower orders it is relatively small, in the higher

relatively large. In many fishes the optic lobes alone are larger than the cerebrum. In man, at the other end of the series, the cerebrum is very much larger than all the remaining encephalic ganglia combined. Between these extremes there is every degree of gradation.

Under this head may be included the suggestion of Dr. Carpenter, that a comparison of the bulk of the cerebrum with the diameter of the spinal cord would give more accurate results than a comparison with the whole body.

(b) Unsatisfactory as this comparison is in some respects, and inferior as it may be to that suggested by Dr. Carpenter, it yet has much value, and when its results have been carefully corrected, for density, quality, activity, etc., it will be found free from most of the objections urged against it. It must not be expected that any one comparison will show all of the truth, especially when the truth is so complex as here. Each one shows its peculiar phase. All must be combined to give all phases and the true result.

*With modifications, the larger the cerebrum, compared with the whole body, the higher the rank.*

General estimates would seem to indicate that the law of the cerebellum, considered individually, is the same, subject however to more important modifications.

(c) Comparisons of the cerebrum are especially indicative of intelligence. But this is not the only element of the problem. Power of the more physical kind must be computed and combined with it to give correct results. Given two animals of equal intelligence, the one which has the greatest muscular power, either quantitative or qualitative, must rank the higher. Comparisons of the encephalic mass and of the entire nervous system must be made, to correct errors arising from this source.

(e) The size of connecting parts is an additional item bearing upon the co-operation of the parts, and taken in connection with what has been said already, and with the fact that the commissures are introduced at different points in the scale,

and that their development is markedly varying, renders this a most highly indicative item. Attention should be given to longitudinal bands as well as transverse.

(d) The parts of a ganglion, especially of the larger, have different degrees of development, and if, as many believe, the different parts have different functions, the relative size of each must be indicative, and, whether functional differences are conceded or not, inductive study shows it to be true at least in a general sense. The anterior lobe of the cerebrum is much more developed in man than in the apes or any of the higher mammals, and in these, than in the lower orders. The posterior lobe, as such, does not appear at all except in the highest mammals. Similar significant facts are presented by the other lobes of the cerebrum and by those of the cerebellum. The development of the anterior, upper, and posterior parts of the cerebrum especially indicate high rank. This is intimately associated with and in a measure determines the form of the parts which, however, is thought worthy of being considered under a separate head.

#### *7th. Absolute size.*

Given two animals, alike in every other respect, the one that possesses the greatest nervous mass must rank the higher. Size is one measure of power. Prof. Dana in his articles on "Cephalization" has given to a somewhat different application of this principle, the importance it merits, and which seem to have been overlooked or disregarded by other systematists.

#### *8th. Form of the parts, especially of the cerebrum.*

The attention that has been paid to the form of the skull by ethnologists, indicates the value of this point; but a higher value, the author believes, attaches to the form of the brain itself than to its representative, the skull. The deductions of ethnologists from the form of the skull, however, must be accepted in general, when applied to the brain itself. What-



ever may be thought of the technicalities of the doctrines of Gall and Spurzheim, the general truth that the form of the brain indicates the form of the character can scarcely be questioned. The force of observations in this direction will be measured somewhat accurately by the degree of development of the organ, the form being most significant when the development is highest.

*9th. Relative position and amount of grey and white matter.*

The general position is not a variable element, but is worthy of notice as indicating the functions of the several parts; the tendency of the grey matter being toward the outside for the higher functions and toward the inside for the lower. No especial value is attached to this.

The presence, number and depth of the convolutions have been regarded as especially characteristic of rank. The variations of the human brain in this respect, and its correspondence with character have been appealed to; as also the fact of their late introduction into the scale of creation. A comparison of man with other mammals, with birds, with reptiles, with fishes, is conclusive as to the general truth that numerous and deep convolutions signify elevation of rank. This rule, however, taken by itself would elevate the cerebellum above the cerebrum, and, if the general way in which Prof. Huxley states the facts does not deceive me, aquatic carnivora above terrestrial, and would give a much higher rank to the cetacea than is usually accorded them. But in the cetacea on the other hand the limited development of the commissures indicates low rank, so that here, as elsewhere, the indications of different parts are not always in harmony, which shows the necessity of collating and combining all the indices. On this subject a word at the close of the article.

The amount of vesicular matter is an important item. The functional power of the organ is doubtless more accurately indicated by this than by the entire mass.

10th. *Density.*

The actual amount of nervous matter is to be regarded rather than the space it occupies. Some ganglia are hollow in one order and solid in another. Errors are liable to arise from this. Again the structure where solid may be more dense in one case than in another. The specific gravity will be a valuable guide. Simple weight will not answer. A dense structure will unquestionably differ in functional power from a loose one of equal weight.

11th. *Quality of the nervous organization.*

This, unquestionably, it is difficult to determine with certainty and precision, but its significance cannot be questioned. It is a very important element in determining superiority among men, where it can be estimated somewhat accurately, and it is doubtless equally so among the whole class vertebrata. A general harmony of structure pervades the organization of an animal. Coarseness in one part is usually accompanied by coarseness in all others, and *vice versa*. It is not difficult to determine the general quality of the organization as a whole, and thus we may form a general though somewhat uncertain estimate of the quality of the nervous organization. What assistance microscopic study may lend in this estimate is not yet demonstrated. That it will be important, it is reasonable to hope.

12th. *Activity of the nervous system.*

Like quality, this may be difficult to determine, but yet it is important. Yet I think, in the amount and in the changes of the blood sent to the brain, we have a reliable index of its activity. I am not aware that any observations, save a few by the author, have been made with this end in view. Yet the value of such observations are apparent upon a mere statement. And that value is not confined to the determination of activity merely, but of the total amount of nervous force. The

chemical and molecular changes of the blood sent to the nervous centres are regarded as the true measure of the nervous force generated. The amount of this force compared with the amount of nervous substance should show the activity.

*13th. Relative development of the sympathetic and cerebro-spinal systems.*

The comparative rank of the two systems is unquestioned. The distinct differentiation of the latter from the former marked a large advance upon previous structures. The relations of the two systems must then be indicative.

The indications of a single one of these rules alone is not to be regarded as decisive. The fallacy of most of the objections that have been urged against such of these rules as have been previously advanced lies here. Because they have not been universally decisive, their value within the sphere of their application and with the modifications and corrections to which they are subject, has been falsely estimated. That that sphere and those modifications and corrections can be ascertained and their relations adjusted, is the firm belief of the author. It is the combined and corrected result of all these rules that is to be decisive. And as their indications are not always harmonious when two subjects are being compared, the question of their relative value arises. This question, as I have attempted to show, has not by any means the significance it has when applied to a system based upon the various organs of the system. But whether more or less significant, the author is not yet prepared to answer it, except in generalities.

## ANCIENT LAKES OF WISCONSIN.

BY HON. J. G. KNAPP, MADISON.

Few persons have reflected—probably because their attention has not been directed to the subject—upon what barriers have been cast across the courses of our rivers; and how they have been removed by the action of water and drift, in the long periods of the past; what immense tracts were once covered with water, forming fresh water lakes, where now men plow, hoe and tend crops, and human habitations stand. To enlarge or particularly define any locations is not intended, but to call attention to a subject scarcely noted.

The Mississippi dam may be located just below the mouth of the Wisconsin, where the strata of rocks rise on each side of the river in unbroken series, several hundred feet. If these strata were carried across the river, and the supposition is not violent, since the strata are nearly horizontal, and there is no evidence of violent terremotal action at this point to break down the strata since their deposition, then both streams would be backed up and made to cover their present valleys; the Mississippi to the Falls of St. Anthony and the Wisconsin to the Baraboo bluffs. This barrier is out of the drift region, and has been broken down by the action of water. If the next supposition be warranted, the Wisconsin river was much smaller than at present.

The Baraboo barrier next deserves attention. This elevation was united with the high lands on the east of the Wisconsin in the southern towns of Columbia county, thus forming a large lake into which the Wisconsin, Baraboo, Duck creek and Fox rivers emptied, and which then belonged with the Wolf river to the Lake Michigan watershed, as the Fox yet does. The

Swan lake, east of the portage, and the deep holes in Big Slough appear to be remnants of this lake. The barrier has been broken down, and much of the filling up has been done by glacial action, as here is near the western boundary of that action. Where the eastern boundary of this lake was located we may never know, since all monuments of its former existence may have been swept away by the glacial action, which spread over that whole region. For the same reason it will be difficult to accurately determine the former character of the lakes and valley of the Upper Fox and Wolf rivers; whether they are remnants of one immense lake or parts of several, or whether they were deep cavities in the ancient Potsdam sand rocks or scooped out during the glacial period, we may never be able to determine with any degree of exactitude.

Lake Winnebago was once much larger than at present. The ancient boundaries may be readily traced, at about the same level as the present clay banks at Appleton, which have been cut through with the entire channel of the lower Fox since the drift period, and the clay deposits. That higher lake level may have been sufficient to have mingled the waters of Lake Winnebago with the Horicon, during the existence of the present fauna, since the fishes of Lake Winnebago and Rock river, with few exceptions, are identical even to varieties.

The extensive lakes found in the drift, with the adjacent wet meadows and swamps, owe their origin to the glacial action, and their drainage has been the work of water, and in most cases so gradual, yet continuous, that the ancient beaches have been obliterated, if ever formed. These will each present peculiar characteristics, and must be studied as individuals, and not as a whole system.

The Upper and Lower Dells of the Wisconsin present us with the result of the action of water in slowly cutting down the sand rock, and emptying one of the most extensive of the Wisconsin lakes. This lake, and the water-worn outlet was exterior to the drift range, and was one of the largest fresh-



## ON THE MINERAL WELL AT WATERLOO, WIS.

BY REV. O. A. WRIGHT, A. M., NEW LISBON.

The well referred to in this paper was dug in the fall of 1857. A strong vein of water was found at about ten feet below the surface, and in a stratum of sand some two feet thick. The direction of its flow was from north to south—opposite to the course of Waterloo creek. It flows from underneath a ridge some twenty or thirty feet high, which seems to be nothing more than the ordinary swell of the prairie, with nothing peculiar in its geological formation, being mainly formed of what is usually known as the glacial drift. The vein is not inexhaustible, but gives the well a capacity of about twenty-five barrels a day.

The mineral properties were first discovered when it acted as a cathartic upon the horses that were watered at the well; this being the only purpose for which the well was used, on account of its peculiar taste. A gallon of water was sent to Mr. J. H. Tesch, of Milwaukee, by whose analysis it was found to contain :

	Grains.
Chloride of sodium .....	23,345
Chloride of potassium.....	7,060
Chloride of calcium.....	28,779
Chloride of lithium .....	12,039
Nitrate of soda.....	36,017
Sulphate of magnesia.....	11,490
Bi-carbonate of magnesia .....	15,786
Bi-carbonate of lime .....	13,416
Silica .....	1,343
<b>Total.....</b>	<b><u>149,275</u></b>

ON POTENTIALS AND THEIR APPLICATION TO  
PHYSICAL SCIENCE.

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BY PROFESSOR JOHN E. DAVIES, M. D.  
Of the Wisconsin State University.

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IN most of the recent Mathematical discussions of Physical Theories and Problems, or where laws of nature, first established by observation or experiment, are afterwards followed to their legitimate consequences by the application of analysis, we find a certain Function used, which, on account of the admirable simplicity it introduces, gives great elegance and brevity to the demonstrations, and the nature of which should, therefore, be thoroughly known.

For attracting bodies, we read of the POTENTIAL of the attracting mass, at some given point external or internal to the mass itself; of Heat Potentials; of Potentials of Stress, Elasticity, &c., &c. In short, the Function is evidently one of such great generality and power, as to be adapted to most cases where the effects of any forms of Force (attractive or repulsive) are to be considered. It is thus of indispensable service in the Dynamical Theories of Heat, Light, Electricity, &c., now so universally accepted as the true ones.

Any attempt, then, to present the exact meaning and nature of this Function in a clear light, ought to be of service to those who wish for that thorough comprehension of Physical laws, which mathematical analysis so much aids in giving.

The *Potential Function* for Gravitation was first introduced by Laplace in discussing the attractions of Spheres and Spheroids. (*Mecanique Celeste*, Book II, Chap. II,



§ 11, and Book III, Chap. I, § 4.) He makes use of it afterwards in discussing the Moon's influence in determining a tide at any point on the surface of the Earth (Book IV, Chap. I, § 1 et seq.); her influence on the protuberant mass about the Earth's equator, causing lunar precession (Book V, Chap. I, § 3 et seq.), and the reciprocal action of this mass in causing irregularities in the orbital motion of the moon. (Book VII, Chap. II, § 20 et seq.)

The introduction of this function enabled him to do away with difficult—in some cases *impossible*—integrations, and to substitute therefor the comparatively easy processes of differentiation.

It seems to have been used by Laplace merely as an Analytical artifice whereby to accomplish certain results in the calculation of attractions, by substituting *indirect*, but, as it proves, *easy* methods for direct but very difficult ones. He applies it, of course, only to the force of gravitation.

Afterwards, in 1828, the term *Potential Function* was applied to it by George Green, a poor operative, in Nottingham, England, whose mathematical labors in the intervals of his other labor raised him to such notice as to cause him to be sent to Cambridge at the age of forty; and to be now regarded as one of the greatest contributors to Mathematical Physics. His papers have recently been published by Messrs. Macmillan & Co. in one volume, edited by Prof. N. M. Ferrers. They are models of analytical elegance and skill.

Green's treatment of the *Potential* is, however, purely analytical. He seems, also, to take it for granted that all that LAPLACE had already written upon the subject in the case of gravitation was well known to those who heard or read him. He first applies this function to distributions of Electricity and Magnetism over bodies of various form.

The only interpretation Green gives to this Function is that which LAPLACE had already given, viz. : that it is a quantity such that its partial differential, with respect to any co-ordinate  $x$  of a point  $p$ , will give the attraction due to the mass along any line chosen for the co-ordinate axis  $X$  ; that, letting  $x', y', z'$  be the *rectangular co-ordinates* of a particle of any attracting or repelling mass,  $\rho'$  its density,  $dx', dy', dz'$  its sides regarded as an elementary *parallelepipedon*,  $r'$  the distance of this element of mass from an attracted point  $p$  exterior to the body, then

$$V = \text{Potential Function of the whole mass at the point } p \\ = \int \frac{\rho' dx' dy' dz'}{r'}$$

The integral comprehending every particle (or elementary mass) in the entire mass.

Green's own words, in beginning his essay on Electricity, are : "*It is well known*, that nearly all the attractive and repulsive forces existing in nature are such, that if we consider any material point  $p$ , the effect, *in a given direction*, of all the forces acting upon that point, arising from any system of bodies  $S$  under consideration, will be expressed by a partial differential of a *certain function* [the Potential] of the co-ordinates which serve to define the point's position in space. The consideration of this function is of great importance in many inquiries, and probably there are none in which its utility is more marked than in those about to engage our attention. In the sequel we shall often have occasion to speak of this function, and will, therefore, *for abridgment*, call it the *Potential Function* arising from the system  $S$ . If  $p$  be a *particle* of positive electricity under the influence of forces arising from any electrified body, the function in question, *as is well known*, will be obtained by dividing the quantity of electricity in each element of the body, by its distance from the particle  $p$ , and taking the total sum

of these quotients for the whole body." [This is expressed by the above integral.]

It will thus be seen that Green's definition is purely mathematical; and, moreover, that he supposes the nature of the function already well known. The object of his essay was "to deduce certain relations between the values of this function for different points, and the densities of Electricity or Magnetism that give rise to these 'values.'"

The object of the present paper is to attempt to give a *Physical* interpretation to this Function and to illustrate it and its use by some simple example. Suppose, then, a body, say a material particle, be lifted to any point  $p$  above the surface of the earth; the co-ordinates of this point  $p$ , referred to the earth's center, being  $x, y, z$ . It is evident that, to do so, work must be done by some agent against the earth's gravity; the amount of this work depending solely on the distance of  $p$  and the total attraction of the earth, the mass of the particle raised being supposed constant. This particle *contains* this work, as it were, *stored* in it, and will give it off in overcoming resistances on its way back to the earth. The Sun expends work—its heat—in raising the waters of the earth into clouds. These clouds overcome resistances, or, in other words, *do* work on their way as cataracts back to the sea. For all different values of the co-ordinates  $x, y, z$ , of the point  $p$ , we shall have different values for the work done against gravity in raising the particle to this point. Were the particle to remain stationary at  $p$ , having constant co-ordinates  $a, b, c$ , this work would change in amount also, by supposing the mass or attracting power of the central body to change. There is thus seen to be a certain definite quantity of *work-power* between bodies endowed with mutually attractive or repulsive forces, which work-power depends in amount on the strength of the mutual forces and the space separating the bodies of

the system. *This quantity*, thus shown to be a function of both force and space, *is the Potential Function*. The integral

$$V = \int \frac{\rho' dx', dy', dz'}{r'}$$

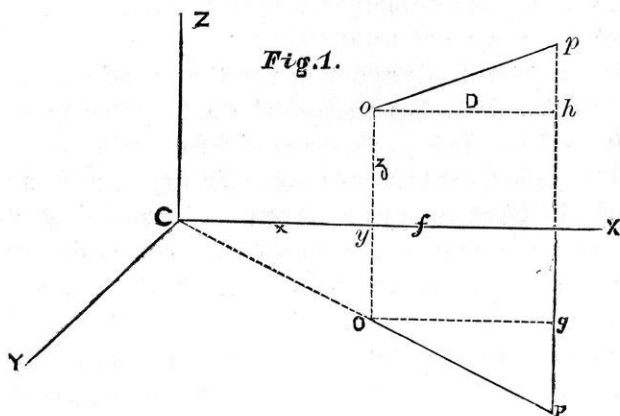
is its analytical expression, and means what we have just indicated. The Physical idea it represents is, therefore, *work*, or *energy*.

It is a quantity representing not the *actual* energy of work *being done*, but the *possible* energy due to work *already done*. It is a consequence of the inertia of matter and the indestructibility of force. Energy exerted is not energy lost, but energy stored or transformed. Potential energy is energy stored. The Potential energy of Elasticity is, according to Rankine's definition, the *work* which a body, in a state of strain, is capable of performing in returning to the free state. The Potential energy of Heat is, according to Clausius, the work which the moving molecules are *capable* of performing in being brought to a state of less energetic motion, or to rest; and Mohr has apparently shown that the Potential energy of Chemical Affinity is due to *atomic* motions *within the molecule*, which, on being lessened or destroyed, must be changed to Heat, Light, Electricity, or Mechanical work. In all these cases, the Potential Energy is a function of force and space, or its correlative, time. When expressed mathematically, it is the famous *Potential Function*; and its value is determined by the special circumstances of each particular case.

We will give an easy example of its application, in a manner which all students of Analytical Geometry and Elementary Mechanics will readily understand.

It is well known that if a material point whose co-ordinates are  $f, g, h$ , be acted on by forces whose resultant  $P$  may be regarded as emanating from  $O$ , a point whose

co-ordinates are  $x, y, z$ , then  $P$  may be resolved into three component forces acting along axes at right angles to each other, the values of which components will be  $P \cos \alpha, P \cos \beta, P \cos \gamma$ —alpha, beta, gamma, denoting the angles made by the direction of the force  $P$ , with the three co-ordinate axes.



Let the straight line joining  $p$  and  $o$  be called  $D$ . Then  $D = \sqrt{(f-x)^2 + (g-y)^2 + (h-z)^2}$ , and the expressions for the component forces will then become

$$\left. \begin{aligned} X &= P \cos \alpha = P \cdot \frac{(f-x)}{D} \\ Y &= P \cos \beta = P \cdot \frac{(g-y)}{D} \\ Z &= P \cos \gamma = P \cdot \frac{(h-z)}{D} \end{aligned} \right\} \text{(A)}$$

which are to be made negative when the force  $P$  is attractive towards  $O$ , as it then tends to diminish the distance  $D$ .

(A reference to Fig. 1 will show the applicability of these formulæ.)

If the force  $P$  be one which depends on the mass of a solid, like gravity; or, like Electricity or Magnetism, one whose accumulation or *density*, as we may say, is greater at some points than others; and if it also depend in any man-

ner upon the distance  $D$ , then the most general form we can give to  $P$  will be  $\int \int \int \frac{\rho \, dx \, dy \, dz}{D^n}$ :

$\rho$ —denoting the varying density.

$dx \, dy \, dz$ —the volume of an element of the solid or surface whence the force emanates.

$n$  being any number, positive or negative; it will be positive in the above expression when the force varies *inversely* as some power of the distance; negative when the force varies *directly* as some power of the same;  $n$  being the degree of the power in either case.

The integration expressed in the equivalent value given above for  $P$ , is to be within such limits as shall include the entire volume of the attracting mass, or the entire surface over which the force, e. g., Electricity, is distributed.

Substituting this value for  $P$ , the expressions (A) will become

$$\left. \begin{aligned} X &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (f - x)}{D^{n+1}} \\ Y &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (g - y)}{D^{n+1}} \\ Z &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (h - z)}{D^{n+1}} \end{aligned} \right\} \dots \dots (B)$$

In the case which is most common among natural forces,  $n$  will be *positive* and equal to 2. The force will then vary *inversely* as the square of the distance.

Taking this case as the easiest apprehended, and substituting for  $D$  its value before given in terms of  $f, g, h, -x, y, z$ , equations (B) will become

$$\left. \begin{aligned} X &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (f - x)}{[(f - x)^2 + (g - y)^2 + (h - z)^2]^{\frac{3}{2}}} \\ Y &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (g - y)}{[(f - x)^2 + (g - y)^2 + (h - z)^2]^{\frac{3}{2}}} \\ Z &= \int \int \int \frac{\rho \, dx \, dy \, dz \, (h - z)}{[(f - x)^2 + (g - y)^2 + (h - z)^2]^{\frac{3}{2}}} \end{aligned} \right\} \dots (C)$$

If, then, we wish to ascertain the amount of attraction or repulsion exerted upon some material point whose co-ordinates are  $f, g, h$ , by a heterogeneous mass or an electrified surface, the integrals (B) or (C) will enable us to write down the values of the component attractions along the axes  $X, Y, Z$  at once. But to evaluate these integrals is always difficult; in some cases *impossible*. A careful *inspection* of them, however, will show that if we separate out from each one of them the quantity

$$\begin{aligned} & \int \int \int \frac{\rho \, dx \, dy \, dz}{D} \\ &= \int \int \int \frac{\rho \, dx \, dy \, dz}{[(f-x)^2 + (g-y)^2 + (h-z)^2]^{\frac{3}{2}}} \\ &= V, \text{ say, then} \end{aligned}$$

$$\left. \begin{array}{l} \text{the whole expression for } X = \frac{dV}{dx} \\ \text{“ “ “ “ } Y = \frac{dV}{dy} \\ \text{“ “ “ “ } Z = \frac{dV}{dz} \end{array} \right\} \dots \dots \dots (D)$$

Here, then, is a quantity  $V$ , which, when once a value is found for it, will give us the values of the attractions  $X, Y, Z$ , by a single differentiation of it with reference to  $x, y$ , or  $z$ . This quantity is the *Potential Function* which we have before explained; as is evident on a comparison of the two expressions.

To find  $V$  is generally far easier than to directly integrate the expressions for the components of force. Indeed, Laplace has given a general mode of expanding  $V$  into a series, which is both simple and beautiful. *To explain methods of finding the value of  $V$  in different cases*, is not the object of this paper; \* but merely to call the more general attention of students of Physical science to the

\* This is very fully done in Laplace (Book III, Chap. I, § 4); Green's Math. Papers, edited by Ferrers—Thompson & Tait's Nat. Phil., Vol. I.

importance of this Function by a simple explanation of its nature and use.

As a further example, we will apply it to finding the attractions of a Sphere, on an external or internal point. This, it is true, is a case in which it is easier to integrate directly the expressions for the attractions; but we use it merely as an example.

We already know by other methods that these attractions will be

$$\text{for an external point} = \frac{4}{3} \pi \rho \cdot \frac{r^3}{x^2}$$

$$\text{“ “ internal “} = 2 \pi \rho r^2 + \frac{4}{3} \pi \rho \cdot x$$

where  $r$  = radius of the sphere.

$x$  = distance of attracted point from centre.

$\rho$  = density of the sphere.

Let us get these values through the *Potential Function* in each case.

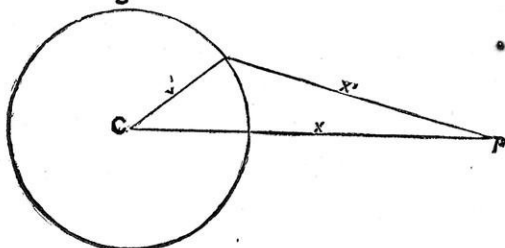
If  $r, \mu, \omega$  be the polar co-ordinates of any *surface* element of the Sphere, referred to the centre of the Sphere as origin; — $r$  being the radius;  $\mu$ , the cosine of the latitude (or better, the co-latitude);  $\omega$ , the longitude of the element;  $\rho$ , the density of the sphere; then the

$$\text{Mass of this element} = \rho r^2 dr d\mu d\omega.$$

If in Fig. 2,  $x'$  = distance of this element from  $p$ , then will, by ordinary Geometry,

$$x' = \sqrt{r^2 + x^2 - 2rx \cdot \mu}.$$

Fig. 2.





Now by the definition of the *Potential*, it must be (designating it by  $V$ ) 
$$= \int_0^r \int_{-1}^{+1} \int_0^{2\pi} \frac{\rho r^2 dr d\mu d\omega}{\sqrt{r^2 + x^2 - 2rx \cdot \mu}};$$
 i. e., the sum of all the quotients arising by dividing each element of the entire sphere by its distance ( $x'$ ) from the attracted point.

Effecting this summation, we have

When  $p$  is without the sphere,  $V = \frac{4}{3} \cdot \frac{\pi \rho \cdot r^3}{x}$ .

“ “ within “ “  $V = 2 \pi \rho r^2 - \frac{2}{3} \pi \rho \cdot x^2$ .

Now it has been pointed out that when the Potential  $V$  has been found in any case, to get the attractions, we have only to differentiate  $V$  once; hence, when  $p$  is without, the attraction along  $x = \frac{dV}{dx} = \frac{d(\frac{4}{3} \pi \rho r^3)}{dx} = \frac{4}{3} \pi \rho \cdot \frac{r^3}{x^2}$ , or the attraction is *directly* as the mass of the sphere, and *inversely* as the square of the distance from the center; *the known law*.

When  $p$  is within the sphere, the attraction along  $x = \frac{dV}{dx} = \frac{d(2 \pi \rho r^2 - \frac{2}{3} \pi \rho \cdot x^2)}{dx} = 2 \pi \rho r^2 + \frac{4}{3} \pi \rho \cdot x$ , the value of which will depend only on  $x$  (the distance from the center), since the first term is constant. The attraction within the sphere will therefore be *directly as the distance* from the center; *which is the known law in this case also*.

These simple examples, it is hoped, will sufficiently illustrate the nature, mode of application, and usefulness of the *Potential Function* when once an expression for that function has been found. And we have carefully indicated where full expositions can be found of the mode of calculating this most important function in all the cases that are likely to occur in the solution of physical problems.

## DEPARTMENT OF THE ARTS.

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### VERMILLION BY A NEW PROCESS—ITS PHOTOGRAPHIC PROPERTIES.

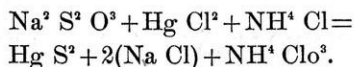
MILWAUKEE, February 13, 1872.

Dr. J. W. HOYT, *President Wisconsin Academy of Sciences, Arts and Letters:*

MY DEAR SIR: Enclosed I send you a sample of *Vermillion* obtained by what I suppose to be a new process, without sublimation or heat, and without the use of an alkali, but directly from solution by deposition. I find no account of its being produced by such method in any work which I have been able to consult. As produced by my process it has *photographic properties*, which fact, I believe, has never been noticed. If deposited in a weak light, or in the dark, it turns much darker on exposure to strong light while yet remaining in the solution from which it was deposited. This property gives the substance great value in its application to photography, for prints after being toned by the mercuric sulphide become more deeply impressed after completion; whereas by the usual method the last thing done in the production of the print is to subject it to the action of hypo-sulphite of soda, which greatly weakens the force with which it adheres to the organic surface. This sulphide is a stable substance, does not dissolve in nitric, muriatic or sulphuric acid except by aid of heat, and is not affected by ordinary conditions of the atmosphere; and by enveloping the silver and gold depositions composing the photographic print, with it the print is thus enabled to resist the destructive

L.

agencies which otherwise would cause it to fade. The reactions which take place in the formation of the sulphide in question are probably represented by the following equation :



The vermilion itself does not rival the commercial product in beauty of color, but I think will do very well for the first result of a new process. I expect to learn to produce a finer article.

Until very recently, I had expected to be present at your next meeting and present this matter in person to the Academy, together with illustrative specimens, but circumstances will prevent.

Very truly yours,

W. H. SHERMAN.

# DEPARTMENT OF LETTERS.

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## THE RURAL POPULATION OF ENGLAND, AS CLASSIFIED IN DOMESDAY BOOK.

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BY WILLIAM F. ALLEN, A. M.,  
Professor of Latin and History in the University of Wisconsin.

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Domesday Book is the record of a survey of the landed property of England, made by William the Conqueror, when he had been about twenty years on the throne; it was completed in 1086. It contains a nearly complete census of the rural population and property of the whole country, with the exception of a few of the northern counties, which were in too disorderly a condition to be reported in detail. For some parts of the country there remain also the preliminary memoranda, which are considerably more detailed than the final report; these are the "Exeter Domesday," for the western counties, and the "Ely Inquest," for the estates depending upon the abbey of St. Ethelred of Ely. For the counties of Norfolk, Suffolk and Essex, this preliminary register is all that is extant.

These documents give us a more exact and detailed knowledge of the condition of England at this early date, than we possess for any other country of Europe. And, nevertheless, such are the inherent difficulties in the way of understanding the social condition of a period so far removed from our own, and so meagre is our collateral knowledge of the matters

treated, that there are many questions raised by an examination of these documents, which have never been satisfactorily answered. Among these is the precise status of the different classes of population enumerated.

The whole population recorded in Domesday Book is 283,242; the heads of families only, it will be remembered, and, in the main, only of the rural parts of England. These are enumerated in several different classes, to the four largest of which our attention will chiefly be confined. These are: the *villani*, numbering 108,407; the *bordarii*, 82,119; the *sochemanni*, 23,072; the *liberi homines* (free men), 12,138. There are also 25,156 slaves; but these do not come within the scope of our inquiry.

[The pages which discuss the *villani*, *bordarii* and *liberi homines* will be omitted, except the summary which follows of the general results of the inquiry.]

1. The *villani* appear to have been in the main the body of the *ceorls* or common freemen; the representative of the primitive Village Communities (see Maine, Vill. Comm., p. 82). "From all that we can gather on the subject, it seems that they were situated on the outside of the demesne land, and in 'common-field' culture." Larking's "Domesday Book of Kent," App., p. 30.

2. The *bordarii* were those who, through misfortune or improvidence, had lost their little estates, and been reduced to the condition of common laborers; together with emancipated slaves and such others as floated to the several localities from one place or another. These had cottages (*bord*), not in the "village" proper, but on the lord's demesne, or "in-land"; they became the villains in gross of feudal times, and their holdings were in time transformed into copyholds (see again Larking).

3. The *liberi homines* were independent freeholders, disconnected with the regular village or manorial organization of the peasantry; the large numbers of them that we find in Norfolk,

Suffolk and Essex, are to be explained by supposing them to be the descendants of the Danes of Guthorm (see Lappenberg's "Norman Kings of England," p. 202).

4. We come next to the *sochemanni*, who present undoubtedly the most puzzling problem connected with these inquiries. It seems to me, however, that the difficulty has arisen chiefly from the attempt to identify them with the socage tenants of later times, to whom also the term *sochemanni* was applied; and from the further attempt to explain the word by *socagium*, socage, which is itself a derived word, rather than by *soc* or *socha*, from which both of these must have been derived. It is easy to see how inadequate this method is. The tenants in "free and common socage" made up the body of the freehold tenants in all parts of England; but the *sochemanni* of Domesday Book are found only in certain counties in the east of England; so that the theory in question makes no provision for the socagers of Wessex and western Mercia. Further, it has been shown [in the pages omitted] that the *villani* held their lands by a tenure which was, to all intents and purposes, free and common socage, that is, a tenure "by any certain and determined service."\* The *villani*, therefore, who are found in all counties of England, must be, in part at least, the representatives of the later socagers; consequently the *sochemanni* must have had something to distinguish them besides this tenure.

We must, then, leave the late and derived word *socagium*, and have recourse to the primitive *soc* or *socha*, and determine from this, on etymological grounds, the probable meaning of *sochemannus*. Etymology is a very unsafe guide to the actual meaning of a word at any given time; but it gives a certain clue to what must have been its meaning at one time—to one of the phases of meaning through which it must have passed. Thus, the derivation of *socage* has been greatly disputed, and, whatever this may have been, it is not at all a safe indication

\* Blackstone.

to the meaning of *socman*; for, although the two words may have been, and probably were, derived from the same source, yet there is no likelihood that either was derived from the other. Now it is probable that *socagium* (socage) was derived from the Anglo-Saxon *sôc*; but it is almost certain that *sochemannus* was so derived. From the meaning of *sôc*, therefore, we can deduce, not what was the meaning of *sochemannus* at any particular epoch, whether at the time of the Conquest or two hundred years later, but what must have been its meaning when the word was first formed.

*Sôc*, in Latin *Socha*, is the territory of the jurisdiction of a thegn. As the village community was transformed into a manor, its territory came to be regarded as the property of the thegn or country gentleman, the "lord of the manor" of feudal times. More than this, as the development of feudal institutions went on, he became "not only a proprietor, but a prince," and the villagers not only his tenants, but his subjects. This was a gradual process. The rights of jurisdiction were at first granted to individual thegns, as a special privilege, or *franchise* as it was called. Some received them, others did not. A law of Edward the Confessor\* contrasts "barones qui curias suas habent de hominibus suis" with "barones qui judicia non habent." Again, the franchise was not always in the same degree. Full powers of jurisdiction, civil and criminal, were comprised under the terms "sac, sôc, toll, team and infangthef"; a lesser degree, relating only to civil cases and petty offences, was "sac and sôc," or, very frequently, simply *soc*. Domesday Book gives the names of 35 persons, thegns and persons of high rank—among them Queen Edith and the Bishop of Durham—who had "sac, sôc, toll and team" in Lincolnshire; but in the city of Lincoln alone there were 12 who had "sac and sôc": one of them being mentioned specially as having also "Toll and Theim." After the Norman Conquest, when the feudal institutions had become fully developed, and

\* Stubbs, *Select Charters*, p. 74.

the powers of jurisdiction had been parcelled out among the feudal tenants, they were an essential adjunct to every manor; but at the time of the Conquest, as we must constantly bear in mind, the system was still in process of development, and various stages of it were in existence side by side.

*Soc*, then, is the territory within which a thegn possessed jurisdiction; and it is often put for the jurisdiction itself, which was more properly expressed by *sac*. Illustrations of this use of the word are common in all parts of Domesday Book; but they are most common in Lincolnshire and the adjoining counties, in which the socmen are principally found. A peculiarity of these counties is that nearly every manor has enumerated as *Soca* a list of small detached tracts in other manors. For example (I take a very simple case), the manor of Tuxfarne, in Nottinghamshire, has 32 *villani* and 2 *bordarii*. As *Soca* belong; 1, in Schidrinton and Walesbi, 2 hides of land with 6 *sochemanni* and 1 *bordarius*; 2, in Agemuntone, 1 1-2 hide with 1 *sochemannus* and 3 *villani*. Agemuntone has a manor of its own, and in Tuxfarne itself is a *soca* of Westmarcham, containing 3 carucates of land, with 3 *sochemanni* and 5 *villani*. Lincolnshire and Nottinghamshire, and to some extent other counties in the neighborhood, are in this way cut up in a remarkable degree into small places of detached jurisdiction. It should be remarked that the *soc* varies very much; it appears sometimes to belong to a person, sometimes to a manor.

Now the term *sóc* was not properly applied to the *demesne* land, of which the lord of the manor was *proprietor*, but to the tenement lands, as they were called, of which he was the *prince*. The lands of a manor were strictly divided into two parts, both of which were essential to its existence. The *demesne* land, or "in-land," as it was called in Anglo-Saxon times, was the private estate or farm of the lord, where he had his manor house or castle, and lived surrounded by his retainers and serfs. This land was cultivated by slaves, or serfs



hardly better off than slaves; and these serfs I have shown to be probably the *bordarii* of Domesday Book. The "ut-land" [*out-land*, contrasted to *in-land*] or *upland*, as it is generally called, was that of which the lord was recognized as proprietor, but only to the extent of receiving certain dues and services, and exercising a certain degree of jurisdiction. Its inhabitants were freehold tenants, and it therefore came to be known as the *tenement lands*; these I have shown were probably the *villani* of Domesday Book. The upland, or tenement lands, were also called the *foreign*\* land, as being in a certain sense free and independent of the lord of the manor. Over the *demesne* he was *master*; over the tenement lands he was only *lord*. The inhabitants of the inland or *demesne* were, so to speak, members of his household; those of the upland or tenement lands came under his authority only in certain specified points.

Now it was to the upland, not to the inland, that the term *sôc*† was applied; that is, to the legal and special jurisdiction over freemen, not the irresponsible mastership over serfs and slaves. But I have shown that the inhabitants of the upland or tenement lands were the *villani* of Domesday Book; these were, therefore, within the *sôc* of the thegn, and were strictly *socmen*. I will go a step further, and anticipate a point which does not properly fall within the limits of this paper, by saying that because they lived within the *sôc*, they were called *socage* tenants.

It appears then, from the etymology of the word, that the *sochemanni* must have been people living within the *sôc* or jurisdiction of individual thegns, as contrasted with the slaves and cottagers upon their demesne lands. It follows that the *villani*, if they were, as I think is proved, the inhabitants of the uplands, members of organized village communities, were properly *socmen*, *provided their thegn possessed the franchise of sac and soc*. Under the fully developed manorial system all

\**Extenta Manerii*, 4 Edw. 1.

† *In dominio aulæ sunt x bovata de hac terra. Reliqua est soca. f. 283a.*

lords of manors possessed these franchises, and all inhabitants of the tenement lands became socmen, or, as the terms were then identical, socagers. But when the system was still in process of development, only those *villani* would be socmen whose thegns had obtained these franchises by special grant; and on the other hand there might be tenants living within the jurisdiction of a thegn, and thus properly socmen, who were not members of the organized village communities. There were therefore *villnai* who were not socmen, and there might be socmen who were not *villani*. In a register like Domesday Book it would be natural to enumerate a great class like the *villani*, which was found throughout England, under this, its special name, and that whether they were strictly socmen or not; while the term socmen would be reserved for those who were not *villani*, and yet who stood like these under the sôc of a lord or a manor.

It appears probable, therefore, that the *sochemanni* of Domesday Book were persons holding tracts of land independent of the organized village communities, but coming like the villagers under the jurisdiction of the thegn. We might, therefore, expect them to be a comparatively scattered and occasional class; and the record shows that as a matter of fact there was a great disparity in their position and protection. We find 2 *sochemanni* of 24 acres of arable land, and 4 of meadow; 14 of 9 acres; 12 of 40 acres; 5 of 20 acres; 1 of 1-2 hide; 3 of 1-2 hide, etc. Their position in the record varies also; sometimes they are enumerated with the other classes [2 *sochemanni*, 1 *villanus*, and 1 *bordarius*—25 *sochemanni* and 15 *villani*.] very rarely standing last. Sometimes they are put by themselves [5 *sochemanni* of 3 hides, and 35 *villani* and 20 *bordarii*.] A very common expression is, "There belonged to this manor so many *sochemanni*." Occasionally a socman seems to rank almost as a thegn; as "in Nortun, 1 *sochemannus* with 81 acres of land, and 1 acre of meadow, and 1 *villanus* and 7 *bordarii*; and he was of a free man of Roger Bigod." Here we have

*villani* and *bordarii* under a socman, himself under a "free man," who was the vassal of the great lord Roger Bigod. Again, "7 *sochemanni* having 12 *villani* and 6 *bordarii*." Also, *sochemanni* holding lands "in demesne," like lords of the manor. Again, the introduction to the Ely Inquest proposes to ascertain how many *villani*, how many *cotarii*, how many slaves—then "how many free men, how many socmen."

The following is a fuller example of socmen from Cambridgeshire, a manor held by one Guido :

[In the time of King Edward] "sixteen *sochemanni* held this land. Of these, 10 had 2 hides and 1-2 virgate\* of the soca of St. Ethelred of Ely, of whom one could not sell his land, the other nine could sell to whom they wished, but the sôc of all remained to the church; and 6 others held one hide and 2 virgates of Count Algar, and could give or sell."

Of 24 socmen, "1 held under Edith the fair—all the others were socmen of King Edward."

We have thus ascertained the probable meaning of *sochemannus*, from its etymology, and found this to be supported by the facts as recorded in the survey. Both etymology and evidence go to show that this was a class in nearly the same social position with the *villani*, but not like them members of the village organizations; that they were an occasional and scattered body, and that they differed very widely from one another in wealth and position. This theory finds a strong support in a provision of the Laws of Edward the Confessor† by which in the Danalagu the "manbote" of the *sochemannus* and of the *villanus* is the same, while that of the "free man" is twice as much. A class like this, equal in rank to the members of the native organizations, but occasional, scattered, and differing very widely in standing and wealth, can be best explained by supposing an intrusion, or an invasion and occupation by the side of the old inhabitants.

\* The virgate was 8 acres; the hide 4 virgates.

†Chap. XII.

Having considered the probable meaning of the term, and the way in which it is used in Domesday Book, let us consider the geographical argument, the one which led Lappenberg to so fruitful results in the case of the "free men." In what counties of England do we find socmen? and is there anything that distinguishes these counties from other parts of England?

1. With very trifling exceptions, the socmen are found exclusively to the north and east of Watling Street.

2. They are most numerous in Lincolnshire, and next to this in the counties adjoining—Nottinghamshire, Leicestershire and Norfolk. In the counties next to these they are in much smaller numbers. That is, they may be said to spread out from Lincolnshire south and west, over the other counties of the Danalagu.

3. In Lincolnshire, and in a less degree, in the adjoining counties, we find that the *sochen*, or detached places under the jurisdiction of the lord of the manor, are very numerous.

We might expect from this that the socmen would be found exclusively in these *sochen*; but,

4. Although these *sochen* almost always contain socmen, they do not always contain these; and on the other hand socmen are found in the manors themselves. This I shall attempt to explain presently; so far as it goes, it is a fact of some importance that socmen *prevail* in these *sochen*, even if they are not found in them universally and exclusively.

The facts here given lead of themselves to the theory which seems to me probable. Just as the *liberi homines* are found in the counties occupied by the Danes of Guthorm, so the counties in which the *sochemanni* most abound are precisely those in which the later settlements of Danes were principally made; we find the socmen most numerous exactly where we know that these Danes were most numerous. I can hardly resist the conclusion that the socmen were the descendants of these Danes. When they conquered the country, they did not disturb the organized village communities of the English, but—

there being plenty of unoccupied land—partly public land, partly the waste of the several manors—assigned tracts to their followers from this. The leaders became thegns, and under their *soc* were two classes, equal in rank—the native *villani*, and the *sochemanni*, the rank and file of their own army. This will explain the irregularity and disparity in the condition of the socmen.\*

The theory that the socmen were the descendents of Danish settlers, finds confirmation in a law of King Cnut, which fixes the *heriot*, that is, “the military equipment of a vassal, which on his death reverted to the lord” [Stubbs.] After giving that of the three grades of nobility, the Earl, the King’s thegn and the medial thegn, it goes on: “and the heriot of a King’s thegn among the Danes, who has his *soken*, four pounds.”† Now we have found *soken*, that is, detached places under the jurisdiction of a thegn or manor, to be very abundant in the counties where the Danes were found; and the passage just quoted proves some peculiar and special relation of the *sesoken* to Danish thegns.

I have now shown: 1. From the meaning of the word *soc*, and its use as contrasted with the “inland” or demesne, that the *sochemanni* were probably a somewhat scattered and irregular class, under the jurisdiction of the several thegns. 2. From the records of Domesday Book, that they were actually a-scattered and irregular class, under the authority of individual thegns, nobles and great persons. 3. From the Laws of Edward the Confessor, that their rank was the same as that of the *villani*, who were the native English peasantry, and were likewise under the jurisdiction of their several thegns. 4. That the existence of such a local and exceptional class as the socmen can be best explained by supposing an intrusion from some foreign country, which introduced an irregular body by

\* When the Danish counties were recovered by the English Kings, the Danish thegns were not displaced, and says Palgrave, “as late as the reign of Ethelred, we can trace their existence as a privileged community, distinct from the kingdom in which they were included.” A. S., p. 97.

† Stubbs, *Select Charters*, p. 73.

the side of the compact and organized one. 5. That we know as a fact that there was such an intrusion of Danes, and that the intruders had their centre and seat precisely in those counties where we find the socmen. 6. That the Danish origin of the socmen is further supported by the passage in the laws of King Cnut, which speak of Danish thegns who have their *soken*, as well as the law of Edward the Confessor, which speaks of *sokemanni* in the Danalagu, as contrasted with the rest of England.

It does not follow from these arguments that all the *sochemanni* registered in Domesday Book were of Danish origin, or that all of Danish origin were *sochemanni* or *liberi homines*. The point to be explained is the existence of these two great classes in a certain group of counties, by the side of the two classes of *villani* and *bordarii*, which are found everywhere. This circumstance is easiest explained by supposing a prevalently Danish origin. But the time when Domesday Book was compiled, was a time of rapid and sweeping changes; the Conquest must have acted powerfully in breaking up the old organizations and mixing together the several classes of population. After this time we find no mention of *bordarii*; the term *villanus* gradually lost its dignity and became equivalent to "serf;" while *sochemanni* were no longer confined to the Danish counties, but the name came in time to be applied to the body of the free peasantry in all parts of England.

ON THE PLACE OF THE INDIAN LANGUAGES IN  
THE STUDY OF ETHNOLOGY.\*

BY PROF. J. B. FEULING PH. D.

Professor of Comparative Philology in the University of Wisconsin.

*Physical ethnology* has shown that all the different tribes of Indians constitute but one race from the Arctic Ocean to Cape Horn. But *physical* evidence of race is as incomplete without the confirmation of *linguistic* evidence, as is the latter without the former. Race and language run parallel only in prehistoric times, or at the very dawn of history. The connection therefore between physical ethnology and linguistic ethnology consists in giving mutual advice and suggestions. Accommodation and mutual concessions should not enter here.

As languages change more rapidly than races, it seems often impossible, even in languages whose current we are able to ascend beyond the dawn of tradition, to gather up the connecting links between language and race, or to point out, when, where or how they separated. Besides we must be careful in drawing conclusions from facts, which may be the "result of accident." All this must be borne in mind by the student the more carefully, as the philological details are very scanty and insufficient. Although the affinity between the Indian languages, as determined by their *vocabularies*, is not less real than that inferred from the analogies of their *grammatical forms*, it would not be a conclusive evidence for the original unity of the various tribes, because we have no historical documents, and tradition is silent as to the existence of a "specific centre." If we had documentary evidence of the

\* The loss, by accident, of this paper, as originally presented, has necessitated its publication in the form of a brief abstract.

intermediate dialects, we would be able, perhaps, to give a complete account for the great dissimilarity of Indian languages. For the present the question of their mutual relation and possible transmutation from a common prototype will best be cleared up by a careful systematic study of the actually existing dialects.

Then followed a critical account of what had been accomplished in this field by eminent scholars, e. g. Gallatin, G. Gibbs, E. G. Squier, Lewis H. Morgan, Dr. Brinton, J. Shea, Dr. J. H. Trumbull and others; the materials and theories of Duponceau, Heckewelder, Schoolcraft, etc. are worthless.

Besides the importance of the Indian languages in an ethnological view, the possibility of an approach through them to the great problem of the origin of language was pointed out.

Mr. F. showed the duty of the Academy towards assisting to secure from destruction the languages of the Indians of America and to facilitate the work of the linguistic scholar by collecting materials, as books, etc. In collecting materials special attention should be paid to those tribes (about 26), which, since our first knowledge of them (a. 1670), lived within or passed through the State of Wisconsin. Attention was called to Col. George Gibbs' "Instructions for research relative to the Ethnology and Philology of America" \* and to the hints given by Hon. J. H. Trumbull in a paper "On the true method of studying the American Languages," read before the American Philological Association, at Poughkeepsie, 1869. †

There are other monuments, besides languages, which claim our attention in the elucidation of the ethnological problems involved in the past history of America,—monuments left by a people, whose very name has vanished. "Mound-Builders" is a conventional name. Geology, and the extreme

\* Smithsonian Miscellaneous Collections, (Vol. vii., Art. xi.)

† This valuable paper has been published since in the "Transactions of the American Philol. Association," (Vol. I, Art. iv.)



decay in which skeletons of Mound-builders are found, have assisted in ascertaining that the mounds are of high antiquity, which is also attested by their relation to forest-growths. It is impossible to give any fixed data; it is, however, safe to say that 2000 years at least have passed since the disappearance of a people which were not the ancestors of the wild Indians, as it is commonly believed. For many reasons (mining operations, etc.) the Mound-Builders must have been stationary and agricultural in their habits. We may never be able to answer the question, Who were these Mound-Builders or whence did they come? Still it is not impossible to find the thread which connects these ancient monuments and their scanty relics with those of Central America and, perhaps, with more distant quarters, after their extent and contents, as well as their general character, have been better understood.

We have a meritorious work by Dr. I. A. Lapham, "The Antiquities of Wisconsin" (Smithsonian Contributions to Knowledge, Vol. vii), which has however not made unnecessary further exploration and study. There remain a great many mounds unnoticed and unexplored, which may lead to more important results. It is hoped that these mysterious antiquities within our State will be saved as sacred mementos of the past from oblivion and destruction.

There is hardly a farmhouse in Wisconsin, where some kind of relics, as stone-implements, etc., are not either kept as a curiosities or thrown aside like so many other "useless things." Sufficient interest should be awakened among the people to care for the preservation of such relics or to forward them generously to some place of collection.\*

Let us mark the words of William D. Whitney, safest and surest of guides: "Our national duty and honor are peculiarly concerned in this matter of the study of aboriginal

\*Mr. F. S. Perkins of Burlington, Wis., has the largest collection of stone implements, beside that of the Smithsonian Institute, and he spares neither time nor money, in order to make new additions to his valuable collection. We hope that the State may be able to procure this collection some day, as the beginning of a State Museum of American (Wisconsin) Antiquities.

American languages, as the most fertile and important branch of American archæology. Europeans accuse us, with too much reason, of indifference and inefficiency with regard to preserving memorials of the races whom we have dispossessed and are dispossessing, and to promoting a thorough comprehension of their history. Indian scholars, and associations which devote themselves to gathering together and making public linguistic and other archaeological materials for construction of the proper ethnology of the continent, are far rarer than they should be among us." "So much the more reason have we to be grateful to the few who are endeavoring to make up our deficiencies by self-prompted study, and especially to those self-denying men who, under circumstances of no small difficulty, are or have been devoting themselves to the work of collecting and giving to the world original materials."

M.



# PROCEEDINGS.

[Condensed from the BULLETIN.]

## PROCEEDINGS OF THE CONVENTION CALLED TO ORGANIZE THE ACADEMY.

Pursuant to a call of citizens, issued February 1, 1870, a large meeting of scientific, literary and other prominent men of the State was convened in the State Agricultural Rooms, at Madison, on the 16th of February, for the purpose of organizing an association that should be devoted to original research and investigation.

The convention was called to order by Dr. J. W. Hoyt, who read the call, and nominated Hon. W. P. Lynde as temporary chairman.

On assuming the chair, Senator Lynde declared his hearty approval of the objects of the meeting in a neat and eloquent speech.

Prof. Foye, of Lawrence University, was appointed temporary Secretary.

On motion, the President appointed Dr. R. Z. Mason, Dr. Joseph Hobbins, and Rev. Samuel Fallows, to nominate permanent officers of the Convention.

The committee made the following nominations:

*President*—Gov. L. Fairchild.

*Vice Presidents*—Ex-Gov. N. Dewey, and Dr. G. M. Steele.

*Secretaries*—Dr. I. A. Lapham and Prof. T. C. Chamberlin.

Dr. Hoyt said:

He regretted that, while his Excellency, the Governor, heartily approved of the objects of the Convention and had expressed his readiness to preside at its sessions, circumstances would necessitate his absence for a time. He moved, therefor, that Ex-Governor Dewey, first on the list of Vice-Presidents, be requested to take the Chair.

On assuming the Chair, Gov. Dewey said:

He thanked the Convention for the honor conferred. Although not claiming to be a man of science, he felt deep interest in every movement that promised to aid in the advancement of Wisconsin. He had long recognized the importance of some institution specially devoted to scientific investigation, and was heartily glad that so large a number of the prominent men of the state had shown their appreciation of the efforts in that direction by attendance upon the Convention. There was much that greatly needed to be done, and there were competent men ready to undertake its accomplishment. The work and workers would at all times have his cordial support, and until the return of Gov. Fairchild, who had very properly been chosen President of the Convention, he would have pleasure in serving them to the best of his ability.

Judge J. G. Knapp offered the following resolution:

*Resolved*, that we do organize an association under the name of "Wisconsin Academy of Sciences, Arts, and Letters."

Dr. Hoyt stated that,

Inasmuch as several of the gentlemen who had expressed cordial approval of the proposition to organize such an Academy as was contemplated by the resolution just offered, were unable to attend the Convention, it seemed proper that their views as presented in the communications he had received from them, although probably not written with reference to such use, should be laid before the Convention. Accordingly, with the approval of its members, he would proceed to read at least such portions of some of them as were likely to be of most interest.

Letters were accordingly read from the following gentlemen:

Hon. John G. McMynn, late Superintendent of Public Instruction; Prof. R. G. Hinsdale, Racine College; Prof. J. J. Bushnell, Beloit College; Lt. Gen. Wyman Spooner; Hon. Asahel Finch, Milwaukee; Prof. W. Porter, Beloit College; Rollin A. Smith, Esq., Fond du Lac; Hon. W. W. Field, Boscobel; J. Lawler, Esq., Prairie du Chien; Hon. D. J. Pulling, Circuit Judge, Beaver Dam; President W. C. Whitford, Milton College; Hon. Anthony Van Wyck, Milwaukee; Professor A. K. Johnston, Mineral Point; Hon. M. K. Young, Glen Haven; Hon. John E. Thomas, Sheboygan Falls; J. H. Evans, Esq., Platteville; President Lewis O. Thompson, Watertown; Hon. James H. Earnest, Shullsburg; Hon. Tim. O. Howe, U. S. Senate; Hon. H. S. Baird, Green Bay; Dr. J. L. Jenckes, Hazel Green; Dr. R. B. Treat, Janesville; Hon. J. H. Rountree, Platteville; Hon. G. W. Cate, Circuit Judge, Amherst; Prof. S. S. Sherman, Milwaukee; Hon. David W. Jones, Mineral Point.

The resolution was then unanimously adopted.

Dr. Hoyt moved the appointment, by the President, of a committee of five members to prepare and submit to the Convention a plan of organization for the Academy.

The chair appointed Dr. J. W. Hoyt, of Madison, President G. M. Steele, of Lawrence University, President A. L. Chapin, of Beloit College, Dr. Solon Marks, of Milwaukee, and Hon. J. T. Mills, of Lancaster, as said committee, with instructions to report, if possible, at the ensuing session.

Adjourned to 7½ o'clock, P. M.

The Convention met pursuant to adjournment.

On behalf of the committee on a plan of organization for the Academy, Dr. Hoyt reported a Constitution, which, on motion, was unanimously adopted.

[For Constitution see BULLETIN No. 1.]

After the adoption and signing of the constitution, on motion of Dr. E. B. Wolcott, of Milwaukee, the President was instructed to appoint a committee of five to nominate a President, a General Secretary, and a Treasurer for the Academy. The chair appointed as such committee, Dr. E. B. Wolcott, Geo. P. Delaplaine, President G. M. Steele, President A. L. Chapin and Professor T. C. Chamberlin.

The committee retired, and in due time returned and reported the following nominations:

*For President*—Dr. J. W. Hoyt.  
*For General Secretary*—Dr. I. A. Lapham.  
*For Treasurer*—Geo. P. Delaplaine.

The report of the committee was adopted.

The President of the Convention having, on motion, appointed

a committee consisting of Dr. E. B. Wolcott and Dr. Joseph Hobbins to notify the said officers of the Academy of their election, and to conduct the President thereof to the chair,

The Convention dissolved.

#### FIRST MEETING OF THE ACADEMY.

Pursuant to call, made at the instant of the dissolution of the convention of citizens met to organize the same, the Wisconsin Academy of Sciences, Arts and Letters convened in the place of said Convention at 9 o'clock P. M. of same day (Feb. 16.)

On assuming the chair, President Hoyt said:

While he felt highly honored by the unanimous expression of the wish of its members that he should preside over the Institution, in the formation of which all gentlemen present had shared, and was sincerely grateful to them for their confidence, he was profoundly sensible of the grave responsibilities involved in an acceptance of the position. Pioneer work was laborious in whatever field, but especially so in the founding and up-building of institutions devoted to a work of which the body of the people could hardly be expected to have a just appreciation. Academies devoted to original research were the forerunners of a higher civilization. It was rarely that their services were recognized at their true value at the time, but without them the world would make but slow progress. He was glad that the proposition to found such an institution in Wisconsin had been received with warm approbation, and desired to congratulate the members of the Academy that it had pleased them to adopt a plan of organization so broad and comprehensive as to include every class of searchers after knowledge. The Convention had manifested an intelligence, unanimity and enthusiasm worthy of the cause sought to be advanced, and it now only remained to push on the work with vigor and resolution. Each member must consider himself a committee responsible for the advancement of the Academy's interests in his own locality as well as throughout the range of his acquaintance, and by every means in his power. Should this be the case, the organization of the Wisconsin Academy of Sciences, Arts and Letters would be notable in the future as the inauguration of a new era in the history of the State. He accepted the responsible and laborious position of President, in the belief that he would not be denied the hearty co-operation he so earnestly craved, and with the purpose to do everything in his power to make the Academy successful in every respect and in an eminent degree.

At the conclusion of the President's remarks, it was moved by Ex. Gov. Dewey that the Academy proceed at once to the election of a Director of the Museum, a Librarian, and of the constitutional departmental officers for the Department of the Sciences; and that, in the absence of By-Laws regulating the mode of procedure, such election be *viva voce*, on nominations made by any member of the Academy. The motion prevailed, and the following officers were duly elected:

*Director of the Museum*—Wm. Dudley, Esq.

*Librarian*—Hon. J. G. Knapp.

*Vice President of the Department of Sciences, and ex-officio a Vice President of the Academy*—Dr. P. R. Hoyt.

*Secretary of the Department of the Sciences*—Col. S. V. Shipman.

*Counsellors for the Department*—Prof. T. C. Chamberlin, Dr. E. B. Wolcott, Dr. R. Z. Mason.

The Treasurer was authorized to purchase the necessary books of record.

The President having given notice that a meeting of the General Council would be held in this place at 9 o'clock on the following morning, for the purpose of adopting By-Laws for the government of the institution, the Academy adjourned *sine die*.

## FIRST MEETING OF THE GENERAL COUNCIL.

*Adoption of By-Laws.*

The General Council of the Wisconsin Academy of Sciences, Arts and Letters, met pursuant to the call of the President, in the State Agricultural Rooms, at 9 o'clock A. M., of February 17, 1870.

Present—Messrs. J. W. Hoyt, President, in the Chair, P. R. Hoy, T. C. Pound, Geo. P. Delaplaine, Wm. Dudley, J. G. Knapp, T. C. Chamberlin, R. Z. Mason, S. V. Shipman and I. A. Lapham.

After due consideration, the Council adopted the following By-Laws:

[For By-Laws, see BULLETIN No. 1.]

On motion, the Chair appointed the following Standing Committees:

*On Nominations*—Dr. G. M. Steele, Dr. Solon Marks and Prof. Jas. H. Eaton.

*On Papers Presented to the Academy*—Dr. A. L. Chapin, Dr. P. A. Chadbourne and Dr. I. A. Lapham.

*On Finance*—Hon. Nelson Dewey, Hon. Alexander Mitchell and Hon. Wm. E. Smith.

*On the Museum*—Dr. P. R. Hoy, Charles Preusser and John Murrish.

*On Library*—Hon. Lyman C. Draper, Dr. Joseph Hobbins and Hon. Wm. Pitt Lynde.

The Council adjourned, "subject to call of the President."

## SECOND MEETING OF THE ACADEMY.

*First Session—Executive Proceedings.*

The Second Regular Meeting of the Academy was held in the rooms of the State Agricultural Society, at Madison, commencing on Tuesday, July 19; fifteen members being present. The president, Dr. J. W. Hoyt, in the chair.

Letters were read from several members unable to be present.

Donations for the Museum were presented as follows:

A wolverine (*Gulo luscus*, Sabine), killed in Juneau county, and presented by Hon. J. T. Kingston, of Necedah; and a lynx (*L. Canadensis*, Rafinesque), killed near Madison, and presented by Jacob Seiler of that city; which, on motion, were accepted, with the thanks of the Academy.

Specimens of the rocks, minerals, ores, clay, etc., from Garrisonville, Sauk county, presented by Mrs. Dr. Taylor of that place, were examined and commented upon.

The President submitted an informal report of what had been done since the date of the last meeting:

A liberal charter had been granted by the legislature, at its late session, with authority to occupy apartments in the capitol, if not inconsistent with the public business of the State; a law had been passed providing for a topographical survey of the lead district, the specimens of minerals, rocks and fossils collected being required by law to be deposited with the Academy; the publication of a Bulletin had been commenced, in which it was proposed to include such of the proceedings as seemed of sufficient importance; and favorable responses, received from all parts of the State, gave encouragement to hope that the Academy would be sustained, and become an institution of permanent usefulness.

He then laid before the Academy the text of the Charter granted by the State.

[See No. 1 of the BULLETIN, p. 17; also General Laws of Wisconsin, 1870.]

The following persons were admitted to membership:

**LIFE MEMBERS:**—Hon. J. E. Thomas, Sheboygan Falls; N. S. Green, Esq., Milford; Hon. J. I. Case, Racine; Hon. Simeon Mills, Madison; Jas. L. Hill, Esq., Madison; Hon. J. G. Thorp, Madison; John H. Van Dyck, Esq., Milwaukee; Jas. J. Hagerman, Esq., Milwaukee.

**ANNUAL MEMBERS:**—Rt. Rev. W. E. Armitage, Milwaukee; Pres. W. C. Whitford, Milton; Prof. T. H. Little, Blind Asylum, Janesville; Samuel P. Cary, Esq., Oshkosh; Rev. Albert O. Wright, Waterloo; Mr. Cyrus T. Hawley, Milwaukee; Prof. John E. Davies, State University, Madison; Rev. J. B. Pradt, Madison; Capt. W. A. De La Matyr, Mazomanie; Eugene R. Leland, Esq., Milwaukee; Alex. Provis, Esq., Lancaster; Mr. Jas. J. Cammack, Madison; Elisha Burdick, Esq., Madison; John R. Baltzel, Esq., Madison; Prof. R. G. Hinsdale, Racine College; Rev. J. C. C. Clarke, Madison; Hon. J. T. Kingston, Necedah; Dr. Moses Barrett, Waukesha.

On motion of J. G. Knapp, it was

*Resolved*, That the fees for members for life be set apart as a permanent endowment fund, to be invested in Wisconsin State bonds, or other equally safe securities, and that the proceeds of said fund, only, be used for the general purposes of the Academy.

A committee was appointed to apply to the Governor for the assignment of apartments in the capitol for the proper preservation of such scientific specimens, books, and other collections as may become the property of the Academy.

The President and Secretary were authorized to continue, from time to time, the publication of the BULLETIN.

Adjourned till 9 o'clock of the following morning.

#### *Second Session—Communications.*

The Academy met pursuant to adjournment, for the reading and discussion of papers. There were present several additional members; the President in the Chair.

The following are the titles of papers presented and discussed during the morning session, with the leading ideas contained:

1. On the Classification of the Sciences. By Rev. Albert O. Wright, of Waterloo. Mr. Wright said in substance, that

Every science has two aspects, a concrete and an abstract. The logical order is from the abstract to the concrete. But the order of discovery is first the practice of an art, then the gathering of facts for the concrete science, then ordering the principles for the abstract science. These last have an order among themselves, which the concrete sciences and the arts follow. Rising from the lower to the higher, this order of the abstract sciences, with their dependent sub-sciences, concrete sciences and practical arts is: Mathematics, Astronomy, Physics, Chemistry, Biology, Psychology, Sociology, Theology. Each of these sciences has a principle underlying it which we have discovered or hope to discover; and each science uses its own laws and the laws of all below it, but not of those above it; and no science can be completed until the one next below it is. Commencing with the science of *Abstract Relations*, by adding one law, we have the science of *celestial phenomena*; by adding again one law, we have the science of *terrestrial phenomena*; again adding one law, we have the science of *chemical affinities*; at the next step we enter the domain of *life*, at the next that of *mind*, at the next that of *mind in masses*; and by the last and greatest step we rise to the *Supreme of the Universe*.

2. On the importance of more attention to the Preservation and culture of Forest Trees in Wisconsin. By Mr. P. Engelmann, Secretary of the Natural History Society, Milwaukee.

The author commented on the rapid destruction of the forests in the State, now going on with a geometrical ratio of progression that must, within comparatively a very few years, bring not only a scarcity of timber, notwithstanding the munificent provisions of Nature, but likewise important and unfavorable changes in the climate of the State. He cited the governments of the Old World as examples of the provident care induced by the lessons of experience, and also alluded to the wise legislative action of some of the neighboring States of the Union in providing for even, the planting of forests where they have not existed heretofore. This seemed to be a matter of sufficient importance to receive the present, and earnest consideration of the Academy and of the Legislature of the State.



3. On the Coniferæ of the Rocky Mountains, and their adaptation to the Soil and Climate of Wisconsin. By J. G. Knapp, Esq., Madison.

[Published in Transactions, p. 117.]

The Academy adjourned until 2 o'clock P. M.

*Third Session—Communications.*

The Academy met, pursuant to adjournment, for the reading and discussion of the following papers:

4. On the Origin of the Potsdam Sandstone. By John Murish, State Commissioner for the Survey of the Lead Regions.

5. On the Importance and Practicability of a Unit of Force in Physics that shall be of Universal Application. By Professor John E. Davies, of the Wisconsin State University.

6. Abstract of a Paper On the Fauna of Lake Michigan off Racine. By Dr. P. R. Hoy, of Racine.

[Published in full in the Transactions, p. 98.]

7. On the Age of the Quartzite of Baraboo. By Dr. I. A. Lapham, of Milwaukee.

In this paper, Dr. Lapham described the geological character of the country about Devil's Lake, Baraboo, and presented reasons for concluding that the peculiar formations there should be attributed to the action of water.

8. On the Formation of Certain New Compounds of Manganese. By Professor James H. Eaton, of Beloit College.

In this paper, Professor Eaton gave an account of some exceedingly interesting original investigations into the chemical properties of manganese, with details of the steps taken in the formation of some new compounds analogous to the yellow and red prussiates of iron, and observations upon the physical and chemical properties of such compounds.

Adjourned till 8 o'clock P. M.

*Fourth and Final Session.*

The evening session was occupied mainly with an informal discussion of various questions pertaining to the future of the Academy, and the issuing of certificates of membership. His Excellency, Governor Fairchild, was present, and took occasion to express cordial sympathy with the important objects of the Academy and to congratulate its members upon the success of the present meeting.

The Academy then adjourned *sine die*.

THIRD MEETING OF THE ACADEMY.

*First Session.*

The third regular meeting of the Academy was convened in the City Hall, at Milwaukee, on Tuesday, the 28th of September, at 2 o'clock P. M.; the President, Dr. J. W. Hoyt, in the chair.

Owing to an error in the published notices, which named the 29th as the date of the meeting, but few members were present. And, accordingly, on motion of Dr. R. Z. Mason, an adjournment was taken until the following day, at 2 o'clock P. M.

*Second Session—Executive Proceedings.*

The Academy met pursuant to adjournment, and, in the absence of the President, detained by pressing duties connected with the State Industrial Exhibition, was called to order by Dr.

A. Lapham, General Secretary; upon whose motion Dr. R. Z. Mason was elected temporary chairman.

Rev. C. Caverno, of Lake Mills, and Messrs. G. W. Chapman and Amasa J. Finch, of Milwaukee, were put in nomination for membership, and, upon motion, were elected without dissent.

The following papers were read and discussed.

1. The Metamorphic Rocks in the town of Portland, Dodge county. By A. O. Wright, of Waterloo.

He gave a description of the position and appearance of the rock formations in question. They were fractured, and presented, to his eye, indications of having been cracked by some subterranean force. The force that acted below sent up through the crevices steam and heat to the extent of transforming the sandstone into quartzite, and, in veins, pure quartz. He also discovered here traces of the glacial period.

Dr. Lapham said this region had been discovered many years ago by Dr. Thayer; that it was also mentioned in Owen's and Percival's report, wherein it was stated that the quartzite is modified sandstone of older formation.

Dr. Mason said, as the object of the Academy is investigation, he thought it would be proper to invite some one of experience to go to this place and gather facts, and give, as far as can be ascertained, the geological appearance, with the theory of their causes.

On motion, Prof. Eaton was selected as a committee to make the investigations, and afterwards, Prof. Chamberlin was added to the committee.

2. The Metamorphic Rocks at Devil's Lake. By A. O. Wright, of Waterloo.

3. Some Observations upon the Fauna of Mammoth Cave. By P. Engelmann, Esq., Secretary of the German Natural History Society, Milwaukee.

Mr. Engelmann's paper embraced an account of a late visit to Mammoth Cave, with descriptions of various curious fishes found in its waters, specimens of which were displayed before the Academy.

At the conclusion of the readings and discussions, Prof. T. C. Chamberlin, of the State Normal School at Whitewater, after some remarks upon the importance of systematic work, offered the following:

*Resolved*, That the Secretary be requested to present an outline of the scientific investigations that have been made in Wisconsin, and that he indicate what lines of investigation it is most desirable to pursue, and that he be empowered to assign such portion of its work to the various members of the Academy as may seem most desirable.

Which, on motion, was adopted.

Adjourned, to meet again at 9 o'clock A. M. to-morrow.

*Second Session—Papers and Discussions.*

The Academy met pursuant to adjournment, Dr. R. Z. Mason in the chair.

Papers were presented as follows:

4. On the Isothermal lines of the Northwest. By J. G. Knapp, Esq., of Madison.

This paper called attention to the climatic peculiarities of Wisconsin, as illustrated by meteorological charts of Dr. J. W. Hoyt and Dr. I. A. Lapham, and sought to explain their relation to the actual distribution of vegetation, and to the agricultural and horticultural capabilities of the State.

5. On the Nebular Hypothesis in Astronomy. By R. Z. Mason, LL.D., of Appleton.

The author of this paper admitted that there was no conclusive evidence that the process of world-formation from nebulous matter was actually going on at the present time. There were, however, strong reasons in support of the nebular hypothesis; the first being based on the constancy of the "moment of inertia," the second on the identity of composition of the earth and sun as shown by the spectroscope, and the third on the correlation of forces.

Adjourned until 2 o'clock, P. M.

*Third Session.*

The Academy met pursuant to adjournment at 2 o'clock, P. M. Dr. R. Z. Mason in the chair.

The reading and discussion of papers were then resumed.

6. The Mineral Well at Waterloo, Wisconsin. By A. O. Wright.

[Published in the Transactions, p. 151.]

7. On the Classification of Plants. By Dr. I. A. Lapham, of Milwaukee.

[Published in the Transactions, p. 102.]

Mr. Goodwin Lowrie, of Helena, and Mr. Joseph S. Carr, of Neilsville, were elected members.

Judge Knapp gave notice of an amendment to the by-law requiring meetings of the Academy to be held during the annual exhibitions of the State Agricultural Society.

An invitation from the directors of the Association for Natural History, to visit their museum, in the building of the English and German Academy, was received and accepted with thanks.

Adjourned *sine die*.

FIRST ANNUAL MEETING OF THE ACADEMY.

*First Session.*

The fourth regular and first annual meeting of the Academy was convened in the rooms of the State Agricultural Society, at Madison, commencing on the evening of February 14. A large number of gentlemen were present from all parts of the State.

The President, Dr. J. W. Hoyt, in the chair.

Dr. I. A. Lapham, of Milwaukee, General Secretary of the Academy, being absent, Prof. John E. Davies of the State University, was elected Secretary *pro tem*.

Donations to the Museum of the Academy were received from ex-Governor L. J. Farwell, of Chicago.

The President of the Academy, Dr. Hoyt, gave

A general statement of work that had been done since the last meeting, and recommended the immediate organization of the proposed departments of Social Science, of the Arts, and of Letters. He also reported that the Wisconsin State Agricultural Society had passed resolutions expressive of their interest in the work undertaken by the Academy, and tendering the use of their rooms for its meetings and the preservation of its collections, and that said Society had, moreover, amended their constitution so as to make the President and General Secretary of the Academy members ex-officio of the Executive Board of the Society.

Which generous action was recognized by a vote of thanks.  
The Treasurer, George P. Delaplaine, reported as follows:

RECEIPTS.

To fees from thirty-four Annual Memberships .....	\$340 00
To fees from six Life Memberships.....	600 00
Total receipts.....	\$40

EXPENDITURES.

By sundry disbursements per order of the President, as per vouchers herewith submitted .....	\$156 70
Balance in the treasury.....	\$783 30

The report was referred to the Finance Committee, by whom it was examined and reported back with their approval.

The committee on the purchase of Mr. Deininger's Natural History Collection, were, at their own request, allowed more time for examination.

The names of several new members were proposed, and referred to the Committee on Nominations.

A paper was then read by A. J. Finch, Esq., of Milwaukee,

1. On Metallic Veins and the Deposition of Minerals.

The object of this paper was to refute the Wernerian theory, and to prove that metals found *in situ* were deposited from their gases originating in the interior of the earth.

On motion of J. G. Knapp, the following resolutions were adopted.

*Resolved*, 1st. That active members of the Academy be each requested to report to the President or Secretary of the Department of the Sciences, and designate the section of the Department to which he will choose to belong.

2d. That if any member be present who does not desire to connect himself with the Department of the Sciences in any of its sections, he be requested to report to the General Secretary of the Academy, and name the Department to which he desires to be attached.

3d. So soon as the members shall have designated the Department or Sections to which they desire to belong, such Departments and Sections shall meet together and assign to the members thereof their respective work.

Adjourned until 9 o'clock of the following morning.

Second Session.

The Academy met pursuant to adjournment. The President in the chair.

Donations of specimens of copper, iron, lead and graphite were made to the Museum of the Academy by Hon. J. Murrish, which were accepted with a vote of thanks.

On the recommendation of the Committee on Nominations, the following gentlemen were elected members of the Academy:

CORRESPONDING MEMBERS.—Prof. Ezra S. Carr, M. D., LL. D., of the University of California, Oakland, Cal.; Hon. J. Wingate Thornton, of Boston, Mass.

ANNUAL MEMBERS.—Prof. R. Irving, E. M., Prof. of Geology in the University of Wisconsin; Maj. W. J. Nicodemus, U. S. A., Prof. of Military and Civil Engineering in the University of Wisconsin; Daniel S. Durrie, Esq., Librarian of the State Historical Society, Madison, Wis.; Hon. J. A. Bate, Chippewa Falls, Wis.; Prof. F. W. Woodward, Eau Claire, Wis.; Oliver Arey, Prest. State Normal School, Whitewater, Wis.

The following papers were then read and discussed:

2. On the Geology of the region about Devil's Lake, Sauk county, Wisconsin; being a report of observations made at the request of the Academy. By Prof. James H. Eaton, of Beloit College.

[Published in full in the Transactions, p. 124.]

3. On the Relations between Social and Moral Science. By Rev. Charles Caverno, of Lake Mills.

The leading ideas were these:

Whatever relates to the development and improvement of individual man or society will fall under the purview of Social Science. Let Moral Science be taken to be that which concerns itself with the sphere of right and wrong, with obligation, with the sense of *ought* in reference to human actions. It is the object of this paper to show the mutual dependence of these two sciences.

First, the dependence of Social upon Moral Science. To show men the better way, and induce them to walk in it, these are the great end of Social Science. To effect this last, there is no leverage upon humanity like the sense of right. When a new social principle is discovered and its value ascertained, then will come the question of its enforcement in society. But the chances are that it will not fall into place in society with its mere enunciation. It will have privilege and prejudice and custom, perhaps appetite and passion, to combat. To overcome these, it will have to establish itself in the forum of *the right*, with the conviction once firmly established that a thing *ought* to be done, it holds men irresistibly to it until it is done. There is no such might of enforcement in any other department of man's nature. It will be well for this new Social Science if it does not discard this fundamental truth and seek to attain its objects on the basis of and of the great fallacies which have led European reformers into such pitiful failures in the past.

If, now, we turn to the other side of the subject we shall find the dependence of Moral upon Social Science no less certain and considerable. The *ought* in many a subject is struggling up to the horizon, but cannot yet be seen. All the conditions upon which it depends are not mastered and systematized. What ought to be done will depend in many cases upon the effect which courses of action will have. Moral Science, in strictness, is no investigator or experimenter. It comes in with the power of moral obligation on the known and determined. Not so of Social Science. Society, in its advancement, is constantly brought in contact with questions in which the effect of any proposed method of action is problematical. The race has hitherto had scarcely any other way of solving such questions than by blundering in actual experiment through all possible evil courses to that one, which in the end, has shown itself to be good and right. Social Science proposes to take up such questions to see if it be not possible to avoid much of this sad experience by trying these questions beforehand, in tribunals removed as far as possible from human prejudice and party feeling, by the light of the already accumulated stock of human experience, by actual present investigation and experiment, and before the prophetic power of sound philosophy. When such investigations shall have been had, if the conclusions arrived at by Social Science may not be considered as established in the forum of right absolutely, *this* will be established—that it will be right to experiment in a direction so indicated rather than in another.

And when, after due examination had of all the elements that pertain to a matter, Social Science shall have reached an ultimate judgment, let it hand it over to Moral Science to be enforced by the binding power of moral obligation.

Adjourned to 2 o'clock P. M.

### *Third Session.*

The Academy met pursuant to adjournment. The President in the chair.

Reading and discussion of papers resumed.

4. The Mammalia of Wisconsin. By Dr. P. R. Hoy, of Racine.

The Doctor said that the Elk existed in Wisconsin in 1863, but is now probably extinct. The moose still exists in numbers. The last buffalo was killed in 1832. The antelope was once in Wisconsin—at the time of Hennepin's voyage. The musk-ox, the mastodon and the mammoth once existed here. The panther will soon disappear. It will be a

long time before the beaver will be exterminated. The otter will be retained longer. The deer will soon be exterminated. The last wild turkey was killed in '46, at which date a flock was killed in Racine.

5. On the climatic Relations of the Flora of Wisconsin. By Hon. J. G. Knapp, of Madison.

6. On the Results of Recent Investigations in the Lead Regions of Wisconsin. By J. Murrish, State Commissioner.

In entering upon the survey of the lead district, he found that, while there were conflicting opinions among miners in reference to the origin and nature of the fissures in connection with which ore deposits were found, they were nevertheless all agreed on this point, that there is a strong tendency in these fissures to an east and west direction.

They also recognized the fact that these so-called east and west fissures were occasionally intersected by another set of fissures at right angles, thereby presenting the familiar feature of mineral strata noticed in all mining regions.

In examining into these facts to satisfy himself in reference to their correctness, he had noticed, in looking over the various mines which had been opened, that, while the different mineral ranges and mining centers were separated from each other by a space of barren ground, there was nevertheless a grouping of these ranges or mining centers on the east and west direction.

Further observation proves that they were confined to certain belts of land having an east and west bearing. For instance, if we commence in town six, with what mining there is done in the town of Fennimore, in Grant county, and extend east with a strip of land three or four miles wide through a large portion of that county and the whole of Iowa county to Blue Mounds, in Dane county, we shall include in that strip all the mines of Fennimore, Wingville, Dodgeville, Ridgeway, Porter's Grove and Blue Mounds, giving us a belt of land through town six for a distance of over fifty miles.

If we extend our observations south from this belt to Mineral Point, we shall find ourselves on the center of a parallel belt, extending east and west from that place. If from thence to Platteville, in Grant county, on the third. If from thence to Hazel Green, we shall find ourselves on the fourth, all having about the same eastern and western extension. The lead district thus naturally divides itself into four distinct belts, conforming evidently to underlying causes, that have given origin to these peculiar phenomena.

But, striking as the evidences of the action of underlying physical forces along these east and west belts are, he was disposed, nevertheless, to regard them as subordinate to a stronger line of forces that have acted in a north and south direction, across which these belts are found at right angles. If, for example, we draw two lines from the eastern and western boundaries of the lead district, north and south, through the Mississippi valley, we shall include with our own lead district the lead districts of Iowa and Illinois, also the lead and iron mines of Missouri.

On the north, from what little we know along this line, we have a series of undulations or anticlinal lines, along which large deposits of iron are found. Among the most noted is the Penokee Iron Range, in town forty-four. These undulations of the strata, in their bearing and extension, resemble very much the mineral belts of the lead districts, and are collateral evidences, if nothing more, of an underlying north and south line of physical forces of great extent.

7. On the Laws which Govern the Configuration of Comets. By Hon. J. Y. Smith, of Madison.

This paper gave:

1st. A statement of some general *facts* concerning the constitution and form of cometary bodies.

2d. A brief outline of the theory of Prof. Peirce, of Cambridge, concerning the formation of the tails or trains of comets, viz: That a power of repulsion in the comet itself first throws off matter from the general mass as it approaches the sun, and that the sun exerts a repelling power upon the matter thus thrown off, driving it past the nucleus into space and thus forming the train, so far as elongation is concerned—the curve being produced by the particles thrown into a wider orbit falling behind those pursuing a narrower one.

3d. Three objections are brought against this theory, so far as the elongation is concerned: First, that the laws which are supposed to produce the phenomenon of elongation are *assumed*, there being no positive evidence that any such power of repulsion exists, either in a comet in respect to its own matter, or in the sun in respect to the material of a comet. Secondly, if the existence of these forces be admitted, still it is not shown why they should take effect upon one portion only of the cometic matter and not upon the whole of it, nor what is to limit their effect upon those portions upon which their power is exerted; and thirdly, that it ignores the existence and efficiency of well known laws which must inevitably produce the phenomena in question, viz., the laws of gravitation, acceleration and momentum acting upon extremely attenuated matter moving in a highly eccentric orbit.

The theory advanced by Mr. Smith is, in substance, as follows: Cometary matter at repose in space or but slightly acted on by solar attraction, (the latter being the condition of most comets at their aphelia,) possessing fluidity and gravity, however slight the

latter, *must* assume a spherical, or nearly spherical, form. The orbit of a comet being usually highly eccentric, the body moves the greater part of the distance from the aphelion to the perihelion almost in a direct line towards the sun and must, therefore, be subject to the law of acceleration and the varying force of gravitation according to the square of the distance. By this latter law the impulse of solar attraction will be strongest on the side nearest the sun, and less on the opposite side. This, with the slight gravitating power in the comet to hold its particles in a spherical form, must cause the body to elongate to a *spheroidal* form more and more as the difference in the square of the distance between the two extremes of the comet increases and the square of the distance of the whole from the sun diminishes. This elongating process must be assisted, to some extent, by the resisting ether in space (if any such exists) acting upon so light a body.

As the comet approaches the sun from its intersection of the minor axis of the orbit, the angle formed by the radius vector with the tangent of the orbit widens more and more rapidly until they form a right angle at the perihelion. As this angle widens, the centrifugal force comes into action in opposition to the centripetal and a new elongating force is brought to bear upon the cometary mass. Thenceforward these two elongating forces become subject to some curious modifications and transfers of power. That which results from simple solar gravitation, or the accelerating force, goes on increasing as the square of the distance diminishes, and diminishing as the angle of the radius vector with the tangent of the orbit widens, till it reaches the perihelion where this force is reduced to *zero*. At the same time that which results from the centripetal and centrifugal forces goes on increasing both as the square of the distance diminishes and as the aforesaid angle widens, until, at the perihelion, this elongating force reaches its *maximum* power.

The curve of the train is the necessary result of different parts of the body being compelled by the elongating forces to pursue orbits of different breadths with no increase of orbital motion in the outer portions which must needs fall behind the inner and form a curve. When the train becomes largely curved, the centripetal and centrifugal forces are brought to bear *transversely* upon the train and it is spread and flattened, least at the front and more and more at the rear. The elongation, the curving, the spreading and the flattening by the action of these forces, must, necessarily, all take place *in the plane of the orbit*.

When past the perihelion, the laws which brought the comet to its configuration at that point being reversed in their action, their effects are reversed, of course, and the body moves off, straightening, rounding and gathering up its train till it arrives at its aphelion in the same form with which it left it.

Adjourned to 7½ o'clock P. M.

#### *Fourth Session.*

The Academy met at the hour appointed; the President in the chair.

The following persons were elected members of the Academy:

**CORRESPONDING MEMBERS.**—Wm. Stimpson, M. D., Secretary of the Chicago Academy of Sciences; J. C. Freer, M. D., President of Rush College, Chicago; Prof. T. W. Safford, Director of Dearborn Observatory, Chicago; Prof. Alex. Winchell, University of Michigan; Prof. James Watson, Director of Observatory at University of Michigan.

**ANNUAL MEMBERS.**—I. W. Roby, Esq., Milwaukee; E. A. Charlton, President Platteville State Normal School; Prof. Geo. Beck, State Normal School, Platteville.

Reading of papers resumed.

8. On the Kinetic Measures of Force. By Prof. John E. Davies, Wisconsin State University.

9. On the Duty of the State to its Idiotic Children. By Prof. O. R. Smith, Milwaukee.

This paper adduced evidence in favor of the capacity of the idiotic for receiving instruction, and strongly urged upon the State the importance of making provision for this unfortunate class of persons, of whom statistics show the number to be much larger in every community than is generally supposed.

10. On the Place which the Study of the Indian Languages should hold in Ethnology. By Prof. John B. Feuling, of Wisconsin State University.

[Published in the Transactions p. 178.]

Adjourned to 9 A. M. of next day.

Fifth Session—Business Meeting.

The Academy met pursuant to adjournment; the President in the Chair.

On motion it was resolved to organize a section of Social Science; which, on subsequent motion, was expanded into a full DEPARTMENT OF THE SOCIAL AND POLITICAL SCIENCES, with the following officers:

*Vice President*—Rt. Rev. W. E. Armitage, Milwaukee.

*Secretary*—Rev. Charles Caverno, Lake Mills.

*Counselors*—President G. M. Steele, D. D., Lawrence University; Rev. A. O. Wright, New Lisbon; Dr. A. S. McDill, State Hospital for the Insane.

On motion there was organized the DEPARTMENT OF THE ARTS, to the several constitutional offices in which the following persons were duly elected:

*Vice President*—Ex-Governor Nelson Dewey, Cassville.

*Secretary*—Col. S. V. Shipman, Madison.

*Counselors*—J. H. Van Dyke, Esq., Milwaukee; Mr. Alexander Provis, Lancaster; Hon. J. I. Case, Racine.

On motion there was also organized the DEPARTMENT OF LETTERS, with the following officers:

*Vice President*—Rev. Dr. A. L. Chapin, Beloit College.

*Secretary*—Prof. John B. Feuling, Wisconsin State University.

*Counselors*—Prof. Wm. F. Allen, State University; Dr. I. L. Hauser, Milwaukee; Hon. Lyman C. Draper, State Historical Society.

The Academy adjourned *sine die*.

SIXTH MEETING OF THE ACADEMY.

The Academy met in their rooms, at 8 o'clock P. M. of July 18, 1871, the President, Dr. J. W. Hoyt, in the chair.

Adjourned to 9 o'clock A. M. of next day.

The Academy met pursuant to adjournment; the President in the chair.

Letters were read from the following persons accepting membership:

Prof. Ezra S. Carr, Oakland, California; J. Wingate Thornton, Boston, Mass.; Prof. T. H. Safford, Chicago, Ill.; Prof. James C. Watson, Ann Arbor, Mich.; Prof. Alex. Winchell, Ann Arbor, Mich.

Mr. J. Murrish presented numerous specimens of the rocks, minerals and fossils of the lead region of Wisconsin.

The President reported that his efforts, in regard to the scientific exploration of the northern part of the state, the present season, in connection with the railroad companies, had not been successful.

The Treasurer reported

The amount of cash on hand at the date of his last report.....	\$733 30
Received for dues, &c .....	40 00
Total .....	<u>\$823 30</u>
Disbursed since last report.....	112 00
Balance on hand.....	<u>\$711 30</u>



Of this balance, \$600 received from Life Members constitutes a permanent fund, the proceeds of which are only applicable to the general purposes of the Academy.

The proposition heretofore offered to amend section two of the by-laws, relating to the meeting to be held at the time of the exhibition of the State Agricultural Society, was considered and indefinitely postponed.

The proposition, submitted at the last meeting, to amend section eight of the Constitution, so as to provide that the President and Secretary of the State Agricultural Society shall be *ex-officio* members of the Council for the Department of the Arts was considered and adopted.

On motion, it was

*Resolved*, That the resolution requiring the investment of a permanent endowment fund be so modified as to authorize the investment of the same in any securities satisfactory to the Committee on Finance.

The rules being unanimously suspended for the purpose, the following named persons were duly elected members of the Academy.

LIFE MEMBERS.—John L. Mitchell, Esq., Milwaukee, Wis.

ANNUAL MEMBERS.—Prof. W. F. Yocum, Appleton, Wis.; G. F. Luders, Sauk City, Wis.; Rev. W. S. Alexander, Racine, Wis.; Wm. H. Sherman, Esq., Milwaukee, Wis.; H. K. Smith, Esq., Milwaukee, Wis.

CORRESPONDING MEMBERS.—Hon. J. Hammond Trumbull, LL. D., Hartford, Conn.; Prof. S. S. Haldemann, State University of Pennsylvania, Philadelphia; F. Ebener, Ph. D., Baltimore, Md.; Prof. W. D. Whitney, New Haven, Conn.; Dr. J. G. Brinton, Philadelphia, Pa.

It was resolved to publish another number of the Bulletin, to include the proceedings of the last and present meetings.

Rev. C. Caverno announced that being about to leave the state, it would be necessary to resign the office of Secretary of the Social Science Department of the Academy.

The papers read at this meeting were as follows:

1. On the Clay Deposits and Fossils found therein, in the Region about Appleton. By R. Z. Mason, LL. D., Appleton.

The geological characteristics of this region are, 1st. A thin stratum of the lower magnesian limestone overlaying the Potsdam sandstone, all dipping at small angle to the southeast. The limestone in the vicinity of Appleton grows thinner as we go westward, and nearly disappears at the Wolf river, being replaced as a surface rock by the Potsdam sandstone, between the Wolf and Wisconsin rivers. The Lower River flows over the surface of the limestone at a level of about sixty feet below the general surface of the clay deposits. These deposits, of clay mainly, are therefore about sixty to eighty feet deep, and give every appearance of having been made in quiet and shallow seas. Intermixed with these deposits of clay, are boulders, varying in size from a mere pebble to those of many tons weight. These boulders, are granite, quartz, feldspar, hornblende, and trap—the first and last most abundant.

Throughout this entire region there have also been found, at the depth of twenty, forty and sixty feet, large fragments of timber, generally cedar, tamarack and other conifers.

These seem to be the fragments of trees that have grown in this region at an early period, when the temperature was lower than at present, and where the surface of the ground was level and marshy.

The above inference is based on the fact that the forest trees of warmer latitudes and higher regions, such as now grow there, to wit, the oak, the maple, the beech, etc., have never been found in these clays. Nearly all the discoveries of this nature have been made in the digging of wells.

2. On the Ancient Lakes of Wisconsin. By J. G. Knapp, Esq., Madison.

3. Suggestions as to a Basis for the Gradation of the Vertebrata. By Prof. T. C. Chamberlin, of the State Normal School, Whitewater.

[Published in the Transactions, p. 138.]

5. Facts relating to the Local Geology of the Whitewater Region. By Prof. T. C. Chamberlin, State Normal School, Whitewater.

This paper consisted of remarks upon the Galena formation, to which the bed-rock at Whitewater belongs, upon the chemical and physical characteristics of the rock, and upon the paleontology of the region, including remarks upon the following fossil genera: *Receptaculites chaetetes*, *Lingula*, *Rhynchonella*, *Orthis*, *Strophomena Murchisonia*, *Pleurotomaria*, *Orthoceras*, and upon the questionable evidences of plants. The drift phenomena of the region were made the subject of special description and explanation. The peculiarities of its composition and the variety of formation, including beds of clay, of sand, of assorted gravel, of rounded boulders, of rounded and angular boulders, mingled and unclassified forms, the striking features of the surface arrangement and the glacial striae were particularly noticed.

6. On the Rocks and Mines of the Upper Wisconsin River. By J. G. Knapp.

7. On the seventeen-year Cicada, its Geographical Distribution and Time of Appearance in this State. By Prof. T. C. Chamberlin.

The Academy adjourned *sine die*.

#### SIXTH MEETING OF THE ACADEMY.

The sixth meeting of the Academy was held at the City Hall, Milwaukee, on the 26th of September, 1871. Owing to the presence of the State Fair in Milwaukee at the same date, and the engagements of many members in connection therewith, the attendance upon the first session was small. President Hoyt in the chair.

The General Secretary being absent in Florida, on motion, Dr. M. Barrett was chosen Secretary *pro tem*.

Bishop W. E. Armitage moved that the Academy adjourn, subject to the call of the General Council; which motion was carried.

#### SECOND ANNUAL MEETING.

The Second Annual Meeting of the Academy was convened at the State Agricultural Rooms on the 13th of February, 1872, at 5 o'clock P. M., a large number of members being present.

President Hoyt, on assuming the Chair, made some statements concerning the work of the Academy during the year, and said that,

Inasmuch as many members of the Legislature and other citizens would be pleased to attend a general session, he had asked, and, by courtesy of the Assembly, had procured the use of their hall for the first evening session.

Adjourned to meet in the Assembly Chamber at 7½ o'clock P. M.

The Academy met pursuant to adjournment. Attendance of members and citizens large. The President, Dr. J. W. Hoyt, having called the meeting to order, stated the object of the Academy, in general terms, and announced the titles of the papers to be read at this session, as follows:

1. On the German Sunday. By Rt. Rev. Bishop W. E. Armistage, Vice President for the Department of the Social and Political Sciences.

[Published in full in Transactions, p. 62.]

2. On the Common Jail System of this Country. By Hon. S. D. Hastings, Secretary of the State Board of Charities and Reform.

[Published, in abstract, in Transactions, p. 90.]

3. On the Physical Basis of the Mineral Resources of Wisconsin. By Hon. John Murrish, State Commissioner for the Survey of the Lead Region.

This paper was an elaboration, for the somewhat popular occasion on which it was read, of the paper entitled "Results of Recent Investigations in the Lead Region," read by the same author at a previous meeting, and printed in abstract on a preceding page.

Adjourned to meet in the State Agricultural Rooms, at 9 o'clock of the next day.

*Second Session.*

The Academy met pursuant to adjournment; President Hoyt in the chair.

The papers read the previous evening were briefly discussed.

Vice President Chapin moved that a committee of three be appointed to wait upon the Governor and solicit accommodations for the Academy's collections. President appointed Dr. Chapin, Wm. Dudley and John Murrish. On motion, President Hoyt was added to the committee.

The following papers were read and discussed.

4. On Aphides observed in Wisconsin. By Dr. P. R. Hoy, Vice President of the Department of Natural Sciences.

[Published in Transactions, p. 110.]

After the discussion of this paper the President called Dr. Hoy to the chair.

5. On the Post Glacial Deposits of Dane county. By Hon. J. G. Knapp, of Madison.

6. Are the great Plains to be always Treeless? By Hon. J. G. Knapp.

Adjourned till 2 o'clock P. M.

*Third Session.*

The Academy met pursuant to adjournment; Vice President P. R. Hoy in the chair.

The following papers were read and discussed:

7. On the age of the Quartzites, Schists and Conglomerates of Sauk county. By Prof. Roland Irving, M. E., State University.

[Published in full in Transactions, p. 129.]

8. On a Modification of Grove's Battery for a Special Purpose. By Prof. John E. Davies, M. D., State University.

9. On Potential Functions and their Application in Physics. By Prof. John E. Davies, M. D., State University.

[Published in full in Transactions, p. 111.]

Dr. Hoyt resigned the Chair to Vice President Dr. A. L. Chapin.

10. On the Theory of Evolution, illustrated by the Science of Language. By Prof. J. B. Feuling, Ph.D., Secretary of the Department of Letters, State University.

11. On the Rural Population of England as classified in Domesday Book. By Prof. Wm. F. Allen, A. M., State University.

[Published in Transactions, p. 167.]

Adjourned to meet at 7½ P. M.

*Fourth Session.*

Academy met pursuant to adjournment; Rt. Rev. W. E. Armitage, Vice President for the Department of the Social and Political Sciences, in the Chair.

The following papers were read:

11. Social Science and Woman Suffrage. By Rev. Charles Caverno, A. M., Secretary of the Department of the Social and Political Sciences, Amboy, Illinois.

[Published in full in Transactions, p. 72.]

12. The Relations of Labor and Capital. By Rev. A. L. Chapin, D. D., President of Beloit College, Vice President of the Academy for the Department of Letters.

[Published in full in Transactions, p. 45.]

13. Outline of a Plan for a National University. By Dr. J. W. Hoyt, President of the Academy.

14. On the Coal Deposits of Colorado. By Dr. J. W. Hoyt.

[Reading omitted by author owing to lateness of the hour. For substance of Paper 13, see bill No. 1128 S., now pending in Congress.]

The Academy then went into session for the transaction of special business.

The committee appointed to confer with the Governor concerning provision for the Academy's Collections, reported that his Excellency was desirous of doing everything in his power to aid the Academy, and that he would order new cases so soon as the plans were furnished him.

A majority of the committee appointed to consider the propriety of soliciting aid from the State for canvassing the field and other work designed to be undertaken by the Academy,

reported in favor of asking such aid. Prof. R. Irving, of the said committee, made a minority report, urging the inexpediency of making such a request at this time. The minority report was adopted.

A vote of thanks was passed in favor of Messrs. Landruff and Co., and to Mr. Hollyking, of Highland, Iowa Co., for specimens furnished the Academy's Museum.

A committee consisting of President Hoyt, Dr. I. A. Lapham, Prof. John E. Davies, Dr. A. L. Chapin and Bishop Armitage, was appointed to report any changes in the by-laws deemed desirable, and to take action in regard to the publication of the Transactions of the Academy.

The following persons, approved by the Committee on Nominations, were elected members of the Academy.

LIFE MEMBER:—Hon. S. A. White, Whitewater.

ANNUAL MEMBERS:—Prof. S. H. Carpenter, LL. D., University of Wisconsin; Prof. J. B. Parkinson, A. M., University of Wisconsin; Hon. H. D. Barron, Osceola; Daniel S. Durrie, State Historical Society; G. W. Rayner, Editor Madison Democrat.

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Adjourned *sine die*.