[No. 12.

SEVENTH BIENNIAL REPORT

OF THE

BOARD OF TRUSTEES

OF THE

IOWA STATE

Agricultural College

AND FARM,

MADE TO

THE GOVERNOR OF IOWA,

FOR THE YEARS 1876 AND 1877.

DES MOINES:
R. P. CLARKSON, STATE PRINTER.
1877.

STATE AGRICULTURAL COLLEGE,
AMES, IOWA, Dec. 1st, 1877.

To His Excellency, JOSHUA G. NEWBOLD:

In accordance with the statute defining the duties of the Secretary of the Board of Trustees of the Iowa State Agricultural College and Farm, I have the honor to transmit herewith the Seventh Biennial report of said Board.

E. W. STANTON, *Secretary.*

CALENDAR FOR 1878.

FIRST TERM.

Entrance examinations	Tuesday and Wednesday, March 5th-6th.
Recitations begin	Thursday, March 7th.
Term examinations	July 5th-11th.
Junior exhibition	Wednesday evening, July 10th.
Summer recess	July 12th-16th.

SECOND TERM.

Entrance examinations	Wednesday, July 17th.
Recitations begin	Thursday, July 18th.
Term examinations	November 8th-13th.
Address before the Literary Societies	Monday evening, November 11th.
Address before the Trustees	Tuesday evening, November 12th.
Commencement exercises	Wednesday afternoon, November 13th.
Winter vacation	November 14th, 1878-March 5th, 1879.

PRESIDENT'S REPORT.

To the Honorable Board of Trustees of the Iowa State Agricultural College:

Gentlemen:—I submit according to law the Seventh Biennial Report of the Iowa Agricultural College. The matter embraced therein is arranged in five parts as follows:

PART I. Contains a Catalogue of the Trustees, the Officers of Instruction and Government, the Graduates from 1872 to 1877 inclusive, and the Students in attendance the last two years.

PART II. Comprises a series of statements on the Conditions of Entrance, Examinations, Expenses, Manual Labor, Government, the College Code, Student Government and the True Work of the Agricultural College.

PART III. Exhibits the revised Courses of Study, namely:

1. The Course in Sciences related to Agriculture.
2. The Course in Mechanical Engineering.
3. The Course in Civil Engineering.
4. The Ladies' Course in Science.
5. The Course for Juniors and Seniors in special lines of Industrial Science.
6. Post-graduate Courses of Study for resident graduates.
7. The Preparatory Course.

Part III sets forth, also, the conditions on which the first and second degrees are conferred, and concludes with careful statements made by the officers of departments as to their methods and means of instruction.

PART IV. Presents the need of a limited appropriation from the State, for improvements that are pressing; also the Reports on the Farm, the Garden, Orchard &c., by Professor Budd; a Register of Meteorological Observations by Professor Macomber; a paper on "Injurious Fungi," and one on "Orthoptera of Iowa," by Professor Bessey; and an Essay, by myself, on the Laws of Breeding.

PART V. Will be added by the Secretary of your honorable body, and will be made up as follows:

1. Report of the Superintendent in charge of the expenditure of the appropriations of the Sixteenth General Assembly.
2. Report of the Treasurer for the year ending Nov. 15, 1876.
3. Report of the Secretary for the year ending Nov. 15, 1876.
4. Report of the Treasurer for the year ending Nov. 14, 1877.
5. Report of the Secretary for the year ending Nov. 14, 1877.
6. Biennial Report of Land Agent Bassett.
7. Report of the Secretary on settlements with Land Agent Bassett.
8. Report of the Secretary on settlements with Land Agent Stone.
9. Abstract of the proceedings of the Board of Trustees for the years 1876 and 1877.

During the last term the Courses of Study, the Laws regulating Manual Labor and the Conditions of Graduation have been carefully revised, and we are confident that the improvements secured, will, under your approval, contribute to the still greater prosperity of the Agricultural College.

Very respectfully,

A. S. WELCH, *President.*

PART I.

CATALOGUE OF OFFICERS AND STUDENTS.

BOARD OF TRUSTEES.

Hon. SAMUEL J. KIRKWOOD, Iowa City.
WILLIAM B. TREDWAY, Sioux City.
BUEL SHERMAN, Fredericksburg.
C. C. WARDEN, Ottumwa.
Hon. LAUREL SUMMERS, Le Claire.

OFFICERS OF THE BOARD OF TRUSTEES.

C. C. WARDEN, Chairman.
E. W. STANTON, Secretary.
WILLIAM D. LUCAS, Treasurer.
Gen. J. L. GEDDES, Deputy Treasurer.

STANDING COMMITTEES.

EXECUTIVE COMMITTEE,
WARDEN, SUMMERS and KIRKWOOD.

COMMITTEE ON FARM AND HORTICULTURE.
TREDWAY and SHERMAN.

OFFICERS OF INSTRUCTION.

A. S. WELCH, LL. D., PRESIDENT,
Professor of Psychology and Philosophy of Science.

GEN. J. L. GEDDES, PRESIDENT *Pro tem.*
Professor of Military Tactics and Engineering.

W. H. WYNN, A. M., Ph. D.
Professor of English Literature.

C. E. BESSEY, M. S.,
Professor of Botany, Zoology and Entomology.

A. THOMSON, C. E.,
Professor of Mechanical Engineering, and Supt. of Workshop.

F. E. L. BEAL, B. S.,
Professor of Civil Engineering.

T. E. POPE, A. M.,
Professor of Chemistry.

M. STALKER, B. S., V. S.
Professor of Agriculture and Veterinary Science.

J. L. BUDD,
Professor of Horticulture.

J. K. MACOMBER, B. S.,
Professor of Physics.

E. W. STANTON, B. S.,
Professor of Mathematics and Political Economy.

MRS. MARGARET P. STANTON, PRECEPTRESS,
Instructor in French and Mathematics.

J. S. LEE, B. S.,
Assistant Professor of Chemistry.

MRS. M. B. WELCH,
Instructor of the English Language, and Lecturer on Domestic Economy.

J. C. ARTHUR, M. S.,
Librarian, and Demonstrator of Botany and Zoology.

T. L. SMITH, B. S.,
Foreman in the Workshop, and Teacher in Preparatory Department.

FRANK W. BOOTH, B S.,
Foreman, and Instructor in the Printing Office.

MRS. MARY L. BEAL,
Teacher of Music for 1876 *and* 1877.

WINNIFRED M. DUDLEY, B. S.,
Teacher of Instrumental Music for 1878.

PROF. GEO. D. FOX,
Teacher of Vocal Music.

H. H. ROBINSON,
Superintendent of the Farm.

MRS. A. THOMSON,
Housekeeper.

MRS. ELLA MILLIGAN.
In charge of Farm House.

H. D. HARLOW,
Proctor.

OFFICERS OF GOVERNMENT.

EXECUTIVE:

A. S. WELCH.

FACULTY, OR LEGISLATIVE BODY:

A. S. WELCH.
J. L. GEDDES.
W. H. WYNN.
C. E. BESSEY.
A. THOMSON.
F. E. L. BEAL.
T. E. POPE.
M. STALKER.
J. L. BUDD.
J. K. MACOMBER.
E. W. STANTON.
MRS. M P. STANTON.
J. S. LEE.
MRS. MARY B. WELCH.

JUDICIARY:

A. S. WELCH.
J. L. GEDDES.
W. H. WYNN.
C. E. BESSEY.
A. THOMSON.
F. E. L. BEAL.
T. E. POPE.
M. STALKER.
J. L. BUDD.
J. K MACOMBER.
E. W. STANTON.
MRS. MARGARET P. STANTON.

LIST OF GRADUATES.

POST GRADUATE, 1877, M. S.

J. C. Arthur.

GRADUATES OF 1872, B. S.

J. C. Arthur,
P. S. Brown,
O. Cessna,
S. A. Churchill,
S. H. Dickey,
Chas. Dietz,
L. Foster,
H. Fuller,
F. L. Harvey,
E. M. Hungerford,
Mattie A. Locke,
J. K. Macomber,
L. W. Noyes,
H. L. Page,
G. W. Ramsey,
Fannie H. Richards,
C. A. Smith,
I. W. Smith,
H. C. Spencer,
E. W. Stanton,
J. L. Stevens,
C. L. Suksdorf,
T. L. Thompson
C. H. Tillotson,
C. P. Wellman,
J. M. Wells.—26.

GRADUATES OF 1873, B. S.

E. L. Beard,
Rowena E. Edson,
G. R. Flower,
W. Green,
G. W. Harvey,
A. M. Hawkins,
D. A. Kent,
Kate Krater,
J. S. Lee,
C. B. Maben,
M. F. Marshall,
Hattie E. Raybourne,
W. O. Robinson,
M. Stalker,
Sally Stalker.—15.

GRADUATES OF 1874, B. S.

Estella J. Bebout,
C. D. Boardman,
C. S. Chase,
C. E. Clingan,
E. R. Clingan,
C. P. Hastings,
J. G. W. Kiesel,
M. C. Litteer,
G. E Marsh,
O. P. McCray,
Mary A. Palmer,
A. A. Parsons,
Eva E. Paull,
E. A. Pyne,
Ida E. Smith,
W. R. Smith,
Kate N. Tupper,
J. R. Whittaker,
S. Y. Yates.—19.

GRADUATES OF 1875, B. S.

E. P. Cadwell,
Millah M. Cherrie,
Alice Cunningham,
Lizzie M. Curtis,
R. P. Kelley,
C. H. Lee,
W. R. Lamoreaux,
Hannah P. Lyman,
F. J. Macomber,
Celestia A. Neal,
T. L. Palmer,
H. R. Patrick,
C. E. Peterson,
Ida M. Ross,
M. E. Rudolph,
Ida L. Sherman,
L. C. Thornton,
J. M. Whittaker,
Nancy Wills,
Lizzie M. Wilson.—20

GRADUATES OF 1876, B. S.

M. I. Aitken,
A. P Barker,
L. W. Beard,
A. M. Blodget,
Julia C. Blodget,
L. A. Claussen,
J. E. Cobbey,
W. S. Collins,
Winnifred M. Dudley,
J. J. Fegtly,
G. A. Garard,
W. T. Gilmore,
J. F. Hardin,
Ellen W. Harlow,
A. E. Hitchcock,
W. M. James,
Ella F. Mead,
H. N. Scott,
A. B. Shaw,
L. E. Spencer,
W. M. Woodward.—21.

GRADUATES OF 1877, B. S.

F. W. Booth,
Alfaretta J. Campbell,
Mary C. Carpenter,
C. C. Colclo,
Kate S. Curtis,
J. W. Doxsee,
Mary E. Farwell,
A. P. Hargrave,
W. A. Helsell,
J. B. Hungerford,
W. N. Hunt,
R. F. Jordan,
Cora B. Keith,
E. L. King,
G. I. Miller,
J. C. Milnes,
Alice Neal,
Cora M. Patty,
L. B. Robinson,
T. L. Smith,
F. L. Stratton,
H. M. White.—22.

Total.....123.

CATALOGUE OF STUDENTS

FOR THE YEAR 1876.

SENIORS.

Names.	*Post-Office.*	*Residence.*
Aitkin, Martin I.	Mason City	Cerro Gordo.
Barker, A. P	Camanche	Clinton.
Beadle, Emma	Cresco	Howard.
Beadle, Lottie	Cresco	Howard.
Beard, Lewis W	Frankville	Winneshiek.
Blodget, Albert M	Le Mars	Plymouth.
Blodget, Julia C	Le Mars	Plymouth.
Bouck, Ira W	Independence	Buchanan.
Claussen, Lorents A	Afton	Union.
Cobbey, J. Ell	Vinton	Benton.
Collins, Winfield S	Solon	Johnson.
Dudley, Winnifred M	Ames	Story.
Fegtly, John J	Mt. Pleasant	Henry.
Fish, Henrietta A	Eddyville	Wapello.
Garard, George A	Riverside	Washington.
Gilmore, Wm. T	Tipton	Cedar.
Goodspeed, Weston A	Lexington	Washington.
Hardin, James F	Steamboat Rock	Hardin.
Harlow, Ellen W	Ames	Story.
Hitchcock, Abner E	Anamosa	Jones.
James, Wm. M	Ames	Story.
McElyea, C. W	Ames	Story.
Mead, Ella	Cresco	Howard.
Scott, H. N	Wheatland	Clinton.
Shaw, Arvin B	Tipton	Cedar.
Sheldon, Dwight D	Iowa Center	Story.
Spencer, Louis E	Grinnell	Poweshiek.
Woodward, Walter M	Marshalltown	Marshall.
Welch, Wm. B	Ames	Story.

Total 29

JUNIORS.

Names.	Post-Office.	Residence.
Beard, Angie M	Franklin	Winneshiek,
Booth, F. W	Anamosa	Jones.
Campbell, Alfaretta J	Washington	Washington.
Carpenter, Mary C	State Center	Marshall.
Colclo, C. C	Carroll	Carroll.
Curtis, Kate S	Independence	Buchanan.
Doxsee, J. W	Monticello	Jones.
Farwell, Mary E	Monticello	Jones.
Garard, Mary	Riverside	Washington.
Hargrave, Almar P	Atalissa	Muscatine.
Helsell, William A	Clarence	Cedar.
Hungerford, John B	Burlington	Des Moines.
Hunt, Wilber N.	Ames	Story.
Jordan, Richard F	Ontario	Boone.
Keith, Cora B	Vinton	Benton.
King, Edward L	Vinton	Benton.
Lee, Thomas F	Olewein	Fayette.
Miller, George I	Exira	Audubon.
Milnes, John C	West Liberty	Muscatine.
Moyer, Alexander	Jesup	Buchanan.
Neal, Alice	Davenport	Scott.
Northrup, J. O	Strawberry Point	Fayette.
Patty, Cora M	Redfield	Dallas.
Robinson, Lyman B	Belle Plaine	Benton.
Smith, Thomas L	Ames	Story.
Stratton, Fabien L	Alden	Hardin.
Voris, George A	Vinton	Benton.
White, Harley M	Vinton	Benton.
Total		28

SOPHOMORES.

Brown, Flora E	Wheatland	Clinton.
Brush, J. B	Marshalltown	Marshall.
Buell, Wm. E	Lyons	Clinton.
Burke, Richard	Sigourney	Keokuk.
Butler, J. R	Ft. Dodge	Webster.
Casebeer, Chas. S	Tipton	Cedar.
Croy, Lily	Ontario	Story.
Dean, May E.	Waukon	Allamakee.

Names.	Post-Office.	Residence.
Devoss, Winfield S	Wilson	Montgomery.
Forest, Chas. M	Glidden	Carroll.
Fowle, Abby	Clarksville	Butler.
Frazier, Alma	Nevada	Story.
Geddes, Patricia L	Ames	Story.
Glenn, Harvey L	Clarksville	Butler.
Griffith, A. E	Story City	Story.
Hitchcock, M. M	Anamosa	Jones.
Hoggatt, Volney	Ames	Story.
Hyman, Wm	Camanche	Clinton.
Keigley, A. E	Ames	Story.
Kreigh, P. S	Ankeny	Polk.
Lonsdale, Mollie	Dale City	Guthrie.
Martin, C. B	State Center	Marshall.
McConnon, W. G	Monticello	Jones.
McElyea, Jennie	Ames	Story.
McHenry, Emma	Des Moines	Polk.
McKinnon, David	Florence	Benton.
Mount, Chas. F	Mt. Pleasant	Henry.
Muncey, John N	Jesup	Buchanan.
Owen, Lizzie	Logan	Harrison.
Pugh, Augustus L	Redfield	Dallas.
Rice, Ellen	Jesup	Buchanan.
Richards, Wyman C	Spencer	Clay.
Robbins, Wm. K	Redfield	Dallas.
Rodearmel, G. M	Nevada	Story.
Roe, Geo. W	Polk City	Polk.
Shepard, Lucy	Masonville	Delaware.
Sigafoos, Josiah	Columbus	Louisa.
Smart, S. A	Des Moines	Polk.
Twitchell, Ida	Redfield	Dallas.
Tyler, Ernest G	Dunlap	Harrison.
Whited, Willis	Alden	Hardin.
Whited, Alice	Alden	Hardin.
Whitney, Warren J	Prairieburgh	Linn.
Wills, Geo. T	Boone	Boone.
Wilson, Geo. W	Cambridge	Story
Woods, Belle	Tipton	Cedar.
Wright, Ella	Nevada	Story.
Total		47.

FRESHMEN.

Names.	Post-Office.	Residence.
Allen, Clara	Lewis	Cass.
Applegate, Chas. C	Atlantic	Cass.
Bailey, Eliza	Dunlap	Harrison.
Bailey, Frank D	Williamstown	Chickasaw.
Baker, Lida	Altoona	Polk.
Baker, Sarah	Altoona	Polk.
Barnes, Sarah	Ames	Story.
Baughman, Alice	Ames	Story.
Beach, Minnie R	Albion	Marshall.
Beresford, H. L	Vinton	Benton.
Boller, Emma	Elkader	Clayton.
Brown, O. S	Willow Grove	Story.
Cahill, Jennie	Ft. Dodge	Webster.
Calkins, F. W	Spencer	Clay.
Call, A. B	Shenandoah	Page.
Carter, Carrie S	Lewis	Cass.
Chavannes, Eneile	Ames	Story.
Cleaver, Minnie	Lewis	Cass.
Coe, Chas. M	Tipton	Cedar.
Conrad, Silas H	Bryant	Clinton.
Crossmun, Marilla J	Ames	Story.
Daniels, Carrie W	Independence	Buchanan.
Davis, H. W	Ames	Story.
Dibble, Frank	Ottumwa	Wapello.
Dudley, George	Ames	Story.
East, Jno. H	Elvira	Clinton.
Edwards, Hattie	Cedar Rapids	Linn.
Everhart, J. W	Ackley	Hardin.
Faville, Geo. E	Mitchell	Mitchell.
Field, Frank	Ottumwa	Wapello.
Fortner, E. C	Waverly	Bremer.
Foster, Jno. W	Panora	Guthrie.
Frazier, Wm. T	Nevada	Story.
Gates, C. W	Big Rock	Clinton.
Geddes, Phebe	Ames	Story.
Gifford, E. W	West Liberty	Muscatine.
Gillett, Laura	Cambridge	Story.
Gillett, Sarah	Cambridge	Story.
Hall, Chas. S	Eldora	Hardin.
Hallowell, Jno. J	Dowville	Crawford.
Hanson, Albert L	Reed's Ridge	Allamakee.

Names.	Post-Office.	Residence.
Hendricks, J. P	Tama City	Tama.
Hardin, David S	Steamboat Rock	Hardin.
Hess, Hattie B	Princeton	Scott.
Hoopes, A. E	Muscatine	Muscatine.
Hyde, Jas. E	Dunlap	Harrison.
Isbell, Victoria E	Ossian	Winneshiek.
Johnson, W. E	Centreville	Appanoose.
Keith, Mollie	Vinton	Benton.
Kellogg, Clara	Dunlap	Harrison.
Kipp, Geo.	Monroe	Jasper.
Leet, Jennie A	Clarksville	Butler.
Leighton, Leon	Ft. Dodge	Webster.
Lemley, J. W	Richland	Keokuk.
Lewis, Esther	Lewis	Cass.
Livermore, C. H	Oto	Woodbury.
Lloyd, C. H	Brighton	Washington.
Lonsberry, Frank	Monroe	Jasper.
Lowry, A. R	Prairie City	Polk.
Manwaring, Louis L	Wheatland	Clinton.
Marshall, Flora	Ames	Story.
Martin, Herman	Bedford	Taylor.
May, A. C	Richland	Keokuk.
McCarn, C. D	Princeton	Scott.
McIntire, Joseph	Ottumwa	Wapello.
Miller, C. A	Centerville	Appanoose.
Mitchell, Peter	Ft. Dodge	Webster.
Moss, Lizzie	Vinton	Benton.
Nelson, J. J	Ames	Story.
Nevin, W. D	Vinton	Benton.
Nicholson, R. M	Eastville	Delaware.
Noble, Jno. C	Monroe	Jasper.
Nowlin, Belle	Princeton	Scott.
Oliver, Addison	Onawa	Monona.
Oliver, Jno	Onawa	Monona.
Orser, R. E	Ames	Story.
Osborne, Herbert	Fairfax	Linn.
Palmer, J. E	Denison	Crawford.
Parsons, Jas. M	Anamosa	Jones.
Pedrick, Samuel	Ottumwa	Wapello.
Perkins, Minnie	Ames	Story.
Pratt, Fred. M	Otho	Webster.
Prime, Angie	Ontario	Story.
Prime, Belle	Ontario	Story.

Names.	*Post-Office.*	*Residence.*
Roberts, Frank	Vinton	Benton.
Rose, Wm. G	Florence	Benton.
Ruggles, Chas. W	Mechanicsville	Cedar.
Sears, A. G	Marshalltown	Marshall.
Shannon, Belle	Janesville	Bremer.
Shearer, J. D	Ames	Story.
Schee, Jno. F	Schonberg	Warren.
Slater, Frank	Lincoln	Polk.
Sherman, Minnie	Frederickburg	Chickasaw.
Smith, Oscar M	Mechanicsville	Cedar.
Smith, Wm. D	New Hartford	Butler.
Starr, W. D	Ames	Story.
Strong, Nellie	Denison	Crawford.
Sutton, Maggie	Vinton	Benton.
Taylor, Lou	Alden	Hardin.
Thomas, Wm. A	Golden Prairie	Delaware.
Turner, Fremont	Marshalltown	Marshall.
Vincent, Jas	Tabor	Mills.
Voris, M. J	Vinton	Benton.
Wattles, Geo. W	Glidden	Carroll.
Waugh, Jas. M	Hazle Green	Delaware.
Wilson, Ida	Cherokee	Cherokee.
Wood, F. D	Muscatine	Muscatine.
Total		107

STUDENTS NOT FULLY ACCEPTED AS FRESHMEN.

Axtell, Geo. W	Janesville	Bremer.
Cunningham, Anna	Waverly	Bremer.
Hance, W. K	Biven's Grove	Marshall.
Hills, A. R	De Soto	Dallas.
Howlett, Chas. H	Fairfield	Jefferson.
Huntington, Lou	Ames	Story.
Hutchinson, Wm. H	Sioux City	Woodbury.
Johnston, Geo	Ames	Story.
Logan, A. C	Mo. Valley Junction	Harrison.
Milligan, Harry	Ames	Story.
Milligan, Wm	Ottumwa	Wapello.
Mitchell, Jno. H	Ft. Dodge	Webster.
Neel, Adel	Ames	Story.
Overton, Olive	Ames	Story.
Owen, Edward	Le Claire	Scott.
Pedan, Allen	Cherokee	Cherokee.

Names.	*Post-Office.*	*Residence.*
Perkins, Geo. C	Ames	Story.
Pierce, M. H	Biven's Grove	Marshall.
Richards, Stella S	Spencer	Clay.
Simmons, Geo. B	Ottumwa	Wapello.
Smith, C. M	Biven's Grove	Marshall.
Snell, M. P	Ogden	Boone.
Stuckslager, Nellie	Ames	Story.
Warden, Chas. H	Ottumwa	Wapello.
Waterman, Elida	Westside	Crawford.
Walker, Alice	Ames	Story.
Webb, Victoria	Ames	Story.
West, Laura	Ames	Story.
Willis, Ida	Waverly	Bremer.
Wright, Walton	Sioux City	Woodbury.
Total		30.

FOR THE YEAR 1877.

SENIORS.

Beard, Angie	Frankville	Winneshiek.
Booth, Frank W	Anamosa	Jones.
Campbell, Alfaretta J	Keota	Keokuk.
Carpenter, Mary C	State Center	Marshall.
Colclo, C. C	Carroll	Carroll.
Curtis, Kate S	Independence	Buchanan.
Doxsee, J. W	Monticello	Jones.
Farwell, Mary E	Monticello	Jones.
Hargrave, A. P	Atalissa	Muscatine.
Helsell, William A	Sac City	Sac.
Hunt, Wilbur N	Nevada	Story.
Hungerford, J. B	Ottumwa	Wapello.
Jordan, Richard F	Ontario	Story.
Keith, Cora Belle	Vinton	Benton.
King, Edwin L	Vinton	Benton.
Lee, Thomas F	Oelwein	Fayette.
Miller, George I	Exira	Audubon.
Milnes, John C	West Liberty	Cedar.
Moyer, Alexander	Jesup	Buchanan.
Neal, Alice	Davenport	Scott
Patty, Cora M	Redfield	Dallas.
Robinson, Lyman B	Belle Plaine	Benton.
Smith, Thomas L	Ames	Story.
Stratton, Fabien L	Alden	Hardin.
Voris, George A	Vinton	Benton.
White, H. M	Vinton	Benton.
Total		26

JUNIORS.

Names.	*Post-Office*	*Residence.*
Brown, Florence	Wheatland	Clinton.
Butler, James B	Ft. Dodge	Webster.
Burke, Richard	Sigourney	Keokuk.
Croy, Lily	Ames	Story.
*Devoss, Winfield S	Wilson	Montgomery.
Glenn, Harvey L	Clarksville	Butler.
Griffith, A. E	Story City	Story.
Hainer, Julius C	New Buda	Decatur.
Hitchcock, M. M	Anamosa	Jones.
Martin, C. B	State Centre	Marshall.
McElyea, Jennie	Ames	Story.
McKinnon, David	Florence	Benton.
McHenry Emma	Des Moines	Polk.
Merideth, J. C	Holt	Taylor.
Mount, C. F	Mt. Pleasant	Henry.
Muncey, Jno. N	Jesup	Buchanan.
*Pugh, A. L	Redfield	Dallas.
Rice, Ellen	Jesup	Buchanan.
Robbins, W. K	Redfield	Dallas.
Sanford, A. M	Bradford	Chickasaw.
Shepard, Lucy	Masonville	Delaware.
Smart, S. A	Des Moines	Polk.
Twitchell, Ida	Redfield	Dallas.
Tyler, Ernest G	Dunlap	Harrison.
Whitney, J. W	Prairieburg	Linn.
Wills, George T	Boone	Boone.
Wilson, Geo. W	Cambridge	Story.
Whited, Alice	Alden	Hardin.
Woods, Belle	Tipton	Cedar.
Total		29.

SOPHOMORES.

Anderson, Jennie	Westside	Crawford.
Applegate, C. C	Atlantic	Cass.
Bangs, Mary A	Dunlap	Harrison.
Beach, Minnie R	Albion	Marshall.
Brewster, Ada	Alden	Hardin.
Brown, O. S	Willow Grove	Story.
Call, A. B	Shenandoah	Page.
Carter, Carrie S	Lewis	Cass.

*Deceased.

Names.	*Post-Office.*	*Residence.*
Chevannes, Eneile	Ames	Story.
Chamberlin, Belle	Cambridge	Story.
Cleaver, Malinda	Lewis	Cass.
Coe, Chas. M	Tipton	Cedar.
Conrad, Silas	Ames	Story.
Crossmun, Marilla J	Ames	Story.
Daniels, Carrie W	Independence	Buchanan.
Everhart, J. W	Ackley	Hardin.
Faville, Geo. C	Mitchell	Mitchell.
Field, Frank	Ottumwa	Wapello.
Foster, Jno. W	Panora	Guthrie.
Frazier, Wm. T	Nevada	Story.
Friend, Fred H	Anamosa	Jones.
Geddes, Patricia L	Ames	Story.
Hanson, A L	Reed's Ridge	Allamakee.
Hardin, David S	Steamboat Rock	Hardin.
Hendricks, J. P	Toledo	Tama.
Hoggatt, Volney	Ames	Story.
Hyde, Jas. E	Dunlap	Harrison.
Isbell, Victoria E	Ossian	Winneskiek.
Kellogg, Clara	Dunlap	Harrison.
Kipp, George	Monroe	Jasper.
Leet, Jennie	Clarksville	Butler.
Leech, Robert R	Mechanicsville	Cedar.
Leighton, Leon	Ft. Dodge	Webster.
Lowry, R. A	Peoria	Polk.
Manwaring, Louis L	Wheatland	Clinton.
Martin, Herman	Bedford	Taylor.
May, A. C	Richland	Keokuk.
Mellette, Jno. E	Monticello	Jones.
Nevin, Wm. D	Vinton	Benton.
Nicholson, R. M	Earlville	Delaware.
Noble, Jno. C	Monroe	Jasper.
Oliver, Jno	Onawa	Monona.
Osborne, Herbert	Fairfax	Linn.
Pratt, Fred M	Otho	Webster.
Roberts, Frank	Vinton	Benton.
Schee, Jno	Schonberg	Warren.
Scott, Wm. M	Prairie Hill	Boone.
Sherman, Minnie	Fredericksburg	Chickasaw.
Shearer, Jas. D	Ames	Story.
Smith, Wm. D	New Hartford	Butler.
Taylor, Chas. D	West Liberty	Cedar.

Names.	Post-office.	Residence.
Thomas, W. A	Golden Prairie	Delaware.
Turner, Fremont	Marshalltown	Marshall.
Wattles, Geo. W	Glidden	Carroll.
Waugh, Jas. M	Hazle Green	Delaware.
Welch, Genevieve	Ames	Story.
Whitney, W. B	Indianola	Warren.
Wood, Geo. E	Monticello	Jones.
Total		58.

FRESHMEN.

Ament, Nettie	Webster City	Hamilton.
Anderson, Edgar	Decorah	Winneshiek.
Bailey, M. J	Shenandoah	Page.
Battersby, Alice	Lewis	Cass.
Beach, Ida M.	Albion	Marshall.
Bell, S. C	Clinton	Clinton.
Beresford, A. M	Vinton	Benton.
Bird, M. J	Belle Plaine	Benton.
Bisbee, George	Ames	Story.
Boddy, Frank	Iowa Falls	Hardin.
Branson, Thomas C	Westside	Crawford.
Branson, James A	Westside	Crawford.
Briggs, D. D	Nevada	Story.
Carter, Mollie P	Shenandoah	Page.
Clark, F. D	Postville	Allamakee.
Coursan, E. T.	West Union	Fayette.
Crawford, Charles	Boonsboro	Boone.
Darrow, W. A	New Hampton	Chickasaw.
Davis, H. G	Arcola	Monona.
Defore, Mary	Ridgeport	Boone.
*Defore, C. A	Ridgeport	Boone.
Dennis, C. W	Bedford	Taylor.
Devoss, Mary J	Wilson	Montgomery.
Doolittle, Kate	Cresco	Howard.
Early, Jennie	Clarence	Cedar.
East, John H	Elvira	Clinton.
Emerson, May	Ridgeport	Boone.
Fortner, A. L	Anderson	Indiana (State).
Foster, John N	Indianola	Warren.
Gates, Charles W	Big Rock	Scott.
Groseclose, Carrie	Cambridge	Story.
Hakes, Montague	Martelle	Jones.

*Deceased.

Names.	Post-office.	Residence.
Hale, William T	Edenville	Marshall.
Hanley, T. B	Le Claire	Scott.
Hardin, James F	Steamboat Rock	Hardin.
Hartwell, F. G	Shelby	Shelby.
Harvey, E. D	Humboldt	Humboldt.
Hassett, James	Ames	Story.
Hawthorne, J. M	Nevada	Story.
Hills, A. R	De Soto	Dallas.
Hopkins, Mary	Sheldahl	Story.
Houston, W. W	Exira	Audubon.
Howard, Silas	Indianola	Warren.
Howlett, Charles H	Fairfield	Jefferson.
Hunt, Charles H	Nevada	Story.
Jackson, James C	Lamoille	Marshall.
Lane, Nellie	Des Moines	Polk.
Lee, Della	Oelwein	Fayette.
Lemley, J. W	Richland	Keokuk.
McClain, Mary	Toledo	Tama.
McGrew, J. E	Haysville	Keokuk.
McMinn, L. F	Ames	Story.
Merrill, R. R	Jesup	Buchanan.
Milligan, Wm	Ames	Story.
Mitchell, Jno	Ft. Dodge	Webster.
Morrison, Jessie	Sigourney	Keokuk.
Needham, O. M	Anamosa	Jones.
*Needham, N. B	Anamosa	Jones.
Nelson, Henry H	Sac City	Sac.
Owen, Chas. H	Boone	Boone.
Perry, Chas. L	Jesup	Buchanan.
Pierce, M. H	Biven's Grove	Marshall.
Proper, Chas. S	Bonaparte	Van Buren.
Puls, Augusta	Le Claire	Scott.
Raybourne, Ida F	Swede Point	Dallas.
Reed, George E	Vinton	Benton.
Richardson, Ella	Nevada	Story.
Richards, Stella S	Spencer	Clay.
Sayles, Dora	Manchester	Delaware.
Saylor, J. F	Saylorville	Polk.
Scott, W. A	Prairie Hill	Boone.
Scott, E. J	Denison	Crawford.
Shearer, Thomas	Ames	Story.
Simcoke, J. L	Redfield	Dallas.

*Deceased.

Names.	Post-Office.	Residence.
Smith, A. A	Burlington	Des Moines.
Swift, Rodney B	Charles City	Floyd.
Tiffany, Ida	Independence	Buchanan.
Tovey, F. S	Dallas Center	Dallas.
Tummel, Emma	State Centre	Marshall.
Vincent, Jas	Tabor	Mills.
Waterman, Elida	Westside	Crawford.
Waterman, Alice	Westside	Crawford.
West, F. T	Cherokee	Cherokee.
Whitney, Hattie	Vinton	Benton.
Wells, Fred D	Boone	Boone.
Will, A. L	Nevada	Story.
Wright, Lou	Albion	Marshall.
Total		87.

STUDENTS NOT FULLY ACCEPTED AS FRESHMEN.

Appleman, John	Clermont	Fayette.
Baldwin, Maria	Boonsboro	Boone.
Baughman, Alice	Ontario	Story.
Budd, Allen	Ames	Story.
Budd, Etta	Ames	Story.
Butler, Aggie	Dowville	Crawford.
Call, Mabel	Shenandoah	Page.
Canfield, Harry	Boonsboro	Boone.
Clark, Jno. L	Waverly	Bremer.
Davis, Ella	Ames	Story.
Dean, Frank L	Sigourney	Keokuk.
Dunn, Henry	Camanche	Clinton.
Gary, W. S	Westside	Crawford.
Geddes, Phebe	Ames	Story.
Geddes, Maggie	Ames	Story.
Goetzman, W. H	Boonsboro	Boone.
Griffin, Daniel	Manson	Calhoun.
Hallam, Grafton	Indianola	Warren.
Hankins, J. C	Monroe	Jasper.
Hatch, A. A	Big Rock	Scott.
Hawley, Chas. E	Cedar Rapids	Linn.
Holmes, Ira W	Boonsboro	Boone.
Hooker, Maggie	Des Moines	Polk.
Hulbert, Effie	Marshalltown	Marshall.
Hull, Lillie	Boone	Boone.
Huntington, Lou	Ames	Story.

Names.	Post-Office.	Residence.
Johnston, J. G	Ames	Story.
Kelley, Henry	Manson	Calhoun.
Latham, W. J	Albia	Monroe.
Lindsley, W. B	Nevinville	Adams.
Mallory, Imogene	Boonsboro	Boone.
Milligan, Harry	Ames	Story.
Moore, Hattie May	Tipton	Cedar.
Moore, Jos. M	Tipton	Cedar.
Neel, Adel	Ames	Story.
Neal, Amos	Davenport	Scott.
Newdigate, Chas	Crawfordsville	Washington.
Northrope, Jos. A	Otisville	Franklin.
Orr, Jno. E	Boone	Boone.
Parsons, W. W	Burlington	Des Moines.
Perkins, A	Ames	Story.
Perrin, Geo. H	Creston	Union.
Perry, E. S	Biven's Grove	Marshall.
Robbins, Estella M	Redfield	Dallas.
Ross, Delia	Ames	Story.
Shaw, C. F	Avoca	Pottawattamie.
Smith, Lucinda	Ames	Story.
Snook, Arthur	Webster City	Hamilton.
Snook, B. F	Webster City	Hamilton.
Story, James	Gifford	Hardin.
Stuckslager, Nellie	Ames	Story.
Twining, Jno	Vinton	Benton.
Thompson, Chas. E	Scranton	Greene.
Webb, Victoria	Ames	Story.
Westrope, Thomas E	Grant	Montgomery.
Wetrope, Perry A	Grant	Montgomery.
Westrope, Orvil D	Grant	Montgomery.
Wilson, Julius	Union	Hardin.
Whitmore, George	West Union	Fayette.
Total		59.

SPECIAL STUDENTS.

Arthur, J. C	Charles City	Floyd.

SUMMARIES.

GRADUATES.

1872	26	1873	15
1874	19	1875	20
1876	21	1877	22
Total			123
Post graduates			1

STUDENTS FOR 1876.

Seniors	29
Juniors	28
Sophomores	47
Freshmen	107
Partial Freshmen	30
Total	241

STUDENTS FOR 1877.

Seniors	26
Juniors	29
Sophomores	58
Freshmen	87
Partial Freshmen	59
Special Students	1
Total	260

COUNTY REPRESENTATION.

COUNTIES.	1876.	1877.	COUNTIES.	1876.	1877.
Adams	.....	1	Humboldt	.....	1
Allamakee	2	2	Jasper	3	3
Appanoose	2	.....	Jefferson	1	1
Audubon	1	2	Johnson	1	.....
Benton	15	13	Jones	9	10
Boone	2	16	Keokuk	3	7
Bremer	5	1	Linn	3	3
Buchanan	6	8	Louisa	1	.....
Butler	4	3	Marshall	10	12
Calhoun	.....	2	Mills	1	1
Carroll	3	2	Mitchell	1	1
Cass	5	4	Monona	2	2
Cedar	6	6	Monroe	.....	1
Cerro Gordo	1	.....	Montgomery	1	5
Cherokee	2	1	Muscatine	5	3
Chickasaw	2	3	Page	1	4
Clay	3	1	Plymouth	2	.....
Clayton	1	.....	Polk	8	6
Clinton	9	5	Pottawattamie	.....	1
Crawford	4	8	Poweshiek	1	.....
Dallas	5	9	Sac	.....	2
Decatur	.....	1	Scott	5	6
Delaware	4	5	Shelby	.....	1
Des Moines	1	2	Story	48	44
Fayette	2	6	Tama	1	2
Floyd	.....	2	Taylor	1	2
Franklin	.....	1	Union	1	1
Greene	.....	1	Van Buren	.....	1
Guthrie	2	1	Wapello	8	2
Hamilton	.....	3	Warren	1	5
Harrison	6	5	Washington	5	1
Hardin	8	9	Webster	6	4
Henry	2	1	Winneshiek	3	3
Howard	3	1	Woodbury	3	.....

COUNTIES NOT REPRESENTED.

Adair,	Emmet,	Lucas,	Pocahontas,
Black Hawk,	Grundy,	Lyon,	Ringgold,
Buena Vista,	Hancock,	Madison,	Sioux,
Clarke,	Ida,	Mahaska,	Wayne,
Davis,	Iowa,	Marion,	Winnebago,
Dickinson,	Jackson,	O'Brien,	Worth,
Dubuque,	Kossuth,	Osceola,	Wright.
Fremont,	Lee,	Palo Alto,	

PART II.

GENERAL STATEMENTS

IN RESPECT TO

ADMISSION, EXPENSES, GOVERNMENT,

AND THE

TRUE WORK OF THE AGRICULTURAL COLLEGE.

GENERAL STATEMENTS.

CONDITIONS OF ENTRANCE.

Candidates for admission, of either sex, must be at least sixteen years of age, and residents of this State. Before entering the Freshman class they must pass a thorough examination in Reading, Orthography, Geography, English Grammar, Physiology, Arithmetic, and Algebra through equations of the first degree. Any applicant for admission to one of the higher classes, must pass examinations with a standing of at least three (four being perfect) in the branches named, and the studies of the preceding class or classes. Students on entering the College are required, moreover, to declare in writing that they will conform to the conditions of membership, and, *except in case of illness or unforeseen misfortune, remain at least one term.*

ENTRANCE EXAMINATIONS.

It is exceedingly important that candidates for entrance to the College should be present at these "entrance examinations," held on Tuesday and Wednesday, March 5th and 6th, on both of which days examinations will be held in the Freshman recitation room as follows:

Geography—8 to 9 A. M.
Grammar—9 to 10:30 A. M.
English Analysis—10:30 to 12 M.
Spelling—1 to 1:30 P. M.
Arithmetic—1:30 to 3:30 P. M.
Algebra—3.30 to 5:30 P. M.

Not more than two trials will be allowed the candidate upon any subject, and under no circumstances, whatever, will a second trial upon any particular set of questions be permitted.

The following are specimen examinations. It will, of course, be understood that they are only *specimens*, and not the actual ones which will be given to the applicant. Seventy-five per cent. of the questions must be answered, in order that the candidate may secure admission to the Freshman class of the College.

GRAMMAR.

Name and define the parts of speech in the following sentence:

"Lives of great men all remind us,
We can make our lives sublime."

Parse "did know," and "what," in the sentence:

I did not know what to do.

ANALYSIS.

Analyze the following sentence:

"Haste thee, nymph, and bring with thee,
Jest and youthful jollity;
Quibs, and cranks, and wanton wiles,
Nods, and becks, and wreathed smiles,
Such as hang on Hebe's cheek,
And love to live in dimple sleek:
Sport that wrinkled Care derides,
And Laughter holding both his sides."

ARITHMETIC.

1. Divide 410,000,090 by 410.
2. Find the greatest common divisor of 16520, 8673 and 7021.
3. Reduce $\frac{\frac{11}{12}+\frac{1}{3}}{\frac{11}{12}-\frac{1}{3}}$ to its simplest form.
4. Divide 4.5 by .00002.
5. Divide 1 acre, 3 sq. yds., 5 sq. ft. by 9.
6. Find interest on $1825.35 for 2 years, 11 months and 17 days at 9½ per cent.
7. Find cube root of 65.003 to three decimal places.
8. Find square root of 50 to three decimal places.

ALGEBRA.

1. From $3a^2b-7cd^2$ subtract $4a^2b+5c^2d$.
2. Divide a^{-3} by a^2.
3. Resolve a^5-b^5 into four factors.
4. Find greatest common divisor of
x^4+2x^2+9 and $7x^3-11x^2+15x+9$.
5. Divide $\frac{a^4-x^4}{a^2-2ax+x^2}$ by $\frac{a^2x+x^3}{a^3-x^3}$.
6. Solve the equation $\frac{3x+4y+3}{10}-\frac{2x+7-y}{15}=\frac{5+y-8}{4}$.
7. Solve the equation $\frac{1}{x}+\frac{1}{y}=a$, $\frac{1}{x}+\frac{1}{z}=b$, $\frac{1}{y}+\frac{1}{z}=c$; find values for x, y and z.

GEOGRAPHY.

1. Bound Illinois, Virginia and Louisiana, and name their principal cities.
2. Name the countries of South America and give their capitals.
3. Name the principal cities, rivers, and mountain ranges of Europe and Asia.
4. On a voyage from San Francisco to Yeddo, through what waters would you pass?
5. Name the largest continent, island, mountain, sea, lake and river in the world.

THE PREPARATORY DEPARTMENT.

For the purpose of securing a better preparation for College classes, the Trustees have opened a preparatory department to which a limited number of students who desire to fit themselves for the Freshman class, are admitted. Such students will hereafter be instructed by *college officers* in the following branches, namely: Elocution, English Grammar, Analysis, Physical Geography, Elementary Drawing, Higher Arithmetic, Elementary Algebra and Elementary Geometry. *No one will be admitted for less than one entire term.* Regular college students will have precedence in the occupation of rooms in the building.

APPLICATION FOR ADMISSION.

All persons of the required age seeking admission at the opening of the next college year, March 6th, 1878, should address the President by letter before the first of February, stating age, advancement in study and the number of terms they propose, if admitted, to spend at the college. These letters will receive prompt replies, and the names of such applicants will be recorded in the list of accepted candidates.

APPLICANTS FOR ADMISSION TO SPECIAL CLASSES.

Any citizen of Iowa who desires to pursue a special branch of study or attend any single course of lectures, may, on applying to the President, receive a card of admission for that purpose. For example, principals of graded schools are invited to spend their vacations in the botanical, the physical or the chemical laboratories. Stock

breeders may attend the lectures on breeding and veterinary science and practice. Mechanics may, if they desire it, secure exclusive instruction in the workshop. The operations of fruit-culture and gardening will be taught, without hinderance by other exercises, to any one wishing to become an expert in that department.

EXPENSES.

Students pay actual cost for board, fires, lights, laundry, damages to college property when caused by themselves, care, lighting, warming, and general repairs of the college building and furniture, and such other incidental expenses as specially belong to them as a body. Students pay nothing for tuition nor for the general expenses of the college. Damages to the college property will be charged to the person damaging the same when known, but if its author is undiscovered it will be *assessed* upon the section where it occurs, or upon the whole school. Students supply themselves with pillows and other bedding, with towels, and with carpets if they desire them. They supply themselves also with ticks, which can be filled with straw after their arrival. The rates of charges are as follows:

Board, per week	$2.65
Fires and lights, per week	.47
Incidental expenses, per week	.25
Laundry, average per dozen, about	.60
Room rent, average per term	3.00

The boarding department of the college will be opened on the afternoon of the Monday preceding the commencement of the spring term. As the department is self-sustaining, receiving no aid from the State, depending entirely upon receipts from students to pay expenses, there can be no free admission to its tables. Students or other persons bringing friends are required, therefore, to pay at the rate of twenty-five cents per meal for each such friend before admission to the dining hall.

The conduct of students in the dining hall, during meals, is under the supervision of one of the professors, and is required to be in harmony with the strictest propriety.

The provisions purchased for the boarding department are of the very best quality that can be procured in the market, the aim being to furnish well cooked, substantial and nutritious food.

Students not boarding in the building will, by order of the board, be charged a janitor's fee of $5.00 per term.

(See *Manual Labor* on page 37.)

DEPOSIT.

Accepted candidates will deposit twenty dollars each, with the Treasurer, as a security for the payment of their bills, and have their names entered upon the books; after which they are considered members of the College, and are entitled to all its privileges.

MONTHLY SETTLEMENT.

Students will settle all bills for each month at the office of the Deputy Treasurer, on the second Saturday of the month following, the original deposit being retained till final settlement. The necessity for prompt settlement is imperative, and any student who neglects this duty, except for reasons satisfactory to the President, may be dismissed by him for such neglect.

CARE OF MONEY AND VALUABLES.

Students may, if they desire, deposit money and other valuables with the Treasurer for safe keeping. While the College authorities will do all in their power to recover lost articles, and to prevent and punish theft, the College cannot be responsible for such losses or thefts from the persons or rooms of students.

MANUAL LABOR.

The following rules, regulating manual labor, have been made by the Trustees:

1. The manual labor required by law, of students in the College, is divided into two kinds, viz: uninstructive labor, which shall be compensated by the payment of wages; and instructive labor, which shall be compensated by the instruction given and skill acquired.

2. Uninstructive labor shall comprise all the operations in the workshop, garden, dining-room, upon the farm and elsewhere, in which the work done accrues to the benefit of the College and not to the benefit of the student. Instructive labor shall embrace all those operations in the workshop, museum, laboratory, experimental kitchen, upon the farm and garden, in which the sole purpose of the student is the acquisition of skill and practice.

3.* Members of the Freshman and Sub-Freshman classes may engage in uninstructive labor three half days each week, at the rate of from four to ten cents per hour.

4. The members of the higher classes shall engage in instructive labor in the presence and under the instruction of the professor in charge according to the statements made in the time-table of each of the courses of study.

5. Special details shall be given, on application, *to the most faithful and meritorious students of the higher classes* at the rate of pay for uninstructive labor.

6. Students of the higher classes may, at their option, engage in uninstructive labor at the same rate and under the same conditions as the Freshman class.

7. Students capable of acting efficiently as foremen, on appointment to such duty by the Superintendents, may receive increased pay not exceeding fourteen cents per hour.

GOVERNMENT AND COLLEGE CODE.

Young men and women are earnestly advised not to apply for admission to the college, unless they can cheerfully submit to wholesome regulations.

The following well considered rules, if obeyed, give the institution the highest efficiency, and secure for the student the largest possible return for time and expense.

SYNOPSIS OF THE COLLEGE CODE.

STUDY, RECITATION AND LABOR.

1. The hours from seven to ten o'clock on week-day evenings, and from 7 A. M. to 12 M., and 1 P. M. to 4:45 P. M., of all week-days except Saturday, are devoted to study, recitation and labor.

2. Students shall attend promptly all exercises of classes to which they belong. The recitation for an excused absence from class shall be made up within two weeks from such absence.

*NOTE.—The College may not be able to furnish all the labor indicated by rule three during the first six weeks of the spring term, but after that time, it is believed that every faithful and efficient worker in these classes can earn one dollar and fifty cents per week. Students who dawdle at their work will not be paid for it.

3. Examinations shall be conducted in writing, when possible, upon questions proposed by the instructors of the various classes, and no special examinations will be granted except on such days as the Faculty may set apart for that purpose.

4. No student shall graduate from this college who has not passed an examination and obtained a standing of *three* (four being perfect) on each of the studies of the course in which he proposes to graduate. Studies which are pursued for a part of a term, or a part of the time during any term, shall be counted proportionately to such part.

5. Students in the Freshman and Sub-Freshman classes will be employed by the Superintendents of the farm and garden three half days a week after the first six weeks of the spring term.

COLLEGE SOCIETIES.

The President or Faculty must in all cases be consulted by the students, before organizing any literary, scientific, or other society. The members of such duly organized society may meet for improvement during the hours of such evenings as may be designated by the President or Faculty. Their meetings may, if necessary, hold till 10 P. M., and in such cases the retiring bell shall be rung at 10:30 P.M.; but in no case shall attendance upon the meeting of any society be construed to excuse students from a strict observance of perfect order after adjournment.

THE SABBATH, AND WORSHIP.

1. Students shall duly observe the Sabbath by maintaining a proper degree of quiet and order in and about the college.

2. Students will assemble in the Chapel once each day for prayers, and on every Sabbath afternoon for public worship.

INSPECTION.

On each week-day morning, at inspection hour, students shall have their rooms open and ready for inspection, and upon Saturday morning, at least one occupant, or some representative, shall be present at such inspection.

EXCUSES.

1. When students have been absent from any exercise, they shall in person, as soon as possible, present their reasons for such absence, to the President. If absent from any recitation they shall, without delay, procure from the Professor in charge a written recommendation for excuse for said absence which excuse shall be presented to the President for approval.

OBSERVANCE OF BY-LAWS.

2. Students shall strictly observe the by-laws pertaining to any of the departments of the College.

PROHIBITORY LAWS.

1. Students may not leave the vicinity of the College building at any time without permission from the President. General permission to be absent on Saturday, is granted by the President.

2. Loud talking, whistling, scuffling, gathering in halls and staircases, and boisterous and noisy conduct, are *at all times* forbidden.

3. During study hours, when not engaged in work or recitations, students may not leave their rooms except for unavoidable reasons.

4. At 10 o'clock P. M. lights shall be extinguished, and from this time to the rising bell no student may be out of his room, except for serious reasons, nor shall he in any way disturb his neighbors.

5. Students shall not abstract or remove any article, whether clothing, food, furniture, tools, fruit, or any other property belonging to the college.

6. Card playing and other games of chance, cooking and the use of tobacco and intoxicating beverages, in any of the rooms of the college buildings, are strictly forbidden.

STUDENT GOVERNMENT.

REVISED RULES.

1. At the opening of each term the President of the College shall nominate to the Faculty the members of the Council from the Senior and Junior classes, taking into account in so doing their good conduct, class-standings and other necessary qualifications; said nominations to be valid upon their election by the Faculty. The number of the Council will equal the number of sections in the building, less two.

2. Members of the Council shall receive the sum of ten cents per hour, while in session, provided said session be held on Friday evenings and shall not exceed three hours.

3. The Council shall organize by choosing a President and a Secretary from its own members, whose duties shall be the ordinary duties of such officers in deliberative assemblies. The Council shall hold regular meetings each week for the purpose of trying such offenses, and only such as are reported.

4. In all trials the President of the Council shall preside as Judge. If in the trial of any offender or offenders, the Council shall deem it advisable to appoint attorneys, they shall be selected from among the students of the College; the number not to exceed one for the prosecution and one for the defense. The same attorneys shall not act as such on more than one trial during the term.

5. In any trial, the testimony of the officer reporting the offense, that of all other competent witnesses, and admissions made by the accused, shall be received in evidence.

6. The verdict, and the number of demerits, shall each be given by vote, in which the President shall have only the casting vote, and no member shall be debarred from voting on account of giving evidence in the case.

7. It shall be the duty of the Council to report its proceedings to the Faculty, weekly, for approval.

8. When a student officer has been reported to the Council for any misdemeanor, the Council shall, without trial, refer the case to the Judiciary Committee.

9. Two candidates for the captaincy of each section shall be nominated by the President of the College, one of whom shall be elected by the section. Captains shall occupy rooms in their respective sections, so situated as to command a view of the section as nearly as possible. Said room shall be selected by the Steward and labelled "Captain's Room." Captains will pay no rental for their room, and shall have the privilege of choosing a room-mate who shall pay rental.

10. Whenever it shall appear that the members of any section are not able to maintain good order, and the disorder shall not seem curable by other and milder means, the President of the College may vacate the rooms in such section.

11. The Faculty reserve the right to try or rehear all cases of disorder, disobedience or immorality, when circumstances demand it.

12. The Faculty reserve the right to expunge the demerit marks of any student upon his subsequent blameless conduct.

THE TRUE WORK OF NATIONAL INDUSTRIAL SCHOOLS.

The following paper will give the enquirer a clear idea of the work required in the colleges created by the Congressional Grant:

[Read before the National Agricultural Congress at the Centennial Exposition, September 30th, by A. S. Welch, President Iowa Agricultural College.]
Read also before a convention of the Presidents of State Universities and Agricultural Colleges in the West, held in Chicago, November 23d, at which the views it advocates were approved by resolution unanimously passed.

The national industrial college now established in nearly every state of the Union is the offspring of congressional enactment. It derives its origin, plan and purpose from an organizing act of the congressional grant, and this act gives to the whole project a clear and definite outline by declaring in precise terms that "the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such a manner as the legislatures of the states may respectfully prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

Now it will be universally conceded at the outset that the entire spirit of the national school so created, its central aims, its faculty, equipment, courses of study and methods of instruction must all be made to conform to a just interpretation of this language. And all conflicting opinions as to its real mission, and all complaints of its drifting therefrom which have been vociferated throughout the land must be settled by the *law* that gave it birth as the supreme and final arbitrator. And this law, though liberal enough in its wording to admit of variation in manner to suit the varying soil and productions of different states, is explicit beyond cavil as to its grand intent and object. But manifest as is the meaning of the congressional enactment from which it sprang, no great educational scheme was ever so buffeted by contradictory theories respecting its actual purpose. From first to last it has been found impossible to give to the general public a correct conception of the real enterprise which the law sets forth. Multitudes in their lack of experience have evolved the new national school out of their own fancies, and then demanded that the actual one should realize the capricious picture. Though embracing by the express terms of the grant, the entire

circle of the industrial sciences, the agricultural journalists from ocean to ocean have assumed it to be a school of agriculture pure and simple. Though limited by language, without ambiguity, to the teaching of industrial science as its leading object, not a few have claimed that it shall be made a school of industrial art which shall unite in its curriculum the smallest modicum of science with the largest modicum of practice in the handicrafts. Some have even developed the theory that the new scheme was to be a mere model farm whereon reluctant boys, untrammeled by the study of science, should be drilled in the manual operations of agriculture, and made to earn their living. On the other hand, many have distinctly declared that the national school was to be a grand depository of general learning unlimited in quantity and kind, where the industrial classes might find anything they wanted in the educational line, without stint and without expense. Meantime, many a specialist in agriculture has revealed the belief that the mere educational work of the college was of minor moment—that it was rather a sort of agricultural station where experiments in his particular branch should be conducted and their results promulgated at the public cost. Finally, amid all these conflicting views, the comparatively few who had gained a just conception of its leading object demanded, nevertheless, that the whole enterprise should, Minerva like, spring into life in full panoply and enter at once upon those higher functions which are to be reached only after the successful progress of years.

Assailed on all sides by such jarring opinions and under the necessity of bringing at once a host of complicated departments into running order, the organizers of the national industrial schools, in every state, had in hand a stupendous task—a task which they could carry to successful completion only so far as they could be guided by a calm and careful questioning of the law. And so far as the courses of study are concerned the law responds in language sufficiently explicit. "The leading object shall be to teach such branches of learning as are related to agriculture and the mechanic arts." These branches of learning are nearly all modern sciences that may be indicated with the utmost precision. To begin with, then, the law prescribes for the curricula of the national school, the industrial sciences, and not the industrial arts. It does not require the teaching of trades, handicrafts or manual dexterities of whatever sort. Pruning and grafting, plowing, planting, harvesting crops and handling

stock, though demanding skill, are not branches of learning; and instruction in these ought not, therefore, to burden the resources of the national college. Only those higher artistic processes, wherein science is taught in its application to practice, should be rigidly included in the training it gives. For example: civil engineering, surveying, economic botany and stock breeding depend for their value on the out door experience that renders the hand skillful and the eye unerring. But the ordinary manual operations in agriculture and mechanics are taught elsewhere far more widely, more economically and even more thoroughly, perhaps, than in the nature of the case they possibly can be under the organization of a college. A thousand work-shops and a hundred thousand farms scattered all over the land are the actual and the adequate schools from which graduate in untold numbers the experts and the artizans that the progress of industry demands. What farmer, gardener or mechanic would send his son to college to learn the very things which he himself could teach with far less expense at home. Nearly all the young men who seek admission to the Iowa Agricultural College bring with them a complete experience in the ordinary routine of farm labor. But the vast interests of agriculture are suffering not so much, as seems to me, from the lack of skillful workmen as from the lack of scientific knowledge. Even if they were, it would be quite impossible for the national schools to supply the deficiency. Its province as defined by law is not to develop carpenters, masons, plowmen and crop raisers merely, but architects, engineers, scientific breeders, veterinary surgeons, economic entomologists and the like. In maturing his noble scheme for the industrial schools, the framer of the law which declares that the leading object shall be to teach the industrial sciences, had a clear and definite perception of the real obstacles to the advancement of the great industries, namely, a wide-spread ignorance of the branches of learning that underlie them. He saw with marvelous clearness of vision that the vast treasures now sleeping in and beneath the soil demand, for their development, the research, the foresight and the facilities which the industrial sciences can furnish. He saw that science alone could protect the great staple productions of the country from those natural enemies which constantly threaten and often accomplish their destruction. He desired to bring learning forth from its venerable haunts into the open air and the broad sunlight where she may become sympathetic and helpful to the industries, where she may indeed reveal the secrets of nature, teaching how lightning is utilized, how ores are discovered, mined and reduced, how rivers are bridged and mountains tunneled, how plants grow, how marshes are drained and worn-out soils refertilized, how fruits and cereals and domestic animals may be improved, how every article of food and fabric may be produced with the least possible waste of muscle and material; in short where science may take the laborer by the hand and lift him up with the loving injunction "I say unto thee arise."

The sufferings and sacrifices endured in every State from a lack of that learning that underlies the industries, made the necessity for such schools the more apparent. In the very capitol, for instance, erected at the cost of millions, where the bill for founding them was drawn many valuable lives have been lost through the poisonous atmosphere of a defective ventilation. Millions on millions of dollars are invested annually in dwellings which are wanting in both convenience and beauty by reason of the absence of architectural knowledge. Uncounted sums go to waste in the erection of public structures in which some fatal defect is due to a blundering builder. Early errors of construction in the main building of the Iowa Agricultural College involved a loss of at least $50,000.00, and a defective heating apparatus at least $25,000.00. Four years ago the rising walls of a new capitol, which the State had projected, were torn down to the tune of $50,000.00, in order to remove the crumbling stone which an incompetent architect had placed therein. These instances are only an insignificant fraction of the innumerable legion of blunders which are born of incapacity in every state. The vast aggregate of treasure sunk in this way beyond the hope of recovery defies enumeration. We can only touch a sample or two and leave the stupendous whole as beyond our grasp. A really competent architect would have saved to Iowa in the single instance referred to more than a hundred thousand dollars. How much would she save with a complete supply of scientific master workmen in every line of industrial art.

But there is even a more urgent call for science to give effective help in the various branches of industrial art which agriculture embraces. For a single example, all over the land there is a deplorable ignorance of the breeding and habits of the commonest pests that infest the farm and consume its products. It is high time that science should seek

everywhere to compass the destruction of these noxious feeders. There is urgent need for a general onslaught to be made on the clouds of insects that season after season make such alarming havoc with our crops of fruit and grain. There is a need, as urgent, that all quadrupeds and birds which are naturally destructive to these should be carefully multiplied. With every returning summer comes the resurrection of the swarms of borers, curculios, weevils, worms, grasshoppers and the like, which combine in countless hosts to rob the farmer of the products of his labor. Particular families of these have generated with such alarming rapidity as to beget a well grounded fear that their numbers will result in the utter annihilation of the crops on which they feed. In some quarters this fear has long since been realized. The locust, once valued for its enduring wood and grateful shade, has yielded to millions of perforations which have reduced its limbs and trunk to dust. The plum tree, which once offered its sure fruits, round, ripe and melting, now, in many a section, casts them annually to the ground, blighted and worthless. In all manner of vegetable delicacies the worm is demanding to be served first. The time may come when no man can taste an apple whose skin, unflecked and unstung, shall forbid the apprehension that the first incision of the teeth shall reveal a slimy occupant. But most terrible of all and without remedy, as yet, from science and skill is the scourge that hides the sun and blackens the sky and wherever it alights turns the beauty and the bloom of the fields into the barrenness of the desert.

These various destroyers, threatening such wide-spread evils, demand the wisest and most vigorous measures for their extermination. Such measures can be founded only on an accurate knowledge of their form, habits, metamorphoses and modes of propagation. The science of entomology reveals all the forms and phases and wonders of insect life. It shows all the mysteries of reproduction, at what season and where the egg is deposited, how long it remains an egg, when the grub comes forth, its structure, food, habits, whereabouts, duration; how with millions of fellow grubs it works its mischief to the crops, then coils itself up and lays itself away to rest awhile in the chrysalis state, from which, after all these vicissitudes, it emerges at last a perfect insect, lives its brief period, lays innumerable eggs, and is gathered to its fathers. Having such intimate acquaintance with the times, seasons, changes, and modes of growth of insects

that are harmful to vegetation, a man may go about their extermination intelligently, but without it he can only make, in some instances at least, such blind endeavors as will lead to blundering failure. The workers in this field are far too few. Clouds of locusts are annually devastating vast areas within its limits, and yet there are not half a dozen well-known entomologists in the entire Northwest. Nor does the demand for scientific helpers in agriculture stop here. We want scientists who shall elucidate with precision every process by which the lifeless mold shall be changed into the marketable product with the least investment of muscle and money. Scientists who shall teach how to preserve our forests and to extend their areas by judicious planting until, as the generations pass, the supply of timber shall equal the consumption. Scientists who shall reveal the mysteries of economic feeding so that our vast crops may produce the largest attainable amount and the finest quality of butter, pork and beef. Scientists who can find beyond cavil the cause and cure of the strange maladies that at times sweep off our cattle and swine by the thousand. Scientists who shall expound those laws of breeding and treatment, under which the lank scrub takes on at last the caliber and contour of the symmetrical Short-horn, and to save us finally from the anomaly of raising and feeding the finest crops and masticating the poorest beef in the world.

Such is the condition of the industries, especially that of agriculture, such are their needs, and such the training of the men required to meet these needs. *Are the national colleges producing such men?* The answer, though an affirmative one, cannot be given in a single sentence. Nearly all of them have organized with the simple purpose of pursuing the leading object set forth in the congressional grant. They have gathered their faculties and equipments and arranged their courses of study in special reference to this leading object, and entered honestly and earnestly on the line of effort assigned by law. Not two years since a committee of congress, after an investigation lasting nearly a year, declared that "It is due to the whole class of these institutions to say, that there is nothing in the results thus far attained, that can be called discouraging. A considerable number of the colleges have done work which requires no apology, and a few of those earliest organized, have already found time to take high rank among the institutions of the land. The number of students in attendance upon these schools, is already

between three and four thousand, and they have furnished more than one thousand six hundred graduates to the active occupations of life. They are generally gathering about themselves material appliances in the form of farms, stock, work-shops, machinery, books, and apparatus. More than two hundred teachers are engaged in the work of instruction. There is evidence of an honest purpose to make the studies pursued such in variety, in extent, and in value, as shall meet the requirements of the law to which they are indebted for their endowment. Studies connected with agriculture and the mechanic arts are made prominent, if not paramount, and there is reason to believe that by these means the taste for these branches of knowledge has been considerably increased in the whole community."

Now take notice that the report from which I have quoted a single extract was written by a committee appointed for the sole purpose of finding whether these colleges were drifting away from the spirit of the law which gave them life; that the scrutiny made into their condition was protracted and thorough to the last degree. Nevertheless it is clear beyond question that the industrial colleges have not, as yet, supplied to any degree of fullness the scientific workers which the progress of agriculture and the other great industries require. It would be indeed unreasonable to expect so large a result at so early a period. These institutions are in their infancy, and the most serious obstacle they are compelled to encounter is the insane demand by the multitude for immediate fruits. Institutions of learning may be early in their blossoming, but they are late in fruiting. It were idle folly to attempt to settle, at present, the value of the industrial schools by an inventory of the distinguished men who hold their diplomas. Still, even now the proofs are multiplying that these schools are earnestly engaged in this vitally important line of instruction and training, and the early results are beginning to appear. Many of their graduates are already giving us, the votaries of industrial science, the promise of future distinction. For example, Michigan Agricultural College, which is not yet twenty years old, has prepared and furnished for its own faculty a professor of entomology, and a superintendent of its own gardens. It has supplied for Cornell University a professor of botany, for Kansas Agricultural College a professor of agricultural chemistry, and a professor of agriculture, for the University of Wisconsin a professor of agricultural chemistry, for Harvard University an assistant in cryptogamic botany, and for the Iowa Agricultural College a professor of economic botany.

Iowa Agricultural College, opened less than eight years ago, already numbers among its one hundred and twenty-three graduates half a dozen professors, who give instruction in such subjects as physics, economic botany and chemistry, practical agriculture, stock breeding, veterinary science and practice. It has sent out also several enthusiastic young naturalists, who, though the ink of their diplomas is scarce yet dry, are already doing excellent service for the state. One of them collected the Iowa soils, and another the plants of Iowa, making a complete classification and arrangement of these for the Centennial Exposition. I do not mention the many from these institutions who are fine stock breeders, fruit raisers, or engaged in the larger operations of agriculture, nor do I note the hundreds of under-graduates who go back annually to the farm, adding to labor new ability and diligence and who, scattered among the distant districts, drop out of the public eye and are taken little account of. These two schools, the one of the older, and the other of the younger class, stand probably on a level in results with the national schools of the other states, and these few first fruits, I have ventured to mention, are only an earnest of the full ripened harvest which time will duly bring. The scheme devised and carried through congress by Justin Morrill, was a grand one, but its realization shall run and be glorified by the grandeur of its success.

It remains to glance at the courses of study in the national college composed of the branches related to agriculture, which if adopted and wisely carried out, will most nearly fulfill the conditions of the congressional grant. And first it seems to me that there ought, in this important department, to be two curricula—one of which, consisting of all the sciences related to agriculture, arranged with reference to the comparative value of each, should prepare the student for a large success in the most skillful and economical management of the farm; in short make the scientific and practical farmer. The other should be made up of special courses, composed of single branches, with their adjuncts arranged for the purpose of meeting the wants of those students, who design to pursue and practice through life some special branch of learning related to agriculture. Each of these sub-courses, conducted by a competent professor, with

sufficient assistance, and furnished with abundant illustration would finally supply the urgent necessity for such workers in scientific agriculture, as the economic botanist, the entomologist, the producer of new varieties of grain or fruits, the veterinary surgeon, the farm architect and engineer, the scientific breeder, and the agricultural writer.

And I here record my belief that this second course, composed of special courses for the specialist in science, will be far more beneficial to agriculture than the first. For the graduates in the *general* agricultural sciences, with some exceptions, expend their entire means in getting through college, have nothing left with which to buy farms, and have invested too much in their education to engage as farm laborers. Even if they did, it would scarcely answer the design of the national college. I have, moreover, serious doubts whether these graduates could quicken the progress of agriculture, by giving themselves up wholly to the *raising of crops.* The farmers of the country cannot be helped by adding to the mere bulk of farm products; which are already so great as to cause frequently a glut in the market. It is not an increased competition, already too great, that the farm needs, but such an advance, rather, in the skill and economy of improved processes, that a wider margin may be left between the cost of production and the market price; and the men who are helping most in this direction, are not generally employed in the raising of crops. They fill the editorial chairs, they are in the student's office, in the laboratory or the workshop, or engaged wholly in observation and experiment or invention. If there be any doubt of the fact, I could give, at the present moment, such a list as would set all questions at rest.

When, therefore, the students of our agricultural colleges continue, after graduation, as some do, the study of economic botany, entomology or agricultural chemistry, or become the teachers of agricultural science in any of its numerous branches, it seems to me they are taking the surest course to realize the purpose of the congressional grant. I do not, however underrate the value to the student of manual skill, and many colleges give abundant opportunity for its attainment.

The question then so often asked, "Do the graduates of the agricultural colleges go on to the farm" will not determine the value of agricultural education. As we have seen, it is not the general

farmer, who in a manner lives and labors unto himself alone, but the specialist in science by whose help the enemies of the farm shall perish, the noxious plants be subjugated, the noxious insects destroyed or rendered harmless, the domestic animals reach such perfection of form, as to answer their precise purpose, the fruits and grains yield their sure returns a hundred fold, the farm dwelling be changed to a model of convenience and beauty, the farm itself reach the topmost limit of its producing capacity, and the farmer's life become the truest life that man can live.

When all this shall be done and well done, then will a prominent purpose of the industrial colleges have been accomplished.

PART III.

COURSES OF STUDY.

DEGREES.

MEANS AND METHODS OF INSTRUCTION.

THE COURSES OF STUDY.

The courses of study which, during the present term, the Faculty have carefuily and completely revised, will afford the student a rare opportunity to gain the "liberal and practical education" required by the congressional law. No pains have been spared to form curricula that are well balanced; for while the technical studies that give to each course its special character, are fully represented, there are not wanting those branches that contribute to a wider culture.

The Courses of Study comprise:

1. The Course in Sciences related to Agriculture.
2. The Course in Mechanical Engineering.
3. The Course in Civil Engineering.
4. The Ladies' Course in Science.
5. Course for Juniors and Seniors in Special Industrial Sciences.
6. Post-graduate Courses of Study.
7. The Preparatory Course.

THE COURSE IN SCIENCES RELATED TO AGRICULTURE.

SPECIAL FACULTY.

The President,

Professors Stalker, (Chairman,) Beal,
Pope, Stanton,
Bessey, Wynn,
Budd, Geddes,
Macomber, Lee.

PURPOSE.

The purpose of the course in the Sciences related to Agriculture, is to make scientists in the branches which underlie agriculture. It aims, moreover, to prepare students who desire it, for scientific farming. Incidentally it furnishes to all the means of attaining an education which is thoroughly practical.

COURSE OF STUDY.

The course consists of the required antecedent studies in the Freshman year and the first term of the Sophomore year—of the general branches pursued in the Sophomore, Junior and Senior years, and of the technical studies which predominate throughout.

GRADUATION.

The candidate for graduation in this course must have secured a standing of at least 3 (4 being perfect) in all the studies (not optional) of the subjoined list, and present a final thesis as required by College law.

COURSE OF STUDY.

FRESHMAN YEAR.

First Term.

Practical Agriculture—(2).
Advanced Algebra—(5) fourteen weeks.
Geometry begun—(5) four weeks.
Book-keeping—(3).
English—(3), *or*
Latin—(3).
Drawing—(3).
Composition—(1).

Second Term.

Practical Horticulture—(2).
Elementary Botany—(2).
Animal Physiology—(2).
Geometry—(5).
Elements of Criticism—(5) *or*
Latin (5).
Drawing - (3).
Composition (1).

SOPHOMORE YEAR.

First Term.

Systematic Botany—(2).
General Chemistry—(3).
General Zoology—(2).
Plane and Spherical Trigonometry - (5) nine weeks.
Land Surveying—(5) nine weeks.
Physics; Mechanics of Solids, Liquids and Gasses—(2).

Second Term.

Stock-Breeding—(3).
Economic Botany—(2).
General Chemistry—(2).
Entomology and Vegetable Zoology—(5).
Physics; Light and Sound—(3).
Analytical Geometry—(5).

JUNIOR YEAR.

First Term.

Horticulture—(1).
Vegetable Physiology—(4) eleven weeks.
Cryptogamic Botany—(4) seven weeks.
Quantitative Chemistry—(2).
Physics; Heat—(3).
English Literature—(5).
Differential and Integral Calculus—(5).

Second Term.

Landscape Gardening (3) nine weeks.
Farm Engineering—(3) nine weeks.
Organic Chemistry (2).
Comparative Anatomy—(4).
Physics: Electricity, Magnetism and Meteorology—(2).
Political Economy—(3).
French—(5).
Dissertations.

SENIOR YEAR.

First Term.

Agricultural Chemistry—(2).
Veterinary Science: Anatomy and Physiology—(3).
Geology and Mineralogy—(5).
Psychology—(5).
French—(3).
Dissertations.

Second Term.

Veterinary Science: Physiology, Disease, Treatment and Medicine—(4).
Lectures on Foods—(1).
Philosophy of Science—(5).
Science of Language—(5).
French (5).
Preparation of Thesis.

TIME TABLE FOR THE FIRST TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Book-keeping, 3. Algebra, 5.	Algebra, 5. Book-keeping, 3.	English or Latin, 3. Practical Agriculture, 2.	Drawing, 3. Composition, 1.

Farm and Garden Work, three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Trigonometry and Surveying, 5.	Botany, 2. Zoology, 2.	Physics, 2.	Chemistry, 3.

Laboratory Practice in Chemistry, two afternoons a week.
Field Surveying, two afternoons a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Calculus, 5.	Physics, 3. Chemistry, 2.	English Literature, 5.	Botany, 4.

Laboratory Practice—{ In Chemistry four afternoons a week. / In Botany, one afternoon a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 3. Agricultural Chemistry, 2.	Veterinary Science, 3.	Psychology, 5.	Geology, 5.

Veterinary Clinics, two afternoons a week.

TIME TABLE FOR THE SECOND TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Criticism, 5, or Latin, 5.	Geometry, 5.	Botany, 2. Zoology, 2.	Drawing, 3. Practical Horticulture, 2.

Farm and Garden Work, three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Analytical Geometry, 5.	Zoology, 5.	Physics, 3. Botany, 2.	Chemistry, 2. Stock Breeding, 3.

Laboratory Practice—{ In Chemistry, two afternoons a week. / In Zoology, one afternoon a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 5.	Farm and Landscape Engineering, 3. Physics, 2.	Political Economy, 3. Organic Chemistry, 2.	Comparative Anatomy, 4.

Laboratory Practice—{ In Chemistry, one afternoon a week. / In Comparative Anatomy, two afternoons a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Veterinary Science, 4. Chemistry, 1.	Philosophy of Science, 5.	Science of Language, 5.	French, 5.

Veterinary Clinics, one afternoon a week.

THE COURSE IN MECHANICAL ENGINEERING.

PECIAL FACULTY.

The PRESIDENT.

Professors THOMSON, (Chairman) BEAL,
STANTON, MACOMBER,
LEE, MRS. STANTON.

PURPOSE.

The object of this course is to impart the scientific knowledge and practical skill which are essential to success in mechanical engineering. This necessarily implies a thorough mastery of the principles of mathematics and a diligent study of their application to the construction of machines. In addition to the technical instruction given it aims to furnish the means for obtaining a liberal and practical education.

COURSE OF STUDY.

It embraces the required antecedent studies of the first year and a half; also, a few general branches in the Junior and Senior years and the entire technical course of study and practice necessary to the master workman.

GRADUATION.

To graduate in Mechanical Engineering requires a standing of at least 3 (4 being perfect) in all the studies of the following list and the presentation of a final Thesis.

COURSE OF STUDY.

FRESHMAN YEAR.

First Term.

Practical Mechanics—(2)
Advanced Algebra—(5), fourteen weeks.
Geometry begun—(5), four weeks.
Book-keeping—(3)
English—(3) *or*
Latin—(3).
Drawing—(3).
Composition—(1).

Second Term.

Practical Mechanics—(2).
Geometry—(5).
Elementary Botany—(2).
Animal Physiology—(2).
Elements of Criticism—(5) *or*
Latin—(5).
Drawing—(3).
Composition—1.

SOPHOMORE YEAR.

First Term.

Plane and Spherical Trigonometry—(5), nine weeks.
Land Surveying—(5), nine weeks.
Physics: Mechanics of Solids, Liquids and Gases—(2).
General Chemistry—(3).
Systematic Botany—(2).
General Zoology—(2).

Second Term.

Analytical Geometry—(5).
Descriptive Geometry—(2).
Physics: Light and Sound—(3).
General Chemistry—(2).

JUNIOR YEAR.

First Term.

Principles of Mechanism—(5), twelve weeks.
Analytical Mechanics—(5) six weeks.
Stereotomy—(2), ten weeks.
Shades, Shadows and Perspective—(2), eight weeks.
Model Drawing—(3).
Differential and Integral Calculus—(5).
Physics: Heat—(3).

Second Term.

Theoretical and Applied Mechanics—(5).
MechanicalDrawing—(2).
Physics: Electricity, Magnetism and Meteorology—(2).
Landscape Gardening—(3), nine weeks.
Farm Engineering—(3), nine weeks.
Political Economy—(3).
French—(5).
Dissertations.

SENIOR YEAR.

First Term.

Principles of Mechanism—(5) nine weeks.
Theory of Motors—(5) nine weeks.
Mechanical Drawing—(2).
French—(3).
Psychology—(5).
Geology and Mineralogy—(5).
Dissertations.

Second Term.

Prime Movers—(5.).
Mechanical Designing—(2).
Philosophy of Science—(5).
French—(5).
Preparation of Thesis.

TIME TABLE FOR THE FIRST TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Book-keeping, 3. Algebra, 5.	Algebra, 5. Book-keeping, 3.	English or Latin, 3. Practical Mechanics, 2.	Drawing, 3. Composition, 1.

Shop Work three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Trigonometry and Surveying, 5.	Botany, 2. Zoology, 2.	Physics, 2.	Chemistry, 3.

Laboratory Practice in Chemistry two afternoons a week.
Field Surveying two afternoons a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Calculus, 5.	Physics, 3.	Principles of Mechanism, 5.	Stereotomy, 2. Model Drawing, 3.

Shop Practice two afternoons a week.

SENIOR YEAR.

8 A. M. —9.	9—10.	10—11.	11—12.
French, 3.	Principles of Mechanism, 5.	Psychology, 5.	Geology, 5.

Shop Practice three afternoons a week.

TIME TABLE FOR THE SECOND TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Criticism, 5. or Latin, 5.	Geometry, 5.	Botany, 2. Zoology, 2.	Drawing, 3. Practical Mechanics, 2.

Shop Work three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Analytical Geometry, 5.		Physics, 3.	Chemistry, 2. Descriptive Geometry, 2.

Laboratory Practice— { *In Chemistry, two afternoons a week.* / *In Geometrical Drawing, two afternoons a week.*

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 5.	Farm and Landscape Engineering, 3. Physics, 2.	Political Economy, 3. Mechanical Drawing, 2.	Theoretical and Applied Mechanics, 5.

Shop Practice five afternoons a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Prime Movers, 5.	Philosophy of Science, 5.	Designing, 2.	French, 5.

Shop Practice five afternoons a week.

THE COURSE IN CIVIL ENGINEERING.

SPECIAL FACULTY.

The PRESIDENT,
Professors THOMSON, (Chairman), MACOMBER,
BEAL, LEE,
STANTON, MRS. STANTON.

PURPOSE.

It is the object of this course to educate and thoroughly train the student for the work of a Civil Engineer. It furnishes a thorough and practical course of instruction in the application of the mathematical and physical sciences to the profession of Civil Engineering. It is necessarily based upon a systematic drill in pure mathematics and includes in common with the other courses the studies necessary to a liberal education.

COURSE OF STUDY.

The course of study embraces the antecedent studies of the first three terms and a limited number of general branches in the last two years. It comprises a full course of technical study and practice preparatory to Civil Engineering.

GRADUATION.

A standing of at least 3 (4 being perfect) in all the studies of the course, and a final Thesis are the conditions of graduation.

COURSE OF STUDY.

FRESHMAN YEAR.

First Term.

Advanced Algebra—(5), fourteen weeks.
Geometry begun—(5), four weeks.
Practical Mechanics—(2).
Book-keeping—(3).
English—(3) *or*
Latin—(3).
Drawing—(3).
Composition—(1).

Second Term.

Geometry—(5).
Practical Mechanics—(2).
Elementary Botany (2).
Animal Physiology—(2).
Elements of Criticism (5) *or*
Latin—(5).
Drawing—(3).
Composition—(1).

SOPHOMORE YEAR.

First Term.

Plane and Spherical Trigonometry—(5), nine weeks.
Land Surveying—(5), nine weeks.
Physics: Mechanics of Solids, Liquids and Gases—(2).
General Chemistry—(3).
Systematic Botany—(2).
General Zoology—(2).

Second Term.

Analytical Geometry—(5).
Descriptive Geometry—(2).
Physics: Light and Sound—(3).
General Chemistry—(2).

JUNIOR YEAR.

First Term.

Railroad Surveying—(5), twelve weeks.
Analytical Mechanics—(5), six weeks.
Stereotomy—(2), ten weeks.
Shades, Shadows, and Perspective—(2), eight weeks.
Model Drawing—(3).
Differential and Integral Calculus—(5).
Physics: Heat—(3).

Second Term.

Theoretical and Applied Mechanics—(5).
Mechanical Drawing—(2).
Landscape Gardening—(3), nine weeks.
Farm Engineering—(3), nine weeks.
Astronomy—(2),
Political Economy—(3).
French (5).
Dissertations.

SENIOR YEAR.

First Term.

Roof and Bridge Structures—(5).
Geology and Mineralogy—(5).
Psychology—(5).
French—(3).
Dissertations.

Second Term.

Roof and Bridge Structures—(5).
Designing—(2).
Philosophy of Science—(5).
French—(5).
Preparation of Thesis.

TIME TABLE FOR THE FIRST TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Book-keeping, 3 Algebra, 5.	Algebra, 5. Book-keeping, 3.	English or Latin, 3. Practical Mechanics, 2.	Drawing, 3. Composition, 1.

Shop Work three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Trigonometry and Surveying, 5.	Botany, 2. Zoology, 2.	Physics, 2.	Chemistry, 3.

Laboratory Practice in Chemistry, two afternoons a week.
Field Surveying two afternoons a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Calculus, 5.	Physics, 3.	Railroad Surveying, 5.	Stereotomy, 2. Model Drawing, 3.

Field Practice two afternoons a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 3.	Civil Engineering, 5.	Psychology, 5.	Geology, 5.

Drawing two afternoons a week.

TIME TABLE FOR THE SECOND TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Criticism, 5. or Latin, 5.	Geometry, 5.	Botany, 2. Zoology, 2.	Drawing, 3. Practical Mechanics, 2.

Shop Work, three forenoons a week.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Analytical Geometry, 5.		Physics, 3.	Chemistry, 2. Descriptive Geometry, 2.

Laboratory Practice— { *In Chemistry, two afternoons a week.*
In Descriptive Geometry, two afternoons a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 5.	Farm and Landscape Engineering, 3. Astronomy, 2.	Political Economy, 3. Mechanical Drawing, 2.	Theoretical and Applied Mechanics, 5.

Drafting, five afternoons a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Civil Engineering, 5.	Philosophy of Science, 5.	Designing, 2.	French, 5.

Drafting, five afternoons a week.

THE LADIES' COURSE IN SCIENCE.

SPECIAL FACULTY.

The PRESIDENT,

MRS. STANTON, (Ch'r.)

MRS. WELCH, LEE,
Professors GEDDES, BESSEY,
WYNN, MACOMBER,
POPE, STANTON.

PURPOSE.

The studies comprised in the ladies' course have been selected with reference, simply to their value, as pre-requisites to a thoroughly practical education, embracing a well balanced variety of subjects. This course is designed to confer a culture that is at once solid and available.

COURSE OF STUDY.

It is composed of the antecedent studies of the first three terms, the most approved branches of science and literature in the last five terms, and the study and practice required for systematic housekeeping.

GRADUATION.

A standing of at least 3 (4 being pefect) and a final Thesis as required by college law, are the conditions of graduation in this course.

COURSE OF STUDY.

FRESHMAN YEAR.

First Term.

Advanced Algebra—(5), fourteen weeks.
Geometry begun—(5), four weeks.
English—(3) *or*
Latin—(3).
Book-keeping—(3).
Composition—(1).
Practical Agriculture—(2)
Drawing—(3).

Second Term.

Geometry—(5).
Elements of Criticism—(5) *or*
Latin (5).
Elementary Botany—(2).
Animal Physiology—(2).
Composition—(1).
Practical Horticulture—(2).
Drawing—(3).

SOPHOMORE YEAR.

First Term.

Plane and Spherical Trigonometry—(5), nine weeks.
History—(5) nine, weeks.
Systematic Botany—(2).
General Zoology -(2).
Physics: Mechanics of Solids, Liquids and Gases—(2).
General Chemistry—(2).

Second Term.

Economic Botany—2.
Entomology, and Vertebrate Zoology - (5).
Physics: Light and Sound - (3).
General Chemistry (2) *or*
Analytical Geometry—(5).

JUNIOR YEAR.

First Term.

English Literature—(5).
Vegetable Physiology—(4), eleven weeks.
Cryptogamic Botany—(4), seven weeks.
Physics: Heat—(3).
Quantitative Chemistry—(2) *or*
Differential and Integral Calculus—(5).

Second Term.

Domestic Economy—(1).
Domestic Chemistry—(1).
French—(5).
Comparative Anatomy—(4).
Political Economy—(3).
Landscape Gardening—(3), nine weeks *or*
Physics: Electricity, Magnetism and Meteorology (2).
Dissertations.

SENIOR YEAR.

First Term.

French—(3).
Drawing—(3).
Psychology—(5).
Geology and Mineralogy—(5).
Dissertations.

Second Term.

French—(5).
Science of Language—(5).
Philosophy of Science—(5).
Preparation of Thesis.

TIME TABLE FOR THE FIRST TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Book-keeping, 3. Algebra, 5.	Algebra, 5. Book-keeping, 3.	English or Latin, 3. Practical Agriculture, 2.	Drawing, 3. Composition, 1.

Kitchen Work in the forenoon.

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Trigonometry, 5. History, 5.	Botany, 2. Zoology, 2.	Physics, 2.	Chemistry, 3.

Laboratory Practice in Chemistry, two afternoons a week.

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
Calculus, 5.	Physics, 3. Chemistry, 2.	English Literature, 5.	Botany, 4.

Laboratory Practice—{ *Chemistry, four afternoons a week.*
Botany, one afternoon a week.

SENIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 3.	Drawing, 3.	Psychology, 5.	Geology, 5.

Practice in Drawing on Friday afternoon.

TIME TABLE FOR THE SECOND TERM.

FRESHMAN YEAR.

1 P. M.—2.	2—3.	3—4.	4—5.
Criticism, 5. or Latin, 5.	Geometry, 5.	Botany, 2. Zoology, 2.	Drawing, 3. Practical Horticulture, 2.
Kitchen Work in the forenoon.			

SOPHOMORE YEAR.

8 A. M.—9.	9—10.	10—11	11—12.
Analytical Geometry, 5.	Zoology, 5.	Botany, 2. Physics, 3.	Chemistry, 2.
Laboratory Practice— { *In Chemistry, two afternoons a week.* *In Zoology, one afternoon a week.*			

JUNIOR YEAR.

8 A. M.—9.	9—10.	10—11.	11—12.
French, 5.	Physics, 2. Landscape Gardening, 3.	Political Economy, 3. Domestic Economy, 1.	Comparative Anatomy, 4. Domestic Chemistry, 1.
Laboratory Practice— { *In Comparative Anatomy, one afternoon a week.* *In Domestic Economy, two afternoons a week.*			

SENIOR YEAR.

8. A. M.—9.	9—10.	10—11.	11—12.
	Philosophy of Science, 5.	Science of Language, 5.	French, 5.

COURSE FOR JUNIORS AND SENIORS IN SPECIAL INDUSTRIAL SCIENCES.

For the purpose of enabling students of the Junior and Senior classes in the Agricultural College, to attain a high degree of proficiency in any branch of industrial science or art, the Faculty permit a choice of some single study and the omission of others, as given below. It is understood that the student will devote double the usual time to the study so chosen.

No permission will be given to specialize in literary studies, neither will a student who chooses special studies be permitted to take any optional ones of the regular course.

The special student in CHEMISTRY may omit,

JUNIOR YEAR—*First Term* —Botany or Physics.
Second Term—Comparative Anatomy, or Physics, or Landscape Engineering.

SENIOR YEAR—*First Term* —Geology or Veterinary Science.
Second Term—Veterinary Science or Science of Language.

The special student in BOTANY may omit,

JUNIOR YEAR—*First Term* —Chemistry or Physics.
Second Term—Chemistry, Physics, or Comparative Anatomy.

SENIOR YEAR—*First Term* —Geology or Veterinary Science.
Second Term—Veterinary Science or Science of Language.

The special student in ZOOLOGY may omit,

JUNIOR YEAR—*First Term* —Chemistry or Physics.
Second Term—Chemistry, or Physics and French.

SENIOR YEAR—*First Term* —Geology, or Veterinary Science and French.
Second Term—Veterinary Science and French.

The special student in PHYSICS may omit,

JUNIOR YEAR—*First Term* —Chemistry or Botany.
Second Term—Chemistry, or Comparative Anatomy, or Landscape Engineering.
SENIOR YEAR—*First Term* —Geology, or Veterinary Science, or Agricultural Chemistry.
Second Term—Veterinary Science or Science of Language.

The special student in AGRICULTURE may omit,

JUNIOR YEAR—*First Term* —Physics or English Literature.
Second Term—Physics.
SENIOR YEAR—*First Term* —Geology.
Second Term—Science or Language.

The special student in HORTICULTURE may omit,

JUNIOR YEAR—*First Term* —Physics or English Literature.
Second Term—Physics.
SENIOR YEAR—*First Term* —Geology.
Second Term—Science of Language.

The special student in GEOLOGY may omit,

SENIOR YEAR—*First Term* —Veterinary Science.
Second Term—Veterinary Science.

The special student in VETERINARY SCIENCE may omit,

JUNIOR YEAR *First Term* —Botany or Chemistry.
Second Term—Agricultural Chemistry or Physics.
SENIOR YEAR—*First Term* —Geology.
Second Term—Science of Language.

POST GRADUATE COURSES OF STUDY.

At a meeting of the Board of Trustees, held in December, 1876, authority was given the Faculty to establish post graduate courses of study and to confer upon those who should pass said courses a second degree. The Faculty have therefore during the past year arranged a carefully considered programme of post graduate studies. All students desiring to secure a second degree must pursue a course of scientific study embracing two or more subjects selected from this programme and approved by the Faculty. At least one year will be required to complete the course. (See *Conditions for Conferring Second Degrees.*)

The following Professors will instruct and examine candidates for second degrees in post graduate courses, as follows:

PRESIDENT WELCH—..... (1) The Philosophy of Science.
(2) Social Science.
PROFESSOR WYNN—..... (3) The English Literature of the Elizabethan Period.
PROFESSOR BESSEY—..... (4) Physiological Botany.
(5) Systematic Botany.
(6) Special Zoology.
PROFESSOR STALKER—... (7) Veterinary Pathology and Materia Medica.
(8) Principles of Breeding.
PROFESSOR THOMSON—... (9) Applied Mechanics.
PROFESSOR BEAL—.....(10) Original Designs of Engineering Structures.
PROFESSOR POPE—.....(11) Agricultural and Organic Chemistry.
PROFESSOR MACOMBER—(12) Advanced Physics.
PROFESSOR STANTON—...(13) Analytical Geometry and Calculus.
PROFESSOR BUDD—.....(14) Horticulture and Forestry.

PREPARATORY COURSE.

(FOR SUB-FRESHMEN.)

INSTRUCTORS.

Professor LEE, Mrs. STANTON.
Mr. T. L. SMITH, Mrs. WELCH.

COURSE OF STUDY.

FIRST TERM.

Higher Arithmetic—(5), twelve weeks.
Algebra, begun—(5).
English Grammar (5), twelve weeks.
English Analysis, begun—(5).
Physical Geography—(3).
Reading—(2).

SECOND TERM.

Algebra—(5), twelve weeks.
Geometry, begun—(5).
English Analysis—(5).
Human Physiology—(3).
Drawing—(2).

TIME TABLE.

FIRST TERM.

8 A. M.—9.	9—10.	10—11.	11—12.
Arithmetic, 5. Algebra, 5.	Physical Geography, 3. Reading, 2.	Arithmetic, 5. Algebra, 5.	Grammar, 5.

Afternoon Work in the Kitchen for the Ladies, and on the Farm for Gentlemen.

SECOND TERM.

8 A. M.—9.	9—10.	10—11.	11—12.
Algebra, 5. Geometry, 5.	Physiology, 3. Drawing, 2.	Algebra, 5. Geometry, 5.	Analysis, 5.

Afternoon Work in the Kitchen for the Ladies, and on the Farm for Gentlemen.

MIXED OPTIONAL COURSES AND THE COLLEGIATE CERTIFICATE.

Students who have passed all the studies of the College courses up to the end of the second term of the Sophomore year, may thereafter choose, in each term, such studies of that term found in any of the college courses, as they may desire to pursue; provided that previous to their classification they file with the President a written declaration of their intention not to seek for a diploma of the College; and in no case shall such student be classified in less than the equivalent of two full studies.

Any person of the requisite age and preparation who may desire to pursue any particular line of study included in the College curriculum will, upon application to the President, be allowed the advantages of the College classes and all other facilities afforded by the institution.

Students having successfully pursued a course of study in the institution composed of studies in advance of the first term of the Sophomore year, but not such a course as to entitle them to graduation will, upon application to the Faculty, be granted a certificate of standings in such studies.

DISSERTATIONS IN THE JUNIOR AND SENIOR YEARS.

Students in the Junior and Senior classes shall, during the first term of the Senior and last term of the Junior year, write two dissertations each, on some topic approved by Special Faculty and embraced in the studies they are pursuing and which shall be appoved by the Professor having charge of such study.

Such Professor shall have supervision of the entire dissertation so written, being the sole judge of its fitness for delivery, and shall report its completion to the President.

Four such dissertations, with the final thesis, will be requisite to graduation.

DEGREES.

The Degree B. S., Bachelor of Science, is conferred upon graduates in the course in Sciences related to Agriculture.

The Degree B. C. E, Bachelor of Civil Engineering, is conferred upon graduates in the course in Civil Engineering.

The Degree B. M. E. Bachelor of Mechanical Engineering, is conferred upon graduates in the course in Mechanical Engineering.

The Degree B. S., Bachelor of Science is conferred upon graduates in the Ladies' Course.

THE GRADUATING THESIS.

Every candidate for graduation shall present an acceptable thesis upon some subject approved by the Special Faculty in whose department he proposes to graduate.

The topic must be selected before the close of the first term of the Senior year, and the completed thesis must be presented to the Special Faculty one month before Commencement Day.

Every thesis must be neatly written upon unruled paper, of a size designated by the Faculty; after acceptance and formal reading it shall become the property of the College, and shall be deposited in the Library.

Ten theses shall be designated for public reading on Commencement Day, each Special Faculty selecting its quota, the basis of such selection being (a) the value of the thesis, (b) scholarship in the course of study pursued, and (c) students good conduct during his stay in college; the remaining theses shall be read before an open session of the Trustees and Faculty of the College.

Each thesis will be in the special charge of the Professor giving instruction in the branch of learning upon which it treats, and such Professor will be responsible to the Faculty for its supervision and correction.

CONDITIONS ON WHICH HIGHER DEGREES ARE CONFERRED.

These degrees are conferred upon candidates recommended by the Faculty in conformity with the following rules:

1. The Degree of *Master of Science*, is open to *Bachelors of Science* who are graduates of either the course in sciences related to Agriculture or the Ladies' Course of this College.

2. The Degree of *Civil Engineer*, is open to *Bachelors of Civil Engineering* and *Bachelors of Science*, (previous to 1878,) who are graduates of the Civil Engineering course of this College.

3. The Degree of *Mechanical Engineer* is open to *Bachelors of Mechanical Engineering* and *Bachelors of Science*, (previous to 1878,) who are graduates of the Mechanical Engineering course of this College.

4. The Faculty will recommend for the Degree of *Master of Science*, candidates otherwise qualified who, after taking their Bachelor's Degree, shall reside at the College for at least one year, and pursue, during that time, a course of scientific study embracing at least two subjects selected with the approval of the Faculty, from the programme of Post-Graduate studies; and shall pass a thorough examination upon that course, showing in one of the subjects special attainments, and shall also present a satisfactory thesis.

5. The Faculty will recommend for the Degree of *Civil Engineer*, candidates otherwise qualified, who, after taking their Bachelor's Degree, shall reside at the College for at least one year, and pursue during that time a course of study in *Civil Engineering*, and at least one additional subject selected, with the approval of the Faculty, from the subjoined programme of Post-Graduate studies; and shall pass a thorough examination upon that course, showing in one of the subjects special attainments, and shall also present a satisfactory thesis.

6. The Faculty will recommend for the Degree of *Mechanical Engineer*, candidates otherwise qualified, who, after taking their Bachelor's Degree, shall reside at the College for at least one year, and pursue during that time a course of study in Mechanical Engineering, and at least one additional subject selected, with the approval

of the Faculty, from the subjoined programme of Post Graduate studies; and shall pass a thorough examination upon that course, showing in one of the subjects special attainments, and shall also present a satisfactory thesis.

7. These Degrees may be respectively conferred upon *Bachelors of Science*, *Bachelors of Civil Engineering*, and *Bachelors of Mechanical Engineering*, graduates of this College who have not resided here since graduation, who, at a date not earlier than three years after graduation, shall pass a thorough examination and present a thesis, as in case of residence.

8. Every resident candidate must apply in writing for examination at least six weeks previous to the annual meeting of the Board of Trustees, stating explicitly the studies in which he desires to be examined, and, at the time of examination, (which may be four weeks previous to the meeting of the Board,) he must present to the Faculty his final thesis.

9. Every non-resident candidate must notify the Faculty of his candidature in writing, at least six months previous to the annual meeting of the Board of Trustees, stating explicitly his present qualifications, and the course of study which he intends to offer; he must, also, six weeks previous to the annual meeting of the Board, apply in writing for examination, stating explicitly the studies in which he desires to be examined, and at the time of examination, (which may be four weeks previous to the meeting of the Board,) he must present to the Faculty his final thesis.

10. The fee for these Degrees is five dollars.

STATEMENTS

MADE BY THE

OFFICERS OF DEPARTMENTS,

RESPECTING

THEIR SPECIAL METHODS AND MEANS OF INSTRUCTION.

TECHNICAL STUDIES IN ONE OR MORE OF THE INDUSTRIAL COURSES.

AGRICULTURE AND VETERINARY SCIENCE.

PROFESSOR STALKER.

FRESHMAN YEAR.

Aside from the circumstances, it would be appropriate that the study of Agriculture should be taken up at a more advanced period in the course, after the student has become familiar with the subjects of Botany and Chemistry. But owing to the large number of undergraduates that go out from the College each year, it is quite desirable that some practical instruction of this department should occupy a place in the course that will make it available to this class of students.

The object aimed at is to give the student such a knowledge of the materials he is to deal with as will enable him to combine them with the greatest advantage. In view of this he is made familiar with the composition and character of the various soils, their adaptation to the several crops and the best means of increasing their fertility. He is taught the simpler facts relating to the composition of the various farm crops, their relation to the soil on which they grow, and their adaptation to the wants of animal growth. The compositive and comparative value of the different fertilizers, and the best methods of preparing, applying and utilizing them are made objects of careful study; as well as the different systems of land drainage, the explanation of the principles involved and the beneficial results that follow. Mechanical cultivation, rotation of crops, improved farm machinery, different systems of farming as affected by proximity to market, the price of land and the cost of labor, are some of the questions that are carefully discussed.

The means of illustration afforded by the large farm, presenting as it does a wide range in the character of its soil, and being stocked with the more popular breeds of cattle, sheep and swine, and furnished with commodious barns, are valuable aids in giving the student clearer notions of the lessons taught. Combined with this instruction is a system of manual labor by which each student engages in all the operations of the farm. The present arrangement by which students are supplied with labor three half days each week, affords ample facilities for acquiring skill in farm operations, as well as meeting a considerable portion of the year's expenses. Those students who go from the College to the occupation of the farmer, take with them many advantages in the way of practical knowledge, and much that enables them to find additional interest in the work, from a better acquaintance with the processes of nature that are continually coming under their observation.

SOPHOMORE YEAR.

The subject of stock breeding occupies three days a week during the second term of this year. Instruction is given entirely by lectures, and embraces the principles of breeding, the history of the several breeds, and more important families of horses, cattle, sheep and swine, the points of difference that distinguish one from the other and their adaptation to the special wants of the farmer. When lectures of a purely descriptive character are given, representative animals are brought before the class, and all the distinguishing characteristics noted. In the examination of horses and cattle, accurate measurements are made, and a carefully prepared scale of points is used as a standard of comparison for the individual under examination. The last lectures of the course are devoted to the subject of sanitary measures and treatment of the more common diseases among domestic animals.

JUNIOR YEAR.

The instruction in Farm and Landscape Engineering* is given chiefly by lectures supplemented by field practice. There are three lectures per week during the second term of the Junior year: the first half of the term being devoted to Landscape Gardening, and the second to Roads and Road-Making. In the former, the student makes a thorough topographical survey of a piece of ground and plats it; then, having given the position of a proposed residence upon it, he designs the approaches and ornamentations in accordance with the principles he has learned. In the latter, the student is

*Farm and Landscape Engineering is taught by Professor Beal.

taught the best location for a road, the proper inclination and most approved form of cross-section, the best material for its construction, and the most effectual means of keeping it in repair.

Drainage is considered in its relation to both of the above subjects, and to general agriculture. Its importance to the farmer, gardener, and road-maker is demonstrated, and the truest methods of accomplishing it are shown. The proper location, size, depth and direction of drains are taught, and also the best and most economical material for their construction.

SENIOR YEAR.

The study and practice of veterinary science occupy five days a week during the Senior year. Lectures are given on veterinary anatomy and physiology, materia medica, pathology, disease, and treatment, surgery and sanitary science and practice. Free clinics are held one afternoon of each week, where the students have an opportunity of seeing an extensive practice, and acting as assistants in surgical operations. Animals taken into the hospital for treatment are placed under the care of some members of the class, who treat them under the direction of the Professor in charge. Students take this work in rotation, so that all become familiar with actual practice.

The means of illustration in the class-room, include skeletons, preparations of the various organs, plats, surgical instruments, collections of parasites, and pathological specimens.

Each student is required to dissect one subject.

HORTICULTURE AND FORESTRY.

PROFESSOR BUDD.

Instruction in this department has a far wider scope with our peculiar conditions of soil and inter-continental climate, than in regions with more equable climate, and with less porous, and, at times, highly-heated surface soil.

In more favored sections, as in parts of New York, Ohio and Michigan, quite satisfactory success may be realized in Horticultural operations, with comparatively little attention given to selection of varieties of soils, or even, if little attention be given to culture or the nicer processes of the art.

On the prairies of Iowa the sudden and extreme variations in humidity and temperature of air, combined with peculiar conditions of soil and sub soil, give rise to questions as to varieties, modes of planting, culture, protection from wind sweep, selection of suitable sites and soils for the different fruits, &c., intimately associated with perfect failures or various gradations of success.

Instruction will be mainly imparted by seasonable lectures, explanatory of the varied in and out-door operations and processes of the different divisions of the department, in their successive stages throughout the season ; these familiar talks to be supplemented, as far as possible, by practice in the details of the modes and methods of work in the Vegetable Garden, the Orchards, the Small Fruit Plantations, Forestry Plantations, Flower Borders, and the Nursery. No text-book will be used except for reference in the study of the nomenclature, and the terms used in descriptive Pomology. In this field of study, care will be taken to secure in their season the popular fruits of the state as object lessons for identification and description. The leaf, bud, mode of growth, &c., of each variety, will be considered in connection with its fruit.

The means for practical illustration at the command of the department are as follows :

The vegetable gardens, planted in all descriptions of culinary crops.

The nurseries, planted with such stock as will best illustrate our work.

The orchards, planted with seventy varieties of apples, fourteen varieties of pears, five varieties of cherries, and three varieties of plums.

The small fruit plantations, planted with the hardiest and best varieties of grapes, raspberries, currants, strawberries, &c.

The forestry plantation, planted with such trees as are best adapted to climate and location.

The ornamental grounds, planted with one hundred and fifteen varieties of trees and shrubs.

The flower gardens upon which a large variety of hardy flowering shrubs and plants are grown.

In addition, collections are in hand, or being made, as follows :

A set of *fac-simile* casts of the fruits of Iowa, native and introduced.

A set of the native woods of Iowa, with their leaves and fruits.

A set of sections of the cultivated woods of Iowa, to show the rate of growth under culture.

A set of insects injurious to objects of culture in this department.

A set of insects and animals beneficial in horticulture, by being predatory upon destructive insects.

A set of abnormal and diseased growths.

DEPARTMENT OF MECHANICS.

PROFESSOR THOMSON.

This department is supplied with tools for the purpose of giving the student a thorough drill in wood-work. It has a number of wood-working machines provided to teach the care and management of this class of machinery. The equipment consists of a surface planer, mortise machine, jig-saw, circular saw, moulding machine, two turning lathes, and nine cases of bench tools with benches.

The student is first instructed to keep his tools in order, and then to use them on a series of problems which lead to accuracy in planing pieces straight, square, and to any angle; cutting tennons, and making joints, &c., until he finally produces a complete model of a machine, structure, or pattern, or some piece of work for use in the College.

After having practiced a sufficient length of time to gain skill and accuracy, he is taught to run and manage wood-working machines.

In the machine shop the plan is similar to that adopted by the Russian government. The student is provided with files, cold-chisels, squares, calipers, gauges, &c., and is required to execute a series of problems in filing, chipping, scraping, and fitting; such as making squares, plane surfaces, straight edges, and finally producing a set of pieces, which, when combined, make some model or machine. In this way, several engines and a number of tools for use in the shop have been made.

For this purpose the machine shop is furnished with lathes, a planer, press-drill, drills, reamers, fluted reamers, standard mandrils, and all tools usually found in machine shops.

Arrangements are now made to admit those who do not wish to take a full course in Mechanical Engineering, but who may desire to get the shop practice, or to follow some particular line of study for a shorter time. The shop practice in connection with the drawing

may be pursued by those who desire to make the mechanic arts a specialty, and it will give a drill equal to that obtained in any shop, in much less time.

COURSE OF STUDY.

The leading branches of the Mechanical Course, now begin in the Freshman year, by the study of projection drawings and their application to work-shop practice, and run through the three following years, as follows:

Descriptive Geometry.—Its application to sheet metal work

Principles of Mechanism.—Trains of mechanism in general; rolling contact; sliding contact; wrapping connectors; trains of elementary combinations; general principles of aggregate motion; combinations for producing aggregate velocity; combinations for producing aggregate paths or motion in space; adjustments; properties of friction; butting friction; twisting friction; friction wheels; coil friction; universal joints.

Analytical Mechanics.—This subject is taught by lectures, and embraces all the subjects contained in the best text-books, which are deemed appropriate and profitable to the student in the Civil and the Mechanical Engineering courses.

Resistance of Materials.—This embraces experimental work, and results found by other experimentors, from which are deduced the laws and coefficients of elasticity; work of elongation, and time of oscillation; set, viscosity, modulus of strength; safe limits of loading; tension and compression; strength of columns; shocks; crystallization and practical formulas.

Prime Movers.—The indicator as applied to the steam engine, brakes, and to proportion fly-wheels so that their velocity shall deviate from a mean velocity by a given amount; measurement of a source of water power; water power engines; water pressure engines; impulse of water on vanes; turbine water wheels; combustion and fuel, efficiency of furnace; principles of thermo-dynamics; air engines; steam engines; furnaces and boilers. The student is also required to take indicator diagrams, and from them calculate the power of engines, with steam working at different degrees of expansion; the diagrams being taken from different engines.

Machine drawing.—Complete working and detailed drawings for

use in the shops; drawings of original designs, finished in water colors, and by line shading; designs and estimates for machinery.

Books of Reference.—Peck's Mechanics; Wood's Mechanics; Bartlett's Analytical Mechanics; Rankines' Applied Mechanics; Steam Engine, by Burns; Strength of Cast Iron, by Tredgold; Steam Engineering, by Isherwood; Valve Gears, by Zenner; Slide Valve, by Anchincloss; Cinamatique par Laboulage; La Caleur par Zenner; Campin's Mechanical Engineering; Condensation of Steam, by Bung; Mechanics and Machines, by Robt. Scott Burns; Cours de Mechanique et Machines (Bouis); Barlow's Strength of Materials; Strength of Materials, by Baker; Theory of Heat, by Maxwell; Theory of Heat, by Box; Warren's Machine Drawings; Working Drawings.

DEPARTMENT OF CIVIL ENGINEERING.

PROFESSOR BEAL.

It is the purpose of this department to furnish to students a practical and thorough course in the application of the mathematical and physical sciences to the profession of Civil Engineering. Many of the problems involved can be but poorly taught by text-books alone, and to be fully mastered, must be solved in the field. However well the student may have understood the theoretical solution of such a problem as the laying out of a railway curve, he will be puzzled to know what to do first, when he sets up his transit and attempts to apply his knowledge. In land surveying, for instance, the lands to be measured are not smooth, polygonal planes, such as are represented on paper, but hillsides and valleys, covered in many cases by trees and bushes, and intersected by streams and morasses, with borders frequently formed by the irregular shore of a river or lake. These are the actual problems which the student must meet, and they can only be solved where they are found—on the ground.

But this is not all. For the purpose of education, something more is required than simply the knowledge of how to do things; the principles upon which the operations are based, the reasons for the various processes involved, and even the theoretical solution of the ideal problem which is never found in nature, are all of the highest value, and should be omitted from no scheme of technical education.

There is an impression among a certain class, that such a course of study does not give the broadest and most liberal culture, however well it may fit the man for the active duties of life. We see this idea staring at us from almost every page of the educational literature of the day, and hear it reiterated by college orators until we begin to think a scientific man cannot possibly be otherwise than uncultivated and pedantic. No more erroneous idea could be entertained. The vast army of scientists and technologists who are rolling onward the course of civilization and progress, led by such men as Tyndall, Huxley and Roebling, are the best refutation of such a theory. They need no apology.

The fear that scientific and technical studies will tend to narrowness, is entirely without foundation. Wherever narrowness and bigotry are found, they have arisen from other causes; and indeed, if the choice were between narrowness with depth or breadth without it, we should most certainly choose the former. We know of no system of education, and the last century has failed to show any, that can give broader and more enlightened culture than the thorough working out of some particular line of research. To become a specialist does not involve shutting one's eyes to everything but a single series of facts; seeing so much in one branch of learning, we form grander and more exalted conceptions of studies we have never pursued. Seeing much, we infer more, and judge of the fruitfulness of other fields by the harvest we have found in our own.

Because the topics to which the student devotes the chief portion of his time are of direct application to the material uses of life, it does not follow that they do not have as great an influence in refining his thoughts, elevating his principles and cultivating his imagination as those of a more general or classical character; and it is a point upon which we wish strongly to insist, that the technical studies of this department are not intended merely to turn out intelligent artisans, but thoroughly educated and cultured scholars.

The basis of this course of study is laid by a systematic drill in Algebra and Geometry, during the Freshman year. In the Sophomore year, first term, Plane and Spherical Trigonometry and Land Surveying are taught in the class room, and the latter is supplemented by work in the field where the student becomes acquainted with all the manual portions of the business, and acquires proficiency in the use of the chain, compass, transit, and other instruments. Notes are kept of the data taken as in actual work, and from these the areas are calculated, and the fields platted. In the second term, Descrip-

tive and Analytical Geometry are begun, and the latter finished, having five recitations per week during the whole term. In the former, two recitations or lectures per week are given, in addition to which the student prepares twenty plates of drawings, each consisting of some special graphical problem which involves one or more of the general problems of Descriptive Geometry. By this means mechanical drawing is practiced at the same time that its underlying science is studied.

In the Junior year the course becomes more strictly technical. During the first term the various methods of laying out railway curves, putting in switches and side-tracks, and setting slope-stakes, are taught, together with the principles of the construction of water-works, sewers, retaining-walls and other combined structures. As nearly as possible all the problems investigated in the class-room are taken into the field and staked out upon the ground. Data are also taken for problems in earth work, both excavation and embankment, and the cubic contents calculated.

In pure mathematics Calculus is taught during this term, there being five recitations per week. Descriptive Geometry is continued in much the same manner as before, only dealing with the higher problems of Stereotomy, Shades, Shadows and Perspective, and Isometric. About twenty plates of drawings are prepared.

In the second term, Analytical Mechanics and the Strength of Materials occupy five recitations per week. During this term also, a practice survey of a portion of a line of railway is undertaken and the engineering of the work carried as far as is possible without the actual construction. The line is run, the curves put in, the profile taken, the grades determined upon, and it is then cross-sectioned and left ready for the contractor. The notes of the work are kept exactly as in actual practice, and from them a profile and plan are drawn, including also, the more important topographical features of the adjoining lands.

A course in Astronomy has just been added to the department in this term. It will be partly descriptive and partly mathematical, extending as far in the latter, as the determination of latitudes and longitudes and the laying out of a true north and south line by observing the meridian transit of a star.

During the Senior year, the student devotes himself to the higher problems of engineering, such as the strength and stability of arches

and suspension bridges, the construction of bridge and roof trusses and girders, and the laying of foundations. A portion of this year also, is given to the designing of structures and calculations of their strength, with detailed drawings of the same: in a word, the office work of a constructing engineer.

The department is well furnished with field instruments, consisting of two transits, two levels, one compass, chains, tapes, rods, poles, etc. The text books used are Gillespie's Land Surveying, Henck's Field Book for Engineers, Stoney on Strains, Allen on Dock Walls; while many others of a similar character are kept in the library for reference.

DOMESTIC ECONOMY AND THE EXPERIMENTAL KITCHEN.

MRS. WELCH.

Domestic Economy is taught to the Junior ladies, by means both of weekly lectures and actual practice in a well furnished kitchen. Two afternoons a week are set apart for this practice. These lectures embrace such topics as Furnishing and Care of a Home, Plan of Week's Work, Care of the Sick, Management of Domestic Help, Training of Children, Sewing, &c., &c. Practical instruction is given in bread, biscuit, cake and pastry making; cooking of meats—broiling, roasting, boiling, &c., including beef, mutton, veal, ham, and the dressing and cooking of poultry; the preparation for the table of vegetables, of desserts, and the canning, preserving and pickling of fruits. The teacher remains with the class during all the hours of practice. At each session the cooking of some new dish is carefully taught and the class take notes and assist the teacher. At the next session material is supplied and a certain number detailed to do the same work unassisted. If the material is spoiled, it is paid for by those wasting it and the same work given over until successfully performed. Thus each member of the class becomes in turn responsible for each kind of cooking.

CHEMISTRY.

PROFESSORS POPE AND LEE.

GENERAL DESCRIPTION OF THE CHEMICAL LABORATORIES.

The laboratories cover over four thousand square feet of floor, and are capable of accommodating at once, one hundred students, giv-

ing to each a desk room of eight square feet; besides drawers, cupboards and shelves, for bottles and apparatus when not in use. Each desk has gas, sink and faucet. They are made of black walnut, thoroughly oiled, to resist chemicals; those fitted for quantitative work have filter pumps, for creating a vacuum and making quick filtration. These pumps are run by water, in the basement, and are capable of giving, at this height above the sea, a vacuum equivalent to twenty-six inches of mercury.

The scales used for quantitative work, which are in a separate room, are capable of weighing less than one-tenth of a milligram, or about one thousandth of a grain; of these we have two, but the number of students render a third pair necessary. There is also a combustion furnace, apparatus for making soil and gas analysis, heating sealed tubes, and a mill for grinding up grains and fodder, preparatory for analysis. The above, with other apparatus and chemicals now in the laboratory, amount to over thirty seven hundred dollars in value. Besides the laboratory, there is a large lecture room, and store room of equal size.

CHEMISTRY IN THE COURSE IN SCIENCES RELATED TO AGRICULTURE.

The instruction given consists largely of lectures, and is given to the following classes:

SOPHOMORE YEAR.

First Term—General Chemistry. This includes experimenting twice a week, familiarizing the student to some degree, with the properties of the various chemicals and the manipulation of apparatus. The text-book used is Barker's College Chemistry.

Second Term—Qualitative Analysis. The student receives for analysis substances whose composition is unknown to him; the number analyzed is usually about forty, and, as many of them contain a large number of elements, the training he receives in this department is very thorough. During this term he also receives instruction in chemical problems, and is thus enabled to determine how much of a necessary chemical ought to be used to bring about a desired result.

The course in the recitation room consists mainly of lectures—the only text book used being Snively's Tables for Systematic Qualitative Chemical Analysis as a guide to their work at the desk.

JUNIOR YEAR.

First Term—Quantitative Analysis. In the laboratory the students are given for analysis, chemicals, ores, alloys, coals, water, fertilizers, soils, ashes of plants, etc. The text-book used is Caldwell's Agricultural Chemical Analysis.

Second Term—The laboratory work is Quantitative Analysis, embracing volumetric methods and food analysis. The recitations are in Organic Chemistry. Text-book, Bloxam's Organic Chemistry. This is taught practically and theoretically, as far as the time permits; practically in the study of the manufacture of organic compounds; theoretically by considering the methods of making organic from inorganic bodies, their relations to and transformations into each other by chemical reactions capable of being performed in the laboratory, thus throwing some light on those secret processes which are being carried on in the animal and plant.

SENIOR YEAR.

First Term—Lectures twice a week on Agricultural Chemistry. Some of the topics considered are, the chemistry of the soil, the chemistry of the plant, and the best method of improving and enriching the soil by fertilizers.

Second Term—Lectures on Food. The value and use of the protein bodies, carbohydrates, fats, and salts are discussed. The proportion and amount in which it is best to feed them as shown by numerous researches conducted by the most recent experimentors. The value of the different grains and grasses as food; time for cutting and best methods of preservation, are all carefully considered.

CHEMISTRY IN THE LADIES COURSE IN SCIENCE.

JUNIOR YEAR.

First Term—Quantitative Analysis. In the laboratory the ladies are given for quantitative work, chemicals, coals, water, soap, syrup, washing soda, etc. Some volumetric work is done during this term.

Second Term—Lectures on Domestic Chemistry. The ladies are instructed in that part of chemistry, which will enable them to perform in an intelligent manner their household duties. Such subjects as the chemistry of bread making, cooking in general, the composition of foods, the antidotes for most common poisons, adulterations and methods of detection, etc., are treated of.

SPECIAL COURSE OF INSTRUCTION IN CHEMISTRY.

JUNIOR YEAR.

Those students who, at the end of the Sophomore year, elect Special Chemistry pursue during the Junior year the following:

First Term.—A more extended course in quantitative analysis for their laboratory work. They also study Fresenius' Quantitative Analysis, and Suttons' Volumetric Analysis, reciting each day.

Second Term—Quantitative work continued and Cooks' Chemical Philosophy, as far as Organic Chemistry, taken as a text-book. Recitations each day.

SENIOR YEAR.

First Term—Students attend the regular course in Agricultural Chemistry and take besides Schorlemmers' Organic Chemistry; three recitations a week.

Second Term—Lectures on food same as Agricultural course; Organic Chemistry finished; recitations four times a week; lecture once.

The laboratory work of this year will consist largely of soil and food analyses. The students will be expected to aid the Professor in investigations and also in performing any outside work which he may be asked to do. As the work thus requested will frequently be a repetition and therefore mechanical, and as the students are charged with the chemicals and gas used, a *small fee will invariably* be asked and the amount be stated before the work is undertaken. Should the work, however, in any way be for the *interest of agriculture* no fee will be asked, and farmers, or others interested, are earnestly requested to send samples of food, soil or water they may wished to have analyzed; also to state in what respect they think it excels or falls short of the average sample.

PHYSICS.

PROFESSOR MACOMBER.

Commodious apartments for the accommodation of students in this branch, are fitted up in the new laboratory. A lecture room large enough to seat a class of more than a hundred, is fitted up with all the modern conveniences. This room is well supplied

with gas, water, and all the necessary apparatus for successful pursuit of the study. Excellent rooms are fitted up for the physical cabinet, and all are supplied with suitable experimental tables for use in conducting special investigations. Students who wish to pursue the study more thoroughly, are permitted to use these rooms for the purpose.

Physical Cabinet.—The collection of apparatus for illustrating the principles of Physics, is becoming more complete every year. Early in the history of the College, large appropriations were made for purchasing philosophical instruments, and as important pieces are added every year, the physical cabinet has become a valuable adjunct to this department. Space will not allow an enumeration of even the prominent pieces of apparatus, but it may be worth while to say that the value of the instruments amounts to nearly five thousand dollars.

Course of Study.—Physics is studied by the Sophomore and Junior classes. During the first term the Sophomores study the subjects of the Mechanics of Solids, Liquids, and Gases. Elementary lectures on the Mechanics of Solids are first given, and then the subject is pursued by recitations from the text-book, and experiments. Sound and Light occupy the second term, and are studied mainly from the text-book. The exercises occur twice a week during the first term, and three times each week during the second term. The Juniors complete the subject of Heat during the first term, and commence upon Electricity; exercises, three times a week. Electricity is completed the second term, and a course of lectures is given on the more prominent, recent discoveries and generalizations of Physics. These include such topics as the conservation of energy; correlation of forces; physical theory of machines, and the dissipation of energy. This study is required of all students in the regular courses of study, excepting the Course in Science for Ladies. During the second term of the Junior year, the ladies are permitted to substitute for Physics, Landscape Engineering.

Meteorology.—The Junior class pursues this study during the last term. The phenomena of the atmosphere are studied by means of text-books and lectures, and illustrated by instructive experiments. Observations are taken on all the instruments usually kept in meteorological observatories, and the results exhibited upon charts,

where all the phenomena are represented by means of curves. For details on this matter, see the Meteorological Register.

Special Course.—This course occupies the Senior year. Its object is to give greater proficiency to students who propose to teach the subject of Physics. One of the requirements for entering upon this course will be proficiency in mathematics, and it is highly desirable that Analytical Geometry should have been studied. The course includes the study of the methods of physical investigation, and principles of scientific research. Practice in the laboratory is required two afternoons each week, in which the student will investigate the laws of Physics, and learn to manipulate the apparatus with his own hands.

GEOLOGY.

PROFESSOR MACOMBER.

The Senior class pursue this study during the first term. Lectures on Mineralogy are given the class during the first four weeks. The student is required to take copious notes and to collect as many specimens of minerals and rocks as can be found in the vicinity. The class makes frequent excursions to the rock quarries near the College, in quest of specimens. The Museum has a good collection of the common rocks and minerals, and students are permitted to pursue their studies from personal examination of these. After completing the study of Mineralogy, Dana's text-book of Geology is carefully studied. This work the class is well prepared for, having studied thoroughly Zoology, Botany and Comparative Anatomy, during the Sophomore and Junior years. The text-book is completed in about two months, and then the Geology of Iowa, Cosmogony, and the Principles of Geology are pursued by lectures and reading in the library. Among other advantages for pursuing this study, the Museum contains a full set of the Ward Series of Geological Casts. These are restored fossils of animals, representing all the prominent species and genera of the different Ages, from the Silurian to the Age of Man. These casts are in plaster of Paris, and have been pronounced by Prof. Agassiz and others, to be fully equal, if not superior, to the original fossils, for purposes of investigation.

DEPARTMENT OF BIOLOGY.

PROFESSOR BESSEY.

Instruction in Biology begins in the Freshman year. The lower or elementary course extends through one year, *i. e.*, to the middle of the Sophomore year; and is open to students, in all the departments. The higher or advanced course extends through two and a half years, ending with the Junior year; the latter is open to the ladies, and the students in the Department of Agriculture. The subjects included are Elementary, Systematic, Economic and Cryptogamic Botany, Vegetable Physiology, Animal Physiology, General Zoology, Entomology and Comparative Anatomy.

BOTANY.

All Freshman students, in the second term of that year pursue a course of study in Elementary Botany. By means of recitations from a text book (Gray's "Lessons") twice a week, with illustrations from fresh specimens, the student is expected to master all the more general facts relating to the external or crude anatomy of plants.

During the first term of the Sophomore year, students in all the departments take up the study of Systematic Botany. They are required to analyze and classify a sufficient number of plants so as to familiarize themselves with the characters of the more important orders, and the principles of classification. Each student is required to prepare fifty herbarium specimens, which are submitted for examination at the end of the term. For this work he supplies himself with a good hand lens, dissecting needles, forceps, a note book, etc. Gray's "Manual," and "Field, Forest and Garden," are used in the classifications.

The Higher Course in Botany begins with the second term of the Sophomore year. Twenty-five lectures upon Economic Botany are given to the Sophomores. The origin and history of the more important cultivated plants, together with a discussion of the value and relative importance of the timber trees of the world are dwelt upon. The object in view is to give the student a broader knowledge of the relations which exist between man and the vegetable kingdom, than he can obtain by simply acquainting himself with the comparatively few species he meets with in the gardens, farms and forests of

any one country. The weeds of the farm and garden, with suggestions as to their eradication, are discussed at some length, and the rudiments of Medical Botany are introduced as occasion demands.

In the first term of the Junior year, students who take the higher course in Botany, pursue the study of Vegetable Physiology, reciting four hours from the text-book, and spending one afternoon, each week, in the laboratory. About half the term is given to this study, and it is believed that if the student is faithful and earnest in his work, he cannot fail to obtain a fair knowledge of the anatomy and physiology of plants, as understood by modern vegetable physiologists.

The remaining portion of the term is given to lectures upon Cryptogamic Botany, in which the student is familiarized with the general structure, and principles of classification of the lower orders of plants. The lectures are supplemented by a course of laboratory work, which includes an examination of typical and other more important forms. The parasitic Fungi are studied and dwelt upon to a considerable extent, in accordance with the growing idea of their importance in Agriculture, Horticulture, and other industrial arts.

In the higher course in Botany, Sachs' "Text-Book of Botany," Johnson's "How Crops Grow," Smith's "Domestic Botany," Gray's "Structural and Systematic Botany," Le Maout and Decaisne's "General System of Botany," Torrey and Gray's "Flora of North America," De Candolle's "Prodromus," Berkeley's "Introduction to Cryptogamic Botany," and Cooke's "Handbook of British Fungi," are particularly recommended for reference. It is urged upon students that they make frequent use of these books in the College library, or in the library of the Professor, to which they have access, and that whenever it is possible for them to do so, they provide themselves with copies of one or more of those which are of the most immediate importance.

The means of illustration throughout the course are: (1), The college herbarium; (2), a collection of billets of various kinds of woods; (3), a collection of grasses; (4), a collection of cones of evergreens; (5), a set of diagrams and charts; (6), seven compound microscopes, with Tolles' and Beck's objectives; (7), alcoholic and dry material for examination in the Botanical laboratory; (8), students also have access to the collections of mosses, lichens and fungi, belonging to the Professor.

ZOOLOGY.

Students in all the departments in the second term of the Freshman year, begin the study of Animal Physiology. By means of recitations from the text-book, together with a series of familiar lectures, the student is acquainted with the general structure and physiology of animals; two recitations per week are given to this subject.

In the first term of the Sophomore year General Zoology is taken up, and the principles of classification, together with the limits and characters of the larger groups of animals are learned. The object of the two foregoing terms of instruction in Zoology, is to give to the students of all courses a fair general knowledge of the animal kingdom, and at the same time to lay a good foundation for a further study, by those who pursue the subject in the higher course.

In the second term of the Sophomore year, fifty lectures are given upon Economic Entomology, and twenty upon Vertebrate Zoology. The student spends in addition one afternoon a week in the study of specimens in the laboratory; in which work he becomes familiar with the more common species of insects and vertebrates indigenous to Iowa. In the lectures on Entomology, the life-history of the insect is dwelt upon as of the greatest importance in enabling the farmer and gardener to suggest remedies; the various checks and remedies are taken up, and the student is invited to freely give his opinion as to their value and practicability.

Packard's "Guide to the Study of Insects," Riley's "Reports upon the Insects of Missouri," and Harris' "Insects Injurious to Vegetation," are recommended to the student in Entomology as valuable for study and reference. In Vertebrate Zoology, the Zoological reports in the "Pacific Railroad Reports" and the recent "Reports of the U. S. Geological Survey," and Coues' "Key to N. A. Birds," are especially recommended for reference. Jordan's "Manual of the Vertebrates of the Northern United States" is used in the laboratory.

In the second term of the Junior year in the study of Comparative Anatomy, the modifications and development of the various organs of animals are taken up in a series of sixty lectures. The bearings of such modifications, and of the facts of Embryology, which are studied at some length, are discussed in such manner as to prepare the student for a study of the great biological questions

of the day, and serving at the same time as a good preparation for the more particular study of the life, growth, and development of domestic animals. Three hours of laboratory practice each week, enable the student to make dissections of animals, and to examine many of the minuter parts by means of the microscope.

Books of reference: Carpenter's "Principles of Comparative Physiology," Packard's "Life Histories of Animals," Clark's "Mind in Nature," Foster and Balfour's "Elements of Embryology," Carpenter's "Mental Physiology," Darwin's "Origin of Species" and "The Variation of Plants and Animals under Domestication," Hæckel's "History of Creation." The foregoing books are accessible to the student, either in the College library or in the library of the Professor; and it is urged that frequent reference be made to these in preference to inferior books. Other standard books will be recommended to students who wish to study particular branches of the subject. The laboratory manual used is Huxley and Martin's "Elementary Biology."

THE HERBARIUM.

The Herbarium includes the botanical collections belonging to the College, and to the Professor of Botany. It contains mounted specimens of about three thousand species of Phænogams, and two thousand Cryptogams, besides several thousand duplicates and unmounted specimens. There are also available for study, collections of grasses, cones, and woods.

The Herbarium is open to students for study and consultation at any time, on application to the Professor of Botany.

THE BOTANICAL LABORATORY.

A room has been fitted up on the second floor of the main building, for a Botanical Laboratory. It adjoins the Biological lecture room, the Herbarium, and the office of the Professor of Botany. It contains shelves and cases for material, and tables and chairs enough to accommodate ten students at once. Each table is provided with a compound microscope, and the necessary scalpels, forceps, reagents, and other materials for making and mounting microscopic preparations of vegetable tissues. The Laboratory is open to Junior students in Botany, three afternoons a week for work and study.

In the second term of the college year the Laboratory is open for histological study to Junior students in Comparative Anatomy.

THE MUSEUM.

The Museum occupies a large room on the third floor of the south wing of the main building. It includes mounted specimens of a few mammals; several hundred birds (mounted), representing the avian fauna of the State; a large collection of reptiles, in alcohol; a few fishes; and a small but typical collection of invertebrates. A set of the "Ward Models," illustrating the principal larger fossils, and a cabinet of mineralogical specimens, are of service in the study of Geology. There are, besides, the following collections in process of formation: A seed collection; an entomological cabinet; sets of the eggs and nests of birds; the brains of vertebrates; skulls of mammals; and skeletons of vertebrates.

During the second term of the college year, the museum room is used as a laboratory, in which the students in Zoology make a direct study of the specimens. Tables and chairs enough to accommodate twenty students at once, are provided, and the room is open three afternoons a week for this work.

Visitors are admitted to the Museum every afternoon from one to five o'clock.

GENERAL STUDIES COMMON TO ALL THE DEPARTMENTS.

THE FRENCH LANGUAGE.

MRS. STANTON.

Instruction in French is given through the last three terms of each of the College courses. In the Course in Sciences related to Agriculture, however, its study is optional with the student. Fasquelle's French course is studied during the first, and a part of the second term. Especial attention is given to pronunciation and to the forms, laws, and usages of the language. As a part of the daily recitation, the translations from English into French, made by the students are written upon the board, and carefully corrected by the class; the pupils being required to give the rules under which the corrections are made. This drill in daily recitation, together with the frequent written reviews required of the class, secures thoroughness and prepares the student for the course in reading, which he enters immediately upon finishing the grammar.

The course in reading pursued during the latter part of the second term, consists in selections from Knapp's Chrestomathie Francaise.

The third or last term is given to making translations from Le Bourgeois Gentilhomme by Moliere, Phedre by Racine, and Corinne by Mme. De Stael.

DEPARTMENT OF ENGLISH LITERATURE, SCIENCE OF LANGUAGE, &c.

PROFESSOR WYNN.

This department embraces all the literary studies of the several courses, and includes Analysis of the English Sentence, Historical Grammar, Rhetoric and Composition, History, English Literature, and the Science of Language. Beginning in the Sub-Freshman with the Analysis of the English Sentence (Welch's) the subject of Language is continued in the first term of the Freshman year. During this term a thoroughly practical system of Composition and Rhetoric is taught, the aim of which is to subject the student to a close and effective drill, during the hours allotted to the work, in the

main maxims of elegant and accurate composition. It is deemed best here to avoid the confinement and mechanical routine of the text-book, and, in the use of gradual and slow-moving exercises, looking to the product of the best labor of the student on the spot, secure results in the arts of expression which can be immediately inspected, and thus not be exposed to the risk of the very uncertain criticism which often accompanies a subsequent and hasty review. The common error of aiming to do too much and accomplishing little or nothing for the student, is in this way sought to be avoided.

CRITICISM.

The subject of Criticism and Æsthetics will claim the students' attention during the second term of the Freshman year. Kame's Elements is the text-book here, which, though subtle and abstruse in parts, and trying to the average capacity of Freshmen, is yet so valuable in its analysis of the emotions and passions as bearing upon the fine arts, that its place cannot easily be supplied. By a judicious selection of contents, and further elucidation of the text in familiar conversations, in course of which most of the more modern researches and theories in this line of thought are drawn out, it has been observed that the study awakens an enthusiasm equal to anything in the course. Dealing with the Beautiful in art and literature it often, indeed, stirs up on the very threshhold of the College course, faculties that might otherwise have lain dormant; whilst on the other hand, the difficulty of the study acts conveniently as a sifting process, trying the courage and capacity of the student, and deciding whether it is in the order of things that he shall go on with the course. The talks here are also made tributary to the study of English Literature, which is to follow in the Junior year, by indicating so long beforehand the great English classics, which the student in his library hours may leisurely peruse.

ENGLISH LITERATURE.

Students of the first term of the Junior year of the Agricultural and Ladies' Course are admitted to the lectures on English Literature. The vast range covered by this study in history, biography and criticism, and the time to be devoted to it being limited to one term of four months, together with the comparatively unformed methods and

tentative processes which embarrass a branch so recently coming into prominence in higher education, are circumstances which have made it peculiarly difficult to cut out a course which would be in harmony with the predominantly practical features of the curriculum of which it is a part. After six years of experiment and growth it is hoped that this end has been measurably attained. It may be well, in a general way, to describe the method which finally has taken a somewhat definite shape, and has proved itself in a very gratifying aggregate of results.

The shortest route to the successful prosecution of the study of English Literature, is to furnish the student with a comprehensive knowledge of the epoch in which any great masterpiece has appeared, and then put him down to an intelligent and sympathetic contact of his own spirit with the spirit of the great master, whose power and inspiration he desires to feel. The great poets, orators and philosophers have propagated their influence down to us through the ages in the form of a spell, a species of enchantment, which is their title to immortality. The end of all critical study of these masters in English poetry and prose is attained when the student has yielded himself sympathetically, spirit with spirit, to the magic sway of what Mr. Wordsworth calls "the presence and power of greatness," as perpetuated in the monuments of their skill. Chaucer, Spenser, Shakspeare, Bacon, Milton, Burke,—it is, above all, necessary that the student should come into immediate contact with the genius of these writers, so as to feel their inspiration, and catch the tide of their impulse, as it sweeps through all time, and beats in unison with the universal heart of the race. This is the aim of all aims, the maxim inclusive of every other, in the study of English Literature. Whatever fails of accomplishment, this must never fail.

It will be found, then, that there are two errors that must be carefully avoided: first, the mistake of embracing more than pre-eminently representative characters in the survey of an epoch; and, second, the too critical study of their works. Most of our text-books are overcrowded with biographical sketches, critical estimates, and dry chronological details, which have no underlying unity, and must therefore be an encumbrance to the memory, and disappoint, and bewilder the student in an interminable maze. They have the effect of an unsucessful attempt at an encyclopedia of English Literature. Mr.

Green, in his remarkable work, "Short History of the English People," has made it appear that the great literary lights of the centuries are better guides to the social condition, culture, mental habits, and the deep world-currents that give character to an epoch, than the customary rehearsals of war and diplomacy; and, following his suggestion, and aided, indeed, directly by his labors, it has been the aim of the lectures prepared for this department, to present to the student, in a series of monographs, only the strictly representative characters, whose literary labors epitomize the age in which they lived.

This, also, is simply preparatory to the work which the student is required, on his own account to do, in analyzing and profoundly studying the great masterpieces themselves. The details of the method in which this is secured need not here be drawn out. It will be sufficient to say that the mind of the student is put down to the direct study of the great English classics either as wholes, or in such detached portions as are in themselves connected wholes. Matthew Arnold has given us the key-note here, in one of his suggestive prefaces, when he says; "It is through the apprehension, either of all literature—the entire history of the human spirit—or of a single great literature, or of a single great literary work, as a connected whole, that the real power of *letters* makes itself felt." Then, also, speaking of Ancient classic literature, "short single pieces, or else bits detached here and there from longer works, as, for example, the last book of the *Iliad*, or the sixth book of the *Æneid*, or the *Agememnon*, are considerable wholes in themselves." So, applying this suggestion to our work in English Literature, we should treat Chaucer's *Prologue* and *Knights Tale*, the first book of Spenser's *Faerie Queene*, and any one of the plays of Shakespeare, as "considerable wholes in themselves," and therefore, suitable material for direct study and systematic recital in the class-room.

But, even here, there is the other error to be avoided, the temptation to give the selected portions a too formal and miscellaneous study. Mr. Hales, of King's College School, London, has edited a volume of "Longer English Poems" with invaluable notes philological and explanatory, which as a book of reference and for private study cannot be too highly prized. But in a preliminary Essay on the Teaching of English, he suggests that each of these masterpieces be subjected to a critical study which shall embrace the following particulars: (1) The piece should be committed, if not too long, and

made the instrument of elocutionary drill. (2) The general meaning of the piece, and the unity that pervades it must be looked after. (3) Attention must be given to minor and subsidiary matters—to allusions, to manners and customs, to historic and semi-historic details. (4) The prosody and rhythm must receive consideration. (5) Information about the author must be gained. (6) The grammar of the piece must be studied, the words parsed. (7) The sentences must be analyzed, and submitted to the formal processes of logic. (8) The philology of the piece would come in finally for a detailed examination. Such a process of literary anatomy would kill any piece before it had proceded half way down the list. To make a poem the theatre for formal drill in grammar, prosody, philology, and logic, is to put the dissecting knife to its very vitals, and destroy the subtle elements which above all are the objects of the student's quest. These branches have their respective provinces elsewhere, and are supposed to have been duly attended to by the student who has advanced thus far on his course, but to throw them promiscuously together in this higher field, where the mind of the author and the inspiration of his genius are pre-eminently the ends to be attained, would be the most direct route to speedy and utter defeat. We have frequent illustrations of this in the life-long disgust which some minds have contracted for the sublime poem of Paradise Lost, from the practice, happily long since abandoned, of making it the tilting ground in the schools, on which to test the tyro's capacity to parse.

Enough has been said to indicate in the main the peculiarities of method adopted in this Department. The task is still felt to be a difficult one, and beset by many problems which future experience may help to solve. Meantime, the study itself is so inspiring, and "the best thoughts of the best minds" are so profusely scattered along the whole route, that all defects of method are in a measure compensated in the supreme joy of that "apprehensive power," of which Wordsworth speaks, whereby the mind

—"is made quick to recognize
The moral properties and scope of things."

SCIENCE OF LANGUAGE.

The whole course is closed up, in the last term of the Senior year, with the Science of Language, which represents an advanced movement in philological studies, analogous to that which has given the physical sciences such unwonted prominence in our educational schemes. It is not so much a *polite* study, as a course of rigid induction in language, taking rank, thus, in congenial association with the scientific curriculum which prevails at this place. The student here is made familiar with the great laws underlying all language, in so far as these laws have been discovered; he learns to distinguish the processes of linguistic growth and decay; to note the subtle workings of thought, association, and caprice, in the wearing out of old terms, and the organization of new ones; and, incidentally, deals with the deeper questions in controversy among the *savans* in this line of scientific research, such as the origin of language, its relation to thought, the boundary lines and probable antecedents of the great families of tongues into which the languages of the earth are divided. Ethnological problems as illustrated by linguistic evidence; the unity or diversity of origin of the human race; the primitive civilizations as revealed by language in the pre-historic time; the law of evolution, as discoverable in the unfolding stages of the scientific and religious consciousness of the race, in the words which men have used to express their conception of nature, and of the unseen powers believed to be at work behind her forces;—all these allied topics are freely discussed in the class-room, on the principle that, if the results are not very definite, the student has his mind stirred meanwhile to extraordinary activity, gets wider and more liberal views of the great family of man, is thrilled with a fresh conception of human capabilities and destiny, and is started out on new lines of discovery, of which he, otherwise, would never have dreamed.

Prof. W. D. Whitney is deemed the safest guide in this line of scientific research, whilst free use is made of the more brilliant, but less exact, disquisitions of his great Anglo-German coadjutor and opponent, Prof. Max Muller. The student will naturally be drawn to the pages of this enthusiastic explorer and bold adventurer in the dim border-land of the science, and, although on many points he may be beguiled by the beauty and eloquence of the author's style, into accepting as valid science what are but ingenious speculations of

a sanguine intellect, it will, nevertheless, be a powerful stimulus upon his energies, and he will find a very complete corrective in the strictly scientific work which, under the direction of Prof. Whitney, he will be required to do. There is also this special advantage in Prof. Whitney's discussions, that they illustrate the ruling principles of the science, in so far as that is at all practicable, by familiar processes going on in our own mother-tongue, so that collaterally they constitute an invaluable treatise on the philology of the English language.

Here, as in the course in English Literature, the classes gather up their material in a syllabus, and denote their progress in the frequent written examinations they are required to pass. It is not absolutely necessary that the student should be familiar with any other language than his own, nor that he should be practically acquainted with the processes of comparative philology, in order to understand and master the Science of Language, but still, as the English language is of a prevailingly analytic structure, and it would be of no small advantage to him to have at least an elementary knowledge of a synthetic tongue, provision has been made for the option of

LATIN.

The whole of the Freshman year may be devoted to the study of Latin instead of the grammatical studies and Criticism, that otherwise must be taken in the course. During this time a thorough ground-work may be laid, and several books of Cæsar's Commentaries, and one or two books of Virgil's Æneid, may be read.

MATHEMATICS.

PROFESSOR STANTON.

The course of instruction in the department of Pure Mathematics pre-supposes a thorough knowledge of Arithmetic and the elementary principles of Algebra. It occupies two and a half years for its completion, and embraces:

FRESHMAN YEAR.

First Term.—Algebra; Loomis' Treatise.
Second Term.—Plane, Solid and Spherical Geometry; Loomis.

SOPHOMORE YEAR.

First Term.—Trigonometry; Chauvenet.
Second Term.—Analytical Geometry; Church.

JUNIOR YEAR.

First Term.—Differential and Integral Calculus; Buckingham.

During the Freshman and the first term of the Sophomore year, the studies of this department are common to all the College courses. Analytical Geometry and Calculus are regular studies in both the Engineering Courses, optional with Chemistry in the Ladies' Course, and in the Course in Sciences related to Agriculture, may be pursued by such students as desire to take them, in addition to the regular studies of their course.

Algebra.—In Algebra there will be two divisions. The first of these will be composed of students who show by their entrance examinations, thoroughness in Arithmetic, and a ready familiarity with the principles of Algebra, through Equations of the First Degree; the other, will include all students who obtain a high standing in Arithmetic, and are able to pass the required examination in Algebra, but show in this latter study a want of thoroughness. Both divisions will carefully review Algebraic Addition, Subtraction, Multiplication, Division, Factoring, Greatest Common Divisor, Least Common Multiple, Fractions, and Equations of the First Degree. The advance work of the class will begin at Involution, and will include Involution, Evolution, Radicals, Quadratic Equations, Ratio and Proportion, Continued Fractions, Permutations and Combinations, Arithmetical and Geometrical Progressions, Binomial Theorem, and Series.

Particular attention will be given in this study to the explanation of the cardinal principles, and the drill in the solution of problems and equations will be conducted with reference to fixing these principles in the minds of the students. The first division will complete the subject in fourteen weeks; the other will devote to its study the entire term.

Geometry.—All students securing a standing of three (four being perfect) in either of the divisions in Algebra will be permitted to enter the class in Geometry. This class will be divided into two divisions, corresponding to those in Algebra. The first division will

give to the study of Plane, Solid and Spherical Geometry the last four weeks of the first, and all of the second term of the Freshman year, while the other division will devote to the same subject the eighteen weeks of the second term.

In this class the student is early taught the full meaning of a Geometrical demonstration. He is warned against the danger of learning the propositions by rote; and in order that he may not fall into this error, is, at the end of the first book, assigned original theorems, which he is required to demonstrate. He is expected not only to thoroughly understand each proposition, but to be able to so arrange and present the points of the proof as to form a complete and perfect demonstration. The two leading objects aimed at in the instruction given in Geometry are: *First*, to prepare, for the more severe work of the higher studies, those who desire to take the full course in Mathematics; *Second*, to implant in the mind of each student a high ideal of a complete and symmetrical demonstration.

It is not expected that the student will be able to solve all the problems of life by the exact rules of Mathematics, but whenever he has aught to prove, the more nearly he can bring his argument to correspond with the demonstrations of Geometry, the nearer perfection will be his proof.

Trigonometry.—Instruction is given in this branch during the first nine weeks of the first term of the Sophomore year, by Professor Beal. The class is thoroughly drilled in the nature and use of the Trigonometrical Functions.

Analytical Geometry.—This study is pursued by the Sophomore class during the second term. The course of instruction embraces Determinate and Indeterminate Geometry, including a full examination of the Conic Sections. The underlying principles are brought prominently forward and discussed. The students are required to carefully analyze each article, and solve the problems connected therewith. To secure thoroughness frequent reviews are given.

Calculus.—Instruction in Calculus is given during the spring term of the Junior year. To enter this class it is necessary that the student should have *passed* the lower mathematical studies of the course. In no case can the study be pursued successfully without previous drill in Analytical Geometry. Buckingham's Calculus is used as a text-book. The abstruse principles of this method of mathematical investigation are explained upon the theory of *rates*, rather than upon the theory of *infinitesimals*. Instruction is given by daily recitations and lectures, with a review each Friday, of the week's work. Twelve weeks are devoted to Integral, and the remainder of the term to Differential Calculus.

POLITICAL ECONOMY.

PROFESSOR STANTON.

Political Economy is the science of exchange. It treats of Value, Cost of Production, Labor, Capital, Money, Foreign Trade, American Tariffs and Taxation—subjects of vital importance to the prosperity of the industrial classes. It deals with questions of public interest, concerning which there is at present a wide diversity of opinion. It is a matter of no small moment that students should possess intelligent views upon these grave points of difference in public policy. The various sides of these questions are presented and thoroughly canvassed. Perry's Political Economy is used as text-book, but no small part of the instruction is given by means of lectures and discussions. Each student is required to write three essays upon topics pertaining to the subject. Valuable books of reference can be found in the College library.

PSYCHOLOGY.

PRESIDENT WELCH.

Psychology is studied by all the Seniors through the first half of the College year. The revelations of consciousness are accepted as the only basis on which the science of the human mind can securely rest. At the same time, such collateral light as Physiology can throw upon the subject is not rejected. The fundamental fact that man is a free agent, responsible for his own acts and the arbiter of his own destiny, is enforced by scrutinizing the intuitive evidence which the mind itself supplies. The theory that mental phenomena are the product of the machinery of nerves, and that the brain secretes thought as the liver secretes bile, is shown to be unsupported by the facts in the case. The study of Psychology will include throughout the term five exercises a week consisting of recitations, familiar lectures, and essays written and read by the class. The main purpose will be to give the student an insight into the actual facts of human nature, and no time will be wasted on transcendental theorizing or sterile speculation.

PHILOSOPHY OF SCIENCE.

PRESIDENT WELCH.

Twenty-five lectures on the Philosophy of Science, will be given by the President, to the Senior Class of 1878, during the last half of the Senior year. These lectures embrace the following topics: Inductive and Deductive Reasoning; the Creation and Nature of Science; Classification of the Sciences; Necessary and Contingent Truths; Primary Truths; Axioms and Definitions; subject matter of each Science; its Special Methods of Classification; Absolute and Practical Certainty; Regressive Reasoning from the Conclusions of Geometry to the Axioms; Growth of the Sciences; Observation; Experiment; Discovery; Hypothesis and its use; Limits of Scientific Knowledge; Harmony of Science and Religion. Sixty lectures will be given to Seniors of 1879.

MILITARY TACTICS.

PROFESSOR GEDDES.

All who desire to do so may take the entire course of military instruction. This course embraces the following studies and exercises, viz :

School of the Soldier.
School of the Company.
School of the Battalion.
Bayonet Exercise.
Broad-Sword Exercise.
Field Artillery.
Ordnance and Gunning.
Cavalry Tactics.
Military Engineering.

Besides the above, a College company will be organized, not to exceed fifty members, who shall uniform themselves.

TEXT BOOKS.

The text books used are Upton's Infantry Tactics; McClellan's Bayonet Exercise; Mahan's Military Engineering; and Smith's Field Artillery.

Works of reference are the following :

Scott's Military Dictionary; Duparco's Military Art ; and United States Army Regulations.

INSTRUMENTAL MUSIC.

MISS DUDLEY.

Music is not, by law, a regular study in the College curriculum. Opportunities are given, however, to such as desire it, to take lessons upon the organ or piano. The rates of charge are as follows :

Lessons on piano, (one each week).....$10 per term.
Lessons on organ, (one each week) with practice every day.....$10 per term.

Students pay for tuning instruments twenty-five cents per month. Sheet music extra.

VOCAL MUSIC.

PROFESSOR FOX.

Instruction in Vocal Music, in class or by private lessons, will be given by Prof. George D. Fox. In this department special attention will be paid to voice culture.

Students desiring tuition in Thorough Bass, Harmony, or Theory of Music, or lessons on the Violin or Flute, will be taken in class or privately.

The course of instruction as pursued in the Boston Conservatory of Music will be followed in the above studies.

As music is not provided for in the regular College courses, all instruction in the above lessons will be paid for by students availing themselves of them.

THE LIBRARY.

The Library now numbers about six thousand volumes. It is made up almost entirely of new books, purchased since the opening of the College; they are bound in half calf, library style, and substantially covered with strong brown paper. These have all been selected with reference to the wants of the departments, the aim being to build up a working library which shall furnish the students and officers of the College, who are pursuing investigations beyond the ordinary text books, with the best authorities and works of reference. It is not the intention of the College to furnish in its library simply a means of amusement, and while its officers hope to see students use the books freely, they expect that such use shall be in

all cases with a definite object in view. As the student's stay in college is short, and his time consequently of the greatest value, he cannot afford to waste it in reading worthless books, nor even in desultory reading of good books. It is therefore urged upon students that they lay out for themselves courses of reading and study in the library, under the advice of the Librarian, or of some of the Professors. It is urged further that students make frequent use of the books of reference recommended by the teachers of the various college studies.

The Library is open for consultation, or for the drawing of books during the day and evening, from 7 o'clock A. M. to 9 P. M.

PRINTING OFFICE.

The College Printing Office occupies a commodious room in the basement of the south wing of the main building. It is supplied with the usual material of such an office, including a Potter Power Press, and a Gordon Jobber. During the past year the work in the office has been sufficient to furnish labor to as many students as wished to learn or practice the art of printing. Aside from its use as a means of instruction, the office has proved itself a very valuable addition to the College apparatus, in giving increased facilities for rapidly and accurately putting into print, the many papers always used about the institution.

ORGANIZATION FOR ANSWERING LETTERS OF INQUIRY ON INDUSTRIAL SUBJECTS.

On the opening of the next College year the Faculty will appoint, and thereafter sustain, several committees whose duty shall be to answer questions concerning industrial matters sent in from all parts of the state or the west. Under this arrangement it will be one of the purposes of the College, hereafter, to aid in the solution of the special difficulties which lie in the way of the farmers, breeders, horticulturists, house-keepers and mechanics. An active correspondence will be opened and letters of inquiry be invited from the leading workers wherever located, upon questions relating to crop-raising, soils, grains, fruit culture, weeds, grasses, hurtful insects, treatment of diseased animals or plants, feeding, house and field drainage, improved machinery, household matters, &c., &c. Our laboratories, workshops,

hospital for sick animals, experimental farm and garden, will altogether furnish unusual facilities for this proposed addition to the College work. All answers to questions which shall be regarded important to the public will be published in the College Quarterly, to be issued four times during the year, or in the Western Stock Journal.

To carry out the above enterprise the following standing committees will be organized, viz:

A committee on Stock Breeding.
A committee on Diseases of Animals.
A committee on Plants and Insects.
A committee on Horticulture.
A committee on General Farming.
A committee on Farm and House Drainage.
A committee on Farm Implements.
A committee on Analysis of Soils and Foods.
A committee on Household Matters.

COLLEGE QUARTERLY.

Under the sanction of the Board of Trustees, a College Quarterly will be issued on the 1st of May, July, September, and November. This paper will be edited by the heads of the Industrial Departments under the general management of the President. Its purpose will be to give to our leading agriculturists and mechanics such information as will aid them in those operations of the farm, garden and workshop that require the application of science for successful management.

In this Quarterly it is proposed to discuss such questions of interest as are sent in from the various parts of the state. The paper will be a twelve page quarto, full of original matter. Subscription merely nominal: ten cents per annum.

PART IV.

STATEMENT OF NEEDS.

REPORTS OF FARM AND GARDEN.

SCIENTIFIC PAPERS.

LIMITED APPROPRIATIONS NEEDED FROM THE STATE.

REPAIR OF PUBLIC ROAD.

There is an urgent necessity that the graded road which runs some seventy rods through the bottom land of the College farm should be improved by widening, paving with stone and covering it with twelve or fifteen inches of gravel. This portion of the highway to Ames consists of a low, narrow causeway which, being frequently overflowed by freshets, is in such condition as to render access to the College from Ames unpleasant and often difficult. In fact the causeway with its perpetual mud and ruts which deepen with every rain is a serious evil, and the success of the institution demands that it should be throughly repaired. The citizens of the district in which it lies are unable to do the work, the College funds cannot properly be used for such a purpose, and we are therefore compelled to ask for a small appropriation from the Legislature. The cost of thorough grading and graveling will be $2,000.

GARDEN AND PROPAGATING HOUSES.

We need, and must have, if the Horticultural Department be made useful in the way of valuable instruction and experimentation—a building which may be called a Garden House, or Horticultural Laboratory. It should contain an office, seed room, room for storage and sorting of roots and nursery stocks in autumn, a tool room, and a room for a horticultural cabinet and workshop, in which the varied processes of the art could be practically taught during the school year, and in which winter grafting could be done. Under these rooms should be a capacious and frost proof cellar, with divisions, for the storage of garden products for the spring term of school, and for the stocks, shrubs, tubers, root grafts, &c., connected with the nursery department. Such a building can be fitted up in creditable shape with an expenditure of about $3,500.

We also need a neat, durable and commodious Propagating House,

not in the way of a show Green House stocked with rare and expensive plants, but mainly for the propagation and winter preservation of bedding plants needed in the flower borders, for the propagation of plants for study in the Botanical classes, and most important of all for the propagation of plants, small fruits, shrubs, &c., for the vegetable garden and nurseries.

The advantages of such a structure in the way of imparting instruction on the important subject of culture under glass should also be duly considered, and to some extent the subject of æsthetic culture should be considered in an institution of this kind.

Built in neat modern style, of brick, iron and glass with best heating apparatus, the cost of such a structure would not exceed twenty-five hundred dollars.

NEW COLLEGE SEWER.

The sewer that drains the College building has for the last year produced malaria among the students. This sewer was constructed nine years ago, and the south wing was afterwards built over it. Being partly filled, it now sends its gases into the rooms above, and beyond question the sickness that prevailed throughout the State was, on this account, rendered more severe in the building.

On careful inspection the Engineer decides that the old sewer must be filled up, and that a new one must be so constructed as to empty its contents where the entire neighborhood will be safe from their deleterious influence.

As the sewer cannot be changed while the college is in session, the pipes for the new sewer *must be laid this fall.*

This work cannot legally be paid for with College funds, and the officers of the College, under the urgent necessity of the case, have borrowed the money, looking to the legislature for reimbursement.

The committee appointed by the Board to take special charge of the sanitary condition of the building for the next year are Dr. D. S. Fairchild, Prof. F. E. L. Beal, Prof. J. L. Budd.

Subjoined is the report of the Committee on Sewerage.

GENTLEMEN OF THE BOARD OF TRUSTEES OF THE IOWA STATE AGRICULTURAL COLLEGE:

Your Committee having, in accordance with the order passed at your last meeting, examined the present system of sewerage of the College, find it to be defective in very many respects, and altogether unsuited for the purpose for which it was originally designed. The state of health of many of the inmates during the past summer and fall, has made evident the fact that something is radically wrong in the sanitary condition of the building, and the investigations of your committee have revealed a cause amply sufficient, in their opinion, to account for all the evil effects observed.

The present main sewer was, when first constructed, made so large as to render it a matter of almost absolute certainty that it would sooner or later be filled with sewage matter, which the current would not be sufficiently strong to remove. As far as can now be observed from its outlet, it has actually become a sewer of deposit, and the testimony of those who opened it last year at the College building, shows that this is probably its condition throughout its entire length. At its outfall, it is half-full of fæcal and other sewage matter, and as it does not appear that any considerable portion of its contents have ever come out, it is more than probable that the greater part of all that has ever been emptied into it remains there now. Moreover, the original construction of the sewer was of so frail a character, that it would not be surprising if in some, or, perhaps, many places, it had become crushed by the weight of earth upon it, thus completely damming its otherwise feeble flow.

Your committee also find that under the College building the sewer has been tapped in a number of places, for the entrance of pipes communicating with various parts of the College, many of which not being properly trapped, rendering the ascent of sewer gas into the different rooms an absolute certainty, besides which, it is probable that the joinings are not tight—as it would be difficult to make them so—thus letting these foul vapors directly into the lower portion of the building. Finally, your committee observe that no provision of any kind whatever, was made for the ventilation of this sewer in any part of its course, thereby leaving these noxious exhalations to make the best of their way into the College building, which as will be seen from what has already been said, was no difficult matter.

The present locality of the outlet, is, in the opinion of your committee, badly chosen, both as regards the healthfulness and beauty of the College grounds. When the wind is southerly, as frequently happens in the summer season, it blows directly into the mouth of the sewer, creating a pressure in the direction of the building, at the same time that the offensive odors, arising from the fetid mass at the mouth, are carried by the winds across the grounds, to the annoyance of every one in the vicinity.

To remedy these evils your committee would recommend: first, that such part of the present sewer as is under any portion of the College building, be at once and completely removed; second, that a new sewer be constructed, running in an easterly direction, and having an outfall at a point near the limit of the ornamental grounds; and that the sewage be there received in a cess pool, disinfected, and used for purposes of fertilization. They would recommend that the sewer be constructed of round cement pipe, of about ten inches diameter, and that an arrangement be made at the College building, by which water can, at certain intervals, be thrown into it in considerable quantities, thereby flushing and cleaning it throughout. They would also recommend that this sewer be provided with ventilators at several points of its course, where the sewer gas can escape into boxes of charcoal, so placed as to intercept it; and that at its upper end, it open into some of the flues of the College, provided there are any that are perfectly tight, and will only allow the escape of the gas at the top. If no such flues are available, a ventilating pipe should be constructed reaching to the top of the building, and terminating above the upper story. Your committee, moreover, would recommend that no part of this sewer pass under the College building, but be laid entirely outside its walls.

Your Committee have examined the ground through which the proposed sewer is to run, with regard to its declivity and with a view to selecting a suitable outfall. They find that for the first eight or nine hundred feet, the ground has an average fall of about two feet in one hundred, and after that, the fall is much more rapid. This is ample, and more than is needed. The distance from the College to the proposed point of outfall is about sixteen hundred feet. At the College building, the depth at which it would be necessary to lay this sewer in order to connect with the soil pipes of the water closets and the drains of the kitchen, would not exceed six feet below the

surface of the terrace; beyond that, it would only require to be placed sufficiently deep to protect it from frost and secure a suitable declivity; (probably about four feet on an average.) This sewer should be entered by as few pipes as possible, and all that do enter, should be securely trapped.

The drainage of the College cellar, now enters the main sewer at some point outside the building; this should be replaced by a new drain, which, as it will convey nothing offensive, may be allowed to come to the surface of the ground at the nearest point which the declivity will permit, in this case, about four hundred feet from the building, if it pursues its present southerly direction. It will be necessary to lay this sewer much deeper than the other, in order to get below the cellar bottom: or about twelve feet below the surface of the terrace, at the beginning.

Your Committee recommend that this sewer be constructed of eight inch cement pipe and furnished with a ventilator at its upper end; and that as much as possible of the drainage that contains nothing offensive, be led into it, in order that a multitude of connections with the other sewer, may be avoided.

The cost of the first sewer may be estimated approximately as follows:

1800 feet cement pipe at 27 cents per foot	$ 486.00
Freight and cartage of same	150.00
Digging and filling 109 rods of ditch at $1,25 per rod	136.25
Laying pipe	50.00
Making connections	100.00
Ventilators, contingencies, etc	100.00
Total	$1,022.25

The cost of the cellar drain may be estimated at:

400 feet of pipe at 24 cents per foot	$ 96.00
24 rods of ditching at $2.25 per rod	54.00
Laying pipe, making connections, etc	100.00
Total	$250.00

Adding to this $200.00 for the removal of the old sewer, gives a total of $1,472.25.

Respectfully submitted,

J. L. BUDD,
F. E. L. BEAL. } *Committee.*

In regard to these appropriations the Board of Trustees, at its November meeting, passed the following resolution:

"Resolved, That this Board regard the several improvements, proposed to be made by means of appropriations to be asked from the State, as vitally important to the prosperity of the Agricultural College, and that for this reason we earnestly urge the General Assembly, to grant the sums set forth in the above statements."

CONDITION AND OPERATIONS OF THE FARM DEPARTMENT, 1877.

J. L. BUDD SUPERINTENDENT.

Assuming the charge of this department unexpectedly, at a time last spring already late for the sowing of oats and preparation for corn planting, I was obliged to plan a campaign not exactly in accordance with the usages of well regulated Agricultural Colleges, viz: to grow crops with a view to profit, without much attempt at useful experimentation.

As the stock department must be provided for, the main crops have been corn, oats, rye, and hay, with incidental products shown in the account of income from farm products.

THE CORN FIELD.

Without really intending it, something in the way of useful experimentation is exhibited in the crop of corn, the gathering of which is just finished, the area planted being about one hundred acres. Not finding an ear of seed corn on the place, nor any in the vicinity that had been kept in a manner likely to insure vigorous and uniform germination, I was compelled to pick up the quantity needed in Benton county, selecting from two to four bushels as I could find it, more with a view to absolute certainty of growth, than regard to choice of varieties. Fortunately the seed all grew, and at the close of the cultivating season, few pieces of corn in the State of like extent had a more even stand.

In husking, however, the yield was decidedly uneven. The pure yellow, and flesh colored varieties, gave a yield of over sixty bushels per acre of large even sized ears; while the mixed up varieties—so very common over the whole extent of the State—with the same culture and general treatment, gave a yield of less than fifty bushels per acre, of smaller and uneven sized ears.

While it is generally admitted that mixing varieties of corn tends to deterioration of stamina of plant and yield of crops, yet so complete a demonstration of the fact is not often so extensively exhibited as in our crops of 1877.

The statement of account of the Treasurer, in this connection, shows a net profit on the corn field of only $90.25.

With a field of one hundred acres, with an average yield, over the largest portion, of sixty bushels per acre, this exhibit is suggestive. Corn can be bought here at twenty cents per bushel for the stock department, so it would not be fair to inventory the crop above the market price.

The whole work of planting and culture was performed by careful, industrious help, with good teams, and the very best modern machinery. The items of cost not usually counted by farmers are: board of hands at $16.00 per month; wages of teams at ten cents per hour; student work to the amount of perhaps sixty dollars in freeing the hills from weeds on lowest ground, where the excessive rains early in the season prevented timely culture; and a little additional cost in the securing of seed corn.

The board could be furnished at the farmers' table at a less rate per month; the team work, when wear and tear of teams and tools are considered, is plenty low enough; and the student labor at nine cents an hour was effective as ordinary help for the really needed work of clean culture in a wet season.

The showing is quite a fair one that twenty cent corn, if made profitable to the grower, must be judiciously fed to stock.

OAT FIELD.

About forty acres were sown with Surprise and Somerset varieties of the oat. The yield averaged about fifty-five bushels per acre, with some of the lower portions of the field seriously decreased in yield by lodging before maturity. The net profit of the field, with full estimates for team work, board of hands &c., is given at $241.59, with estimate of oats on hand at twenty-five cents per bushel.

Some plats of experimental oats gave no results, worth recording, except a variety sent us by Professor Roberts of Cornell University, called "Canada Oat." This variety gave a magnificent yield, and the character of the hull is such that it is likely to prove valuable as a feeding variety for horses.

It will be more extensively tried next year.

RYE FIELD.

By the same inclusive system of book-keeping, the net profit of eighteen acres of rye is given at $189.51.

It may here be noted that ten acres of White Rye now presents a fine appearance, and it is believed that its general introduction in the State will prove a decided gain to our farmers.

A variety of White Rye from the Department of Agriculture seems essentially different from that grown in eastern Iowa. It may prove a separate and more valuable variety.

HAY FIELD.

One hundred and fifty tons of choice hay, put up in the best order, are in store in barns and stacks.

Quite a proportion of this hay is grown on the ornamental grounds, where the many trees planted tend to considerably increase the cost per ton of harvesting; yet, counting the hay at $5.00, per ton, the net profit shown on the books amounts to the nice sum of $735.01.

POTATO FIELD.

Nearly all the potatoes were grown in the Horticultural Department, and the exhibit shows a fair profit.

The farm crop of about three acres, shows a loss of $4.50. It so happened that the farm crop of this valuable esculent was planted mainly with Peach-Blows, intending them for late spring use. This variety, though making a magnificent growth of tops, gave a very meager crop, hardly worth digging, not only on this farm, but in this and neighboring counties.

FARM-HOUSE AND GARDEN.

The original fruit trees, small fruits, etc., planted in this garden for use of farm household, being either entirely dead or in a dilapidated, sod-bound condition, the work was attempted last spring of replanting, and placing it in respectable shape.

Nearly one hundred cherry, plum, and apple trees were planted, and all have made fair growth. The grape vines, raspberries, currants, etc., planted, have also under good care, made a splendid growth, and bid fair, if continued attention be given, to furnish an abundant supply of fruit in a very short time to this department. The

vegetable garden belonging to the farm house, has been managed in connection with the care of the fruit plantation, and has entirely supplied the wants of the large family. A supply of potatoes for nearly the whole year is also now in cellar from this garden.

The farm house cellars were found in condition utterly unfitted for any practical use, winter or summer.

The floors have been paved with brick, the outer courses being made of hard brick, laid in cement. The walls, riddled with rat holes, were refitted, and neatly plastered, as were also the ceilings. The rotted jams and doors were refurnished, and the stairways bricked, and placed in usable shape.

This imperatively needed improvement will allow of the safe storage of potatoes and other vegetables for spring use, in place of selling such products in the fall, and buying at enhanced prices in the spring, as was done last year. The temporary use of these cellars is also kindly permitted for storing the vegetables of the Horticultural department for the spring term of school, and for the storage of stocks for winter grafting. Without this privilege, nothing could have been done in the way of commencing a nursery next spring.

The farm house roof was also found in rotted, leaky condition. The roof, in part, has been re-shingled and the balance repaired, but a new roof will be necessary on the main building next summer.

FARM IMPROVEMENTS.

Some quite extensive sloughs, nearly adjoining the lawn and reaching to the public road on the south line of the farm, have been in part broken up in former years, and since have grown up annually with immense crops of weeds, and slough grass. After securing the hay crop, these were mowed, in part with scythe, and in part with an old mower fitted up for the purpose. After the heavy crop—in some places ten feet in height—was thoroughly dry, it was burned off, leaving the bare exposed soil and turf. Much of the surface had been washed by floods into irregular shape, with holes from one to six feet in depth. These irregularities were reduced in part with spades used by the students, but mainly with plow and scraper. After repeated scarifying with heavily loaded harrow, with steel teeth placed at an angle of about forty-five degrees, a mixture of Red Top and Timothy grass was sown very thickly, followed by additional harrowing. Over ten acres of these low grounds have been treated

in this way. They are now smooth and regular, and covered with a dense mat of young grass. The stream passing through these grounds, on account of abrupt horse-shoe bends at points near the road, flooded the bottom in times of high water. This difficulty has been surmounted by cutting a channel through the bends, with bank on the side liable to overflow. Not only is the improvement desirable on account of adding to the area of productive meadow, but in the way of improving the landscape view as presented from the public road, or nearly any portion of the ornamental grounds. A plat containing over two acres near the workshop and gas-house, was found in the same neglected shape, covered with dense grass, weeds, and bushes. This has been in part broken and tile drained, with a view to squaring the plat selected for experimental orchard. The balance has been seeded very successfully. Various corners and brush patches on other portions of the farm have been improved at intervals of time through the season.

IMPROVING THE CREEK CHANNEL.

The creek, in its flow through the College farm, is exceedingly circuitous in a part of its channel. North of the railroad, adjoining the cornfield on the bottom, it forms several horse-shoe bends, making a circuit of over one mile to secure an actual advance of less than fifty rods. At the acute return bends adjoining the cornfield, the water, when high, is dammed and forced over the banks, flooding not only the cornfield, but the best meadow land on the farm.

Conceiving it to be possible to avoid this ruinous flooding, which for three years in succession, had about spoiled the corn on this natural corn land, as well as many acres of choice hay, at comparatively small expense a system of dyking, and straightening of the creek channel was commenced. At the points where the water was thrown over the banks, a line of strong Willow poles was driven in a ditch excavated for the purpose, as closely as they could be placed.

With the Willows for protection, an embankment of earth was scraped to a height greater than the water has reached. The Willows are expected to take root and form a perfect protection to the levee. A channel has also been excavated, with a view to changing the flow of the creek where two of the most erratic and mischievous bends occur. This artificial channel is less than forty rods

in length, yet it forms a direct line, where the present channel, by two successive and singular bends, makes a circuit of perhaps three-fourths of a mile.

Another cut of about thirty-five rods, which cannot be completed the present season, will entirely straighten the channel, and, it is hoped, stop the mischief heretofore caused by annual overflows. It may be well to note the fact that our last rainy seasons had so broken and worn the creek bank at one of the acute bends, that unless vigorous measures had been inaugurated, the creek would have changed its channel directly through the bottom lands of the farm. South of the railroad bridge, another set of horseshoe bends occur, resulting in flooding the meadows near the public road. A cut fifty-five rods in length has been made from a point just below the railroad bridge to a point a few rods above the bridge on the public road. The present channel of the creek, by a succession of bends, is, perhaps, a mile in length. It is hoped and expected, that as soon as these artificial channels become widened by floods, sufficiently to carry the bulk of the water, the winding channels yet remaining, will never flood the banks.

The graded road across the bottom (which is our only approach to the College) will also be materially benefitted by the straightening of the creek channel. In the further improvement of this channel, if the coming winter prove favorable, the very great number of undermined trees which now lie in and across the creek, holding a great amount of flood-wood, will be removed, as far as practicable. The height of flood-water will be reduced in this way, to a great extent, since the drift is accumulated, as usual, largely at the abrupt bends. Various other needed farm improvements have been effected, in the way of tile draining, fence making and repairing, digging and clearing out of open ditches, repairing and refitting the old barn, building an imperatively needed corn crib, seeding of ground, replacing worn-out bridges, &c.

FARM STOCK.

Cattle.—The herd of cattle is now made up as follows: Short-horns, twenty-three; Ayrshires, three; Jerseys, two; Devons, two; grades, fifteen. The number in herd was considerably reduced by the public sale last spring.

Horses and Mules.—Work horses and mares, eight; four year old colts, two; two year old colts, one; one year old colts, one; mules, two.

Sheep.—Cotswolds, six; South-Downs, forty-eight; Merinos and grades, forty-five.

Hogs.—All of Berkshire and Poland-China breeds,—ninety-seven.

SUGGESTIONS.

The capacity of the barns for stabling, and the resources of the farm in the way of pasturage and the production of hay and feed, will permit of desirable and profitable additions to the stock department.

Beyond all doubt the great quantity of beef, annually used on the place, can be fattened here with decided saving in cost, and gain in quality.

As with private feeders the animals for fattening could, in part, be picked up in the vicinity, and quite likely some corn would be occasionally bought; but the gain, in utilizing feed and pasturage, in uniform well fattened beef, in manure needed on the place, and in many other ways, will be evident to those accustomed to western stock feeding.

The large amount of milk used in the boarding department, and by families on the place, can also be furnished at home with gain in cost and quality.

By reduction in number of Short-horns usually kept, and the further development of the farm in the way of bringing into use the large tracts of now unproductive land, even the *butter* and *cheese* annually used can be manufactured here.

Before this can be realized, however, a first class modern dairy house must be constructed. The system of neighborhood factories for butter and cheese manufacturing should be encouraged in the State, and we see no reason why such a factory, for the use of the College farm and neighborhood, should not be established as one of the useful and instructive features of the College. We are now compelled to purchase the great amount of butter used of a factory in Jasper county, paying the gilt edged price of twenty-five cents per pound for the same through the season, with heavy cost for packing in ice and transportation.

If the stock feeding and dairy interests be inaugurated, it is evident

they will pave the way for increased profit in breeding and fattening of hogs.

The flock of sheep is troublesome and expensive, on account of the several breeds kept.

The *South-Downs* are taking the lead in health and profit. It may prove best to give exclusive attention to the increase and dissemination of this valuable breed in the State.

FARM ACCOUNTS.

The books at the office of the Treasurer exhibit the following balances:

	Dr.	Cr.
Farm Inventory		$2,404.18
Corn Field		90.24
Farm Products		413.86
Oat Field		241.59
Hay Fields		735.01
Farm Teams		294.88
Rye Field		189.51
Farm Woodlands		204.53
Farm Stock	$3,151.80	
Farm Improvements	977.39	
Farm Tools	382.00	
Balance, gain	62.61	
Totals	$4,573.80	$4,573.80

This exhibit shows a clear profit on crops o ,169.62. The charge for farm tools is mainly for new implements for different divisions of the farm, the expense of which is kept in one general account. After paying for permanent improvements to the amount of $977.39; for farm tools; and for purchase and loss by depreciation in value of stock, a balance is still shown on the credit side of $62.61.

LABOR EMPLOYED.

During the season for tending corn, and haying, five men were employed by the month, the time of one man being almost exclusively occupied in the care of the stock. After haying, the number was reduced to four. A manifest gain would accrue if four or five laborers' cottages were erected on the place for the use of laborers employed. The hiring of transient help could in this way be avoided, and

men of steady and industrious habits secured, who could be retained for extended periods of time, enabling them to become familiar with the work and needs of the farm.

Student labor, in all the departments, I have found more manageable and effective than I had reason to expect. In the work of the Garden, the Nursery, the Orchard, the Small Fruit plats, the Lawns, the Flower Gardens, the Hay field, the Harvest field, &c., I have found students not only willing to work, but many of them familiar with all these varied operations.

With the changes effected in the course of study for next season, student labor will be rendered still more effective and pleasant.

PREPARATIONS FOR 1878.

About sixty acres of oat and rye stubble were deeply plowed in September for corn in 1878.

Some three or four hundred loads of manure have been hauled and spread over the higher, and thinner soiled portions of this ground.

Additional lots of manure have been contracted for in Ames, which are being hauled mainly on the vegetable garden.

About fifteen acres of rye have been sown, various plats have been seeded with grass, &c., as noted under head of Farm Improvements.

CONDITION OF THE DEPARTMENT OF HORTICULTURE AND FORESTRY FOR THE YEAR 1877.

J. L. BUDD, PROFESSOR.

In this first report in my new field of Horticultural operations, I may be excused if I do not adhere very closely to the customary routine of department statements.

I wish to combine as precisely and concisely as possible, a review of the present condition of the different divisions of the Department of Horticulture and Forestry as I find them, with suggestions as to future management and experimentation.

THE VEGETABLE GARDEN.

The season having been favorable, all the crops in this department have proved remunerative, except a few like the Summer Squash, Swiss Chard, Early Onions, Lettuce, Peppers, &c., not used to great extent in the College boarding department. The work has been peformed mainly by students, and yet, though much unprofitable labor in the way of culture of a great number of varieties has been done, the receipts exceed the expenditures, as shown by the books of the Treasurer; exhibiting a net profit of two hundred and seventy-two dollars. Some losses were also sustained from seed, kept in a close room in the Laboratory building, failing to germinate.

In addition to supplying all the wants of the boarding department, and the families on the ground, quite a share of the expense has been covered by surplus of products, which found a ready market in Ames.

About six hundred bushels of potatoes, and a full supply of vegetable oysters, parsnips and cabbage, are in store for the use of the College boarding department in the spring term.

No special variation has been made from the ordinary routine of practical market gardeners who have had a long western experience, the details of which are annually given in our Horticultural Reports. Of most garden crops an unusual number of varieties were planted, somewhat with a view to experimentation, but the season has proved so exceptionably favorable, that little would be gained by a general report.

Some varieties not noted for good behavior in our climate, have this year been models in quality and yield.

Believing that from the hundreds of new seedling potatoes now being originated in the Eastern States, many new sorts will prove valuable acquisitions in the West, over two hundred varieties were planted, including about one hundred new seedlings; very many of them are promising, but further testing will better determine their real value.

Some of the varieties that have been quite widely disseminated, and which have behaved remarkably well this season, will be briefly noted:

Early Vermont.—This variety has much to commend it. The tubers are large, smooth, and lay compactly in the hill, making them easy to dig. In quality it is difficult to excel. Its rampant growth of top exempts it to quite an extent from serious injury by the Colorado Beetle. Beyond all doubt it is a valuable acquisition.

Snowflake.—This much lauded variety has sustained its reputation in every respect. It is large, even in size, and vigorous in tops, making it quite easy to manage as to the bug question. It is far superior to the Early Rose.

Chamounay.—This variety is making a famous local record on the College farm, but is yet but little disseminated. If it continues to behave as it has done the past season, it will stand at the head of the new varieties. It is later than the Early Rose, and a prime potato for winter and late spring use; yet for autumn use, either for boiling or baking, it has been voted here the peer of the extended list. It is said to be a sport of the Excelsior, but in appearance it more nearly resembles Bresee's Prolific.

Bresee's Prolific.—This is a fall and winter variety of great excellence in quality. In yield, uniformity of size of tubers, and ability to withstand the bugs, it is about faultless, and worthy of general dissemination in our State.

Genesee County King.—This would be guessed to be a seedling of the Peach-Blow. It matures earlier in the fall than that variety, yet it is equally valuable for late spring use. Where the Peach-Blow the past season was a perfect failure, this variety gave a fine yield. The bugs troubled it more than any of the preceding.

Strawberry Bloom.—This is a very rank growing, large leaved

variety, of even size, and beautiful strawberry color. It gave us the least trouble on the bug question of all the kinds grown. Grown on dry ground the quality is number one for winter and spring use. It is worthy of extended trial.

Very many other new varieties, about which less is generally known, gave promising results the past year, but further trial will be given them before hazarding an opinion.

Of fifty varieties of the tomato grown, taking all things into consideration, the Hathaway Excelsior was voted almost unanimously to be at the head of the list.

The Conqueror, Gen. Grant, Trophy, and Yellow Persian, were all general favorites. For eating fresh from the vines—in which manner the students make an extensive use of this fruit—the Yellow Persian headed the list, and for cutting up raw and eating with cream and sugar, this variety was preferred by a majority of our tasting committees.

Sweet corn has been extensively used in the College boarding department and a supply was kept up, by successive plantings, for fully six weeks.

Contrary to expectation, the Improved Minnesota variety was the one preferred. If any of the larger varieties were sent in, the invariable report sent out from the table was: "Bring us more of that little corn."

The cabbage is only referred to, in order to place on record the fact that it seems hard to kill it with salt. It has been a custom among gardeners to salt the forming heads to accelerate the heading process. To test comparative results, two rows were salted excessively, actually throwing it on by the handful, every alternate day, for a week or more. Instead of killing them, they turned out the heaviest heads in the patch, but with a strong tendency to burst open, perhaps on account of more rapid maturity.

Various other experiments were instituted in the use of salt, which will be reported in due season, only saying at this time, that the quite liberal use of salt on strawberry beds will be likely to prove a very decided advantage, not only in the way of destroying the crown borer, and other insect pests of vine and roots, but in more luxuriant growth of vines.

SMALL FRUITS.

The Strawberry.—The plat of this luscious fruit planted near the College building, as put out by Prof. McAfee, I found in good shape, and the varieties judiciously selected.

The yield the past season was over one thousand quarts, giving a full supply to the boarding department during the season of fruitage. The Wilson, Green Prolific, and Downer, as usual gave the most remunerative crops. In size, quality, and rapidity of picking, Green Prolific stood at the head of the list. The Downer came next in all these essentials. It is well to say that the Wilson plants seemed feeble in the spring, although in covering and general treatment they had an even chance, so far as known. Charles Downing gave a fair crop of even sized and delicious berries. Colfax gave a fair late crop in the bed adjoining the Ida and Wilson. On a bed more isolated, but with same treatment, the fruit was defective and scattering. Recent experience is not favorable to planting this variety, except in close proximity to vigorous fertilizing varieties. This will explain conflicting reports in regard to the behavior of this disputed sort.

The much lauded Prouty, with the same care as other beds, produced only a very few magnificent specimens, of fine quality. It is doubtful if this variety will sustain its reputation in our climate.

Ida gave a good crop of small sized, sour berries, not well liked even by the fruit loving students. Kentucky failed to produc e specimens enough to determine the quality.

NEW PLANTATIONS.

A new plat was put out early in the spring, in rows with early cabbage. Several hundred fine heads of cabbage were grown on the ground, leaving a nice stand of strawberry plants, now in good shape for a crop next season. Instead of setting in beds, as has been the custom here, the plants will be kept in rows, alternating the position of plants every two years, by allowing the runners to occupy the cultivated spaces, and cultivating where the old plants stood.

Late last summer, two of the spaces between apple tree rows in the west orchard, were planted with strawberries. From late planting and imperfect covering, a large portion of the plants were killed by the winter. These were replaced early in the spring, and the

whole given careful culture. The stand of plants is now perfect. The varieties put out, excepting a few for experimentation, are Wilson, Green Prolific, Downer, and Charles Downing.

The covering was purposely varied, with a view to careful noting of results next spring. A bountiful crop of this fruit may reasonably be expected next season.

The Raspberry—The plat selected for this fruit, is in every way unsuited for this very fastidious, yet, under proper conditions, easily grown berry.

It is located on the border of the ancient lake or river terrace, north-west of the barns. The soil is light and friable, such as will freeze to great depth.

The rake of the north and north-west wind is totally unobstructed.

Yet while making this statement relative to the very unfavorable conditions, it is proper to say that all of the soil on the part of the farm where the vegetable gardens and small fruit plats are located, is about alike in its want of adaptation for the successful culture of the raspberry.

The selection of varieties could not perhaps have been much bettered; a smaller proportion, however, of the Davidson's Thornless should have been planted.

But, almost irrespective of varieties, the plants are too entirely exhausted in vitality, and enfeebled by rust and disease consequent on this low vitality, ever to bear even a meager crop, whatever the future management may be. Much labor has been expended on the two acre plat during the season, with the hope of restoring the impaired vigor of some of the hardier varieties. But at every stage of growth the diseased manifestation to which Professor Bessey gives the name of "Raspberry Stem Fungus" has claimed the plants for its prey.

Long experience and observation, has led to the settled opinion that this stem fungus is always preceded by lowered vitality, as a consequence of planting on soils and in situations entirely unlike those of its native habitat.

All the raspberry plantations known to the writer in any part of the State, planted on loose porous soil, in direct rake of west and north winds, have behaved in this way. With the same uniformity, the plantations in sheltered positions, and on more compact soils, have with judicious culture and management, proved models of health

and productiveness. The soil and exposure at the west side of the farm, where the orchard is located, are more nearly suitable, and here next spring a plantation will be started. It will be necessary to secure the plants for this purpose from healthy plantations, as it is more than probable that whatever may be the primal course of fungus development in plant tissue, when once established, the plants are unsafe to use for propagating purposes.

THE VINEYARD.

Success in growing the grape here has been truly discouraging. Prof. Matthews reported in 1872, "Grape vines all root killed. The sorts I have tried—a large proportion of which are Concord—root killed so badly that their propagation in the ordinary way is too uncertain to justify an additional risk for plants." While I am free to admit that the loose, porous soil—before noted—is totally unfit for the raspberry, I yet believe the grape, properly managed, will here reach its highest state of perfection, both in health of canes, and quality of fruit. On similar soils in various parts of the State, after repeated failures when planted in the ordinary way, the difficulty has been entirely overcome by very deep planting of the vines. Last spring about two hundred vines were replanted in vacant spaces in the vineyard, putting them down fully two feet on the highest ground, and about fifteen inches on lower ground. Of course, in planting in this way, the hole must be filled up very gradually, as the growth of the plant progresses during the summer. Many of the Concords put out by Prof. McAfee are now looking quite well, and I feel confident that by replanting very deeply, all vines as they fail, the vineyard will soon become satisfactory in yield and appearance. The stakes for supporting the vines in the older portion of the vineyard are rotten and insufficient, and in the later planting they are short, and in every way unsuitable for holding up the vines. A portion of the rows have been supplied with two lateral fence wires, firmly attached to strong posts, as is the custom in well managed commercial vineyards. The remaining rows will be served in the same way before time for taking up the vines in the spring.

In such situations experience has demonstrated that the Concord produces more, and better fruit, when trained on low wires, than when wrapped spirally or in any other way, around stakes. This will be a subject for experimentation in vineyard management, and

carefully conducted observations will be instituted, with a view to determining the relative advantages or disadvantages of varied depths of planting on porous soils, ranging from a depth of six inches to three feet.

THE ORCHARD.

The first orchard set out on the College farm occupied a plat near the farm house. This plat has necessarily since become a part of the ornamental grounds.

The few trees that could be left, are now fine symmetrical specimens, even bearing a fair crop during the past unfavorable season.

The site selected about the year 1870 for the main orchard, is near the west line of the farm, with native timber adjoining on the west and north. The position is eminently a favorable one for an experimental orchard, as the plat includes about all the variations of our prairie drift, from the dark colored alluvial surface soil, with tenacious clay as a subsoil near the surface, to lighter colored timber soil, with porous joint clay subsoil.

The orchard as it now stands contains about twelve hundred trees, planted and re-planted at various times since 1869.

To a commercial orchardist, who plants in central and northern Iowa only a few of the best hardy varieties, this orchard presents a queer aspect, as might be inferred from the fact that over one hundred varieties are found on the record, including about all the varieties grown in the south part of the State. But hundreds of the trees originally planted have died, from what Prof. Mathews called "root kill," and have been replaced to quite an extent with hardy northern varieties. Wherever these more suitable varieties are met with over the whole plantation, either in the original planting or as replants, they look reasonably healthy and vigorous, and with moderate care they will soon come into profitable bearing.

Looked at from the standpoint of an expert western orchardist, who grows fruit for profit, the orchard as a whole would be counted doubtful as a source of remunerative income.

As an experimental orchard, it will tell many stories to the class in Pomology, hard to impress in any other way. To illustrate: Take the matter of comparative hardiness of varieties, with similar treatment as to culture, but with varied conditions as to soil. Here we have three rows of Grimes' Golden. This variety, while doing well

in favored sections in the south part of the State, has been recorded as semi-hardy north. The trees of this sort on timber soil, with porous joint clay subsoil, have made fine growth, and look well, with the exception that the leaves are little more than half the size they attain in Missouri. On black, alluvial soil, with stiff clay subsoil near the surface, the original planting has been replaced with hardier sorts, with only a diseased stub of Grimes' Golden here and there left. The same record is manifest with other varieties of disputed hardiness.

Near to the Grimes' Golden we find Plumb's Cider, Saxton Stripe, and Gros Pomier. Of these about every one of the original planting is in place, symmetrical and perfect. The forks of the branches are sound; the bark clean, bright and healthy; and the leaves large, deep colored, and luxuriant. On high and low ground they exhibit little difference in appearance or size.

This same lesson will be impressed in every part of the orchard; the tenderest varieties are planted beside the half hardy, the hardy, and the "Iron Clad" sorts.

True, we have these lessons all recorded in our Horticultural reports, but here we have them spread out as object lessons, not only as to comparative hardiness under similar conditions, but with various modifying peculiarities.

A few lessons are also here taught not recorded in the books. For instance, here we have part of a row planted with a foreign variety called *Drap d'Or*. The trees give every evidence of trying to live under extreme climatic difficulties. The leaf is little larger than a squirrel's ear, and the whole expression of the tree is delicate and feeble.

Near to these trees we find another variety with the foreign name *Belle de Havre*, that seems to bid defiance to wind and weather. The leaf is large and coriaceous, the buds are incurved at point, with deeply imbedded base, and the general birth marks are those indicative of north of Europe origin.

Several other varieties not well known North, present here a promising appearance, under difficulties of treatment and position, which have injured or entirely destroyed varieties like Jonathan, and even William's Favorite.

In the part of the orchard south of the first planting, are found three full rows originally planted with Ben Davis. One of the

rows has not been tampered with, and it is a model in health and perfection of growth; so much so as to attract special attention, as imperfect and broken rows are found on either side. Two of the rows have been experimented with, in the way of budding in the tops with other varieties. These rows impress the lesson learned by our practical orchardists, that this is a poor way in our climate to change the tops of our fruit trees. The usual result we see here, viz: the partial ruining of the stock, and the almost utter failure in getting a top started of the budded variety. A single exception to this quite general rule is here found, which it may be well to note. Of several varieties budded,—and the record shows re-budded once or twice—scarcely a bud has made a healthy growth and the stocks are feeble or entirely gone. Yet a single variety called *Duling Sweet*, has proved a perfect success propagated in this way. So vigorous has been the growth of top, as well as stock, that it presents a striking aspect in contrast with the appearance of all surrounding trees except the Ben Davis row before noted. The experiment has a value in the exhibit, that at least one variety will succeed well when top budded in orchard.

FUTURE TREATMENT OF ORCHARD.

Early last spring the dead trees, and those nearly so, were replaced with Gros Pomier. Over one hundred were thus replanted, and fully that number will have to be replaced next spring and the spring succeeding, since many of the very tender varieties originally planted, are certain to entirely fail before coming to bearing size. All the replanting will be done with the Gros Pomier, to be used as a stock on which to top work choice varieties like Jonathan, Dominie, Wagner, &c., not quite hardy as root grafts.

The general treatment of the orchard will be changed. The trees were originally planted quite shallow, on level surface, and the level culture system has since been sustained. The extensive root killing noted in the records, is beyond all doubt largely attributable to this mode of planting and culture.

The trees replanted will be set much deeper, and the rows will be gradually ridged up, by light annual plowing in June, toward the trees.

A crop of buckwheat was grown in the orchard the past season, the proceeds of the crop fully repaying all cost of caring for the

trees, including the replanting in the spring. This plan will be repeated until the trees attain bearing size.

Repeated systems of experimentation, not only by the writer, but by very many of our prairie orchardists, have demonstrated that buckwheat is a valuable crop for young orchards. It seems quite certain that the beneficial results are partly attributable to the friable and porous condition of the soils on which this crop is grown; and in part to the cooling of the surface during the almost tropical heat of our summers. This suggestion will be made a subject for careful experimentation in the new experimental orchard.

THE EXPERIMENTAL ORCHARD.

Upon a private farm an orchard of the magnitude and character of the one under consideration, would be considered a doubtful venture on the score of utility and profit.

But considered as a well matured system of experimentation for the benefit of students in pomology, and for the good of the settlers on the great prairies of the northwest, it will be watched with eager interest by those who have discussed the principles and issues involved at our Horticultural Conventions, for a number of years past.

The leading purposes for which this orchard is started, may be briefly indicated as follows:

First: To test the relative merit, as to quality of fruit, and hardiness of tree, of the many varieties of the apple grown in northern Europe, so far as they may be obtainable.

Second: To test, side by side, the relative value of ordinary root grafted trees, of varieties choice in quality of fruit, yet not quite iron-clad in tree, and of trees of the same varieties top worked on very hardy stocks, like Duchess of Oldenburg, and Gros Pomier.

Third: To make a systematic attempt to extend our list of desirable hardy varieties of the apple by seedling production, from selected specimens matured in our climate.

Fourth: To test the relative advantages of planting orchard trees at about the depth they stood in the nursery, followed by level culture; and the same sorts planted at varying depth not exceeding two feet, to be followed by ridging towards the trees by annual light plowing.

Fifth: To test with same varieties the relative advantages resulting from shading the surface between the rows with buckwheat during the heated months, and of exposed surface liable to become intensely heated.

Various other experiments of minor importance will be instituted; as,—comparative results of low and high tops; dense untrimmed tops, and those thinned to let in the sun; different modes of top grafting, &c.

The site selected for this orchard is in no respect as favorable as that upon which the present orchard is located, neither as to aspect, shelter from winds, or character of surface or subsoil; but as it is a fair sample of quite a large portion of the prairie counties of northern Iowa, east of the divide, it may safely be concluded that the results of the experiments here instituted will be a fair criterion by which to judge of best methods, and of hardiest varieties, for the parts of the State where orcharding is most difficult.

The orchard was started last spring by planting four hundred very fine, uniformly shaped, two year old Gros Pomier trees. These were planted about eight inches deeper than they stood in the nursery, plowing the ground, after planting, toward the trees. A first class crop of potatoes was grown the past season in this orchard. Every tree has made a vigorous growth, not a failure from any cause being found in the plat.

Next spring it is proposed to top graft these trees with varieties from the north of Europe, a part of the cions for which will be obtained from the Russian experimental orchard at Washington, and a part by direct importation from St. Petersburg, Russia. It will be expected that a large proportion of these varieties will prove summer and fall apples, but about all of them will be of fine size and appearance, and the product can be utilized in the boarding department of the College, to good advantage; more especially as all of these northern apples are first class for culinary purposes. If among them all we get a single half dozen "Iron Clad" winter apples, such as we know exist in northern Europe, as crosses between the northern and southern types of the apple, the experiment will prove of inestimable value to the northern counties of the State. These varieties will be top worked on hardy stocks, the sooner to determine character and quality of fruit. The same varieties will be root grafted in nursery, as soon as practicable, to test trees as grown in this way, and for early dissemination. The experiment to test comparative value of top worked orchard trees, with the use of specially vigorous and hardy stocks, is likely to result in establishing as a fact, what is now a settled belief among our most experienced orchardists, viz: that our most desirable winter apples can be grown in no other way than this, on our northern prairies, with any degree of satisfaction and profit. A root grafted tree of well known sorts like Jonathan and Dominie, will be planted alternately with a tree of Gros Pomier, for the purpose of top grafting the succeeding spring with corresponding variety.

As to the important experiment of testing the quality and hardiness of seedlings from seed matured in our climate, I have only space in this connection to say, that almost nothing has yet been done in the West in the way of acclimating the apple by seedling production.

Our apple seed used in our nurseries, is almost exclusively washed from the pomace of the cider mills in the Eastern States. Our people plant root-grafted trees from the many local nurseries, rarely thinking of planting seeds of selected specimens grown at home, as is so generally done by farmers in the East, where about all of the leading popular varieties have been originated in this way.

Leading fruit growers in the State are aiding in the carrying out of this experiment, by saving seeds from selected specimens of their valuable home grown fruits.

The seeds of over one hundred varieties, grown in the northern part of the State, are now saved, and labeled ready for next spring's sowing. The seedlings, with most promising appearance in leaf, bud, and habit of growth, will be top worked in the spring of 1879, on trees to be planted in the orchard next spring for this purpose, and at the same time, all the varieties will be root grafted, with a view to trial of hardiness and habit of growth in nursery. In this way the quality of fruit, and general behavior of tree in this trying position, will be determined in a very brief period.

The value of this experiment will, in part, consist in keeping a careful record of the parentage of each seedling raised. As many of the specimens were grown on isolated trees, it will be of interest to note how wide the variation may be from the parent fruit. It is hoped and expected, that this extended trial of home grown seedlings will add a number of hardy varieties of choice winter apples to our now restricted list for the north.

The experiment to test relative success resulting from varied depth of planting, with results of level and ridged culture, will be one of more value than transient observers would be apt to suppose. The question has been discussed for years, with wide divergence of opinion resulting from directly opposing experiences in different localities. On same soil, with same varieties, and same system of culture, the results obtained must surely have a settled value, although of course not conclusive for all soils.

The experiment to test relative results from shading of soil among young orchard trees, and from surface exposed to the sun and wind of our summer months, will not demonstrate a principle new to our thoughtful tree growers, but will result in disseminating the vitally important fact, that our dark colored prairie soils, when directly exposed to our dry air, and intense summer heats, become too hot for the healthy growth of any fruit or forest tree.

The sowing of buckwheat not only tends to keep the surface cool, but in porous friable condition favorable for the ascent of moisture from below in time of drought.

The plat selected will contain about twelve hundred trees, which number will not prove too great for the several purposes I have briefly indicated.

The remaining eight hundred trees are already secured and will be planted early next spring.

THE CHERRY, PLUM, AND PEAR ORCHARD.

The orchard planted in intermingled manner with these fruits, was started quite recently, and the trees are yet small. It is here referred to, mainly to outline a few proposed experiments suggested by our most experienced western fruit growers.

The Cherry.—The cherry trees planted are almost exclusively Early Richmond. The trees are small, and—as is usual at this age—they have a thrifty appearance. The loose, porous soil is by no means unfavorable for this fruit, when grafted on Morello roots. We can reasonably expect about the same relative success attained with the Richmond in the northern part of the State, where grown on prairie soil. Yet the lesson learned from the united experience of our northern fruit growers seems to be, that all of the varieties of the old Kentish Cherry of Europe, grow thriftily with us for a few years, and at quite an early age bear an occasional crop of fruit that

is quite satisfactory. But even on most favorable soils the trees are short lived, and quite generally unprofitable in fruitage several years before their final premature death. As a rule, from ten to twelve years after planting in orchard, the Kentish varieties assume an appearance of age and debility. So fixed has become this type of the cherry, that its seedlings seem to vary but little in leaf, bud, habit of growth, hardiness, or even character of fruit, from the parent stock. While it might be possible that it would vary in process of time by seedling production in our climate, we have far more hope of success by experimenting with a different type of the cherry.

The English Morello, for some reason, has not been tried to any extent on the College farm, yet it has had a wide trial over the State with the most favorable results. Of late years our experienced growers of fruit have been planting largely of this sort, finding it to be infinitely hardier in tree, and far more regular and persistent in bearing, than any of the Kentish type.

Its stocky habit of growth, rounded top, close grained texture of wood, and thick coriaceous leaf, suggest its far northern home in Europe, as forcibly as does the general aspect of the Oldenburg, or Tetofski apple, indicate their northern home. Intelligent Russians at the Centennial, assured the writer that this type of the cherry as grown in Northern Europe, runs into many variations as to degree of acidity, and time of ripening of fruit. Our experience in growing seedlings of English Morello, favors the idea that it is more fixed in habits of reproduction of type than the Kentish.

We have every reason to hope to secure valuable additions to our cherry list in this direction. Something has already been done in this way by fruit growers of the West. With the co-operation of our horticultural friends it is proposed to top-work, and root-graft, on Black Morello stocks, at least one hundred English Morello seedlings, the most promising in leaf, bud, thrift, etc., that we can secure. The writer has some promising seedlings—yet small—from which to select cions, and friends in Iowa and Illinois have many more. It is also proposed to add to this experimental orchard a few promising varieties of unknown origin, already fruited in the West. At this time no horticultural experiment could be proposed more promising in results than the one here indicated. For the use of the College it is proposed to set out about one hundred English Morello trees, as an addition to the orchard next spring.

The Plum.—Aside from a few specimens in a half dead condition, the only variety of plum planted is the Miner or Hinckley. As is usual, the trees look well, and we must admit we know of no other variety as yet of equal value for prairie planting. Yet new candidates for public favor are annually coming into notice in the prairie states. Some of these are choice native varieties, some of them, it is believed, modified by contact with the domestic plum; some of them are modifications of the Chickasaw species; and still others seem variations of well known sorts named in the books. Loudon announced a number of years since, that valuable additions to the plum list would in time be effected, even by chance, in the way of crosses of the common plum, with the native American species. Now, we do not know that efforts have been made to produce artificial crosses or hybrids in this way, but year after year at our horticultural meetings apparent natural crosses of this kind are reported, having a local reputation. The experiment proposed, is to collect as many of these—which give promise of hardiness and value of fruit—as possible, and place them in the specimen orchard. Some time will elapse before final results as to character and yield of fruit are reached, but the hardiness of tree can be decided upon in very brief time.

The Pear.—As is usual in Central and Northern Iowa, the small pear orchard does not present a very promising appearance. A little thought will enable us to see that we have had an up hill road to travel in our attempts at growing the pear in our soil and climate.

We have a few varieties of this luscious fruit that seem hardy enough to brave our worst exposures. Our known list of "Iron Clad" sorts is yet short, but we have every reason to suppose it will be added to very largely in the near future, as the pear thrives well, and fruits well in Europe, about as far north as the "Iron Clad" apples we have imported from thence.

We have been disgusted with our attempts at pear growing, and little united effort has been made in the way of adding to our list of hardy pears, and in fact thousands of persons will testify that even the sorts we call hardy, have died with them as early, or earlier than the tenderest dwarf trees in the whole list. Our trouble with the pear has been with both roots and tops. About all our trees planted have been from Eastern nurseries, of Eastern varieties, and grown exclusively on roots raised from imported pear seed. Fully ninety-

five per cent. of the varieties introduced, have proved too tender for our climate, and the remaining five per cent. under ordinary treatment in the prairie districts, with porous friable soil, have failed on account of the tender roots. The tender root question will be readily understood in connection with the fact, that our commercial nurseries either graft the pear on the quince, or on stocks grown from imported pear seed, saved in the section of Europe where the making of perry is extensively carried on. The pears from which perry is made have been indigenous for ages to the mildest and most humid portions of Europe, and when grown in our climate they are fully as tender as peach trees. Need we wonder that our pear trees fail when grafted on such roots? It is evident that if we imported the acrid wild pears of Siberia, they would utterly fail with us if grafted on such roots. The question for us to solve is reduced to this: What stock shall we use upon which to establish our future pear orchards? With the Flemish Beauty, Crassane Bergamot, Pennsylvania, and a few other sorts, satisfactory success has been realized by grafting on *White Thorn* roots. The American Mountain Ash has also been used as a stock with fair success, but the most perfect trees in all the West, attaining great size with unimpaired health, are *seedlings*, grown from American seed, and never removed from their germinating position as seedlings. The latter mode of growing the pear would be unsatisfactory, as a large portion of the seedlings from our home grown pears, would prove tender, as with the apple, and of the ones proving hardy not one in fifty might in quality be worth raising.

Believing the profitable growing of the hardy kinds of the pear, which we can now secure, to be the first desideratum, experimental additions will be made to the pear orchard, by planting the hardy sorts we have, together with several imported Russian varieties root grafted on *White Thorn*, *American Mountain Ash*, and on *seedlings* grown from hardy seedling varieties of the pear raised in our climate. For final results in this experiment we will have to patiently wait, and the College farm is, beyond all doubt, a suitable position for experiments so slow in dollar and cent results.

THE LAWN AND DRIVES.

The elevations, depressions, and graceful undulations of the extensive plat selected for ornamental grounds, present fine natural advantages for meandering drives, and artistic effects in selection and grouping of trees and shrubs. The laying out and planting of the grounds have been effected under the immediate supervision of President Welch.

The bleak, monotonous prairie of ten years ago, has been transformed into a succession of landscape views not often equaled in the prairie states.

Considering the great number of deciduous trees which have been transplanted direct from their home in the neighboring forests, the general success attending the work is truly remarkable. Not content with the ordinary varieties and species used for such purposes, the most gratifying success has been realized in removing from their forest homes such refractory specimens as the oak, the crab, and the thorn.

With the conifers, taking all the species and varieties planted into consideration, less perfect success has been realized. The loose, porous soil, before noted, is hardly suitable in our dry western air for a great variety of evergreens.

Some of the varieties planted are not considered hardy in the eastern part of the State, where soil and air are far more favorable. Very many of the specimens of Norway Spruce, Scotch Pine, Austrian Pine, and even White Pine, present a healthy aspect, and the past season have made a fine growth. The wise provision of dense planting of groups, will now permit the thinning out of all irregular and open foliaged specimens, which will much improve some of the clusters. During the season considerable work has been done in the way of shallow inversion of sod around the hundreds of trees, judicious pruning or removal of unsightly specimens, graveling the carriage roads and defining their borders.

The terrace and parts of the lawn west of the College have been leveled, cleared of the debris left by contractors, and seeded with blue grass. A tile drain has also been put in to drain the basin retaining water back of the College.

The low grounds, near the College approaches from the public road, have been graded, and pulverized on the surface with heavily

weighted steel tooth harrows, and heavily seeded with Red Top. The thick matting of young grass over these extensive ravines, where weeds and slough grass have held carnival, adds much to the beauty of the grounds as viewed from the College drives, or from the public road.

A plat of about six acres east of the College has been summer fallowed to secure a mellow, even surface, and is now nicely set in blue grass. Some other portions of the ornamental grounds, set with trees in the native sod, have been heavily manured and seeded, with a view to secure a stand of the cultivated grasses without breaking the sod.

THE FORESTRY PLANTATIONS.

It is not thought best at present, to extend the forestry plantations, except in the way of filling open spaces in the plats already established.

The quite extensive belts now started, include about all the varieties and species of timber trees that have been found profitable for growing in the prairie states. These plats have been kept sufficiently free from weeds, and in fine growing condition with little expense, by ordinary horse culture. Upon the parts of the several plats adapted to any kind of tree growth, the young trees are doing well, though as a rule not thick enough to crowd them into straight, symmetrical growth. The Black Walnut, White Walnut, Green Ash, Yellow Cottonwood, Soft Maple, and Honey Locust, are all making rapid growth, except on the gravel points, where irrespective of kind, the plants are either very feeble, or entirely wanting.

The experiment will be tried the coming spring of planting on these knolls the Green Ash, putting the plants down fully one foot deeper than they stand in nursery. The issues and important questions pertaining to timber growing are so fully discussed in the Forestry Annual, that no space will here be occupied with the vitally important but often told story.

THE NURSERY.

No special argument is needed to make the fact manifest that a well managed nursery of fruit, forest, and ornamental trees should be kept up on the College farm. The practical operations in Horticulture can be made familiar to the classes in no other way. But aside from its value in the course of instruction, it seems radically wrong that a Horticultural Department should be sustained, and yet that every fruit tree, shrub, and flower, needed on the place, should be purchased at distant nurseries.

Again, a useful system of horticultural experimentation imperatively requires a carefully managed nursery department. Year after year the extreme desirability of an experimental station for the benefit of the State, in connection with the College farm, has been discussed at the annual meetings of the State Horticultural Society.

The idea implied in this system of experimentation, is not of course in the way of indiscriminate trial of the extended fruit lists recorded in the books, as the private testing of hundreds of these varieties has already condemned them as undesirable for our soil and climate. New varieties of the apple, pear, cherry, and plum—and indeed of all our fruits—are coming into local notice in hundreds of neighborhoods of our State, year after year. Sometimes these are seedlings, originating in these neighborhoods; in other cases they may be introduced, and the fact accidentally established that they are at home in our climate, precisely as all our "Iron Clad" fruits have become known.

The absence of a central experimental station prevents the rapid introduction and dissemination of these stray horticultural treasures. By the ordinary process of introduction, a number of years may elapse before a variety becomes tested, and its value recognized over such a portion of the state as to enable it to secure votes enough to place it on even the trial list of our Horticultural Society. With an experimental station for testing absolute hardiness of varieties so favorably located as upon the College farm, the value of these locally prized fruits could be extensively made known in a very brief period, at least their value so far as the vitally essential element of hardiness may be concerned. Aside from the collection of very many of these local fruits, the new varieties introduced from Russia will receive special attention in the way of propagation and distribution; and last,

but not least, the extended experiment proposed, in the way of production of new varieties from seeds matured in our climate, on the College farm, will give us, it is hoped, very many valuable "Iron Clad" varieties for propagation and diffusion, for the benefit of the State.

We have now on hand many thousands of apple stocks grown on the place which will be grafted during the current winter. We have also a fine lot of plum and cherry stocks to be grafted for next spring setting in nursery. To graft these roots with leading sorts, as is done in commercial nurseries would, of course, much lessen both labor and expense, but the main benefit to the State would be lost. In the way of the local waifs of the different fruits, together with the Russian varieties, we hope to graft for spring setting, fully four hundred varieties, not one of which will be very likely to prove tender in the central, and many of them not in the extreme northern part of the State.

The work of this kind done this winter will be accomplished under extreme difficulties, not likely to admit of perfect success. For a number of years past, the State Horticultural Society has passed, by acclamation, resolutions deploring the utter want of facilities for any horticultural operations on the College farm. I do not know that a single dollar has yet been appropriated by the State for this vitally important purpose. Not a single appliance or facility has yet been furnished the department, even such as the humblest nursery in the State is compelled to secure as an elementary start in the business. Yet I hasten to say that I am not sure that special blame should attach to any member of the Faculty, the Board of Trustees, or of the State Legislature. A private enterprise may be special in object, and speedy in results, even in the early stages of growth. But a great institution with a scope as broad as that of our Agricultural College, cannot be developed into full perfection in all its departments, in a year, or a decade of years.

The eight years of our College history have witnessed wonders accomplished in the way of securing needed buildings, apparatus in the scientific departments second to none in the West, farm improvements and stock, laying out of grounds, and in a hundred other ways absorbing every dollar of the really liberal Legislative appropriations.

The hundreds of earnest votaries of Pomona throughout the State are now earnestly hoping that the last may become first, by se-

curing—even at this late day—a more liberal appropriation than could possibly have been obtained in the early College history, when its imperative wants were so many.

IMPERATIVE NEEDS.

The language expressing the wants of the department will be little varied from that which I find in every Biennial Report of the College issued since the department was distinctively established.

First: We need and must have, if the department be made useful in the way of valuable instruction and experimentation—a building which may be called a Garden House or Horticultural Laboratory. It should contain an office, seed room, room for storage and sorting of roots and stocks in fall, a tool room, and a horticultural cabinet and work room in which winter grafting could be done, and in which students could be instructed in the practical operations of indoor Horticulture. Under these rooms should be a capacious frost proof cellar for storage of garden products for the spring term of school, and the stocks, root grafts, &c., needed in the nursery department. Such a building can be fitted up in creditable shape for about $3,500.00.

Second: We need a neat, durable and commodious Propagating House—not in the way of a show Green House containing rare and expensive plants—but mainly for the propagation and winter preservation of bedding plants needed in the flower borders, for the propagation of rare plants for study in the Botanical classes, and most important of all for the rooting of small fruits, shrubs, &c., for the nurseries. The advantages of such a structure in the way of imparting instruction on the important subject of culture under glass should also be considered, and to some extent, also, the subject of æsthetic culture should be considered in an institution of this kind. Built in neat modern style of brick, iron and glass, with best heating apparatus, the cost would not exceed twenty-five hundred dollars.

With these essential facilities we may safely promise that in the very near future, the State Horticultural Society will have no occasion for passing such resolutions as that of its last session, viz:

"*Resolved:* That this Society views with deep regret the meager showing of Experimental Horticulture and Arboriculture, on the grounds of our State Agricultural College."

Third: And—by no means so important as the preceding, upon the acquisition of which the very life, saying nothing of the usefulness of the department, depends—we need a dwelling house for the Professor of Horticulture. With a zeal in the horticultural cause amounting perhaps to not very "fine frenzy," the writer came here last spring without an available hole or corner for occupancy, unless as a poor dependent boarder. The alternative seemed to be presented, either to live in shape neither pleasant, convenient, nor economical, to build a comfortable house, or to resign the position assumed purely for the promotion of the horticultural interests of the College and the State. Perhaps unwisely I chose the plan of building, at a suitable point on the College grounds, a neat and comfortable house, with the hope that in due time the State would, by appropriation, reimburse the expense, amounting to seventeen hundred dollars. No claim is urged for such legislation, only that without such dwelling no suitable Professor of Horticulture can be retained, as he must necessarily reside on the place.

REGISTER OF METEOROLOGICAL OBSERVATIONS.

TAKEN AT THE IOWA STATE AGRICULTURAL COLLEGE.

Latitude 42° *North, Longitude* 93° 38′ *West; height above the sea,* 1,007 *feet.*

By J. K. MACOMBER.

Meteorological observations were commenced at the Agricultural College in the spring of 1875, and since that time a careful record of the weather has been preserved for publication. Observations for about nine months were published in the Report of 1875, and it is proposed to give a tolerably full account of them once in two years. The meteorological department has frequent communications with the U. S. Signal Service Office, and receives all the daily and monthly reports from that office. Blanks are furnished by the Chief Signal Officer, and copies of our observations are forwarded at the end of every month. Monthly reports are also sent to Dr. G. Hinrichs of Iowa City, who has in charge the Iowa Weather Stations. Carefully prepared charts of the weather are made each month, in which all the phenomena which are of importance are represented by curves. In this way the eye can see at a glance the relations which different atmospheric changes bear to each other. It is highly desirable to publish these charts as soon as possible, but the expense prevents such an attempt at present.

The annual mean temperature for 1876 is 45°.7. This is about two degrees lower than is usually given for the State. But the observations from which the annual mean temperature of Iowa has been determined have mostly been taken at points from thirty to fifty miles further south than the Agricultural College. The highest temperature was August 13th, 93°, And the lowest temperature for 1876, was December 9th, 17°.8 below zero. For the same year

more than fifty per cent. of the days were clear and about twenty-two per cent. fair days, the remainder being cloudy. The rain-fall is 37.02 inches, which is about the average for this portion of the State. The greatest amount yet recorded for any one month was in June, 1877, when about eight inches fell. Observations are constantly taken on the direction of the wind, and its relation to rain-fall, but it is not thought best to give any of the results until the observations have been carried on a greater number of years. Easterly winds are most liable to bring cloudy weather and they usually precede rain storms. Our heaviest rains seem to fall while westerly or south-westerly winds are blowing. The easterly and southerly winds coming from the Atlantic and the Gulf are laden with moisture which is precipitated by the cool west winds from the Rocky Mountains. Westerly winds, and especially those from the northwest bring most of our clear weather; while those from the south are invariably warm. In the tabular statements which follow the snow has been melted and counted as so much rain. For detailed accounts of each month see the tables.

NOVEMBER, 1875.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.98	37.5	52.5	25.	.....	.....	Clear ...
2	29.89	41.1	53.	28.	.....	.....	Clear ...
3	30.10	35.3	53.5	27.7	.....	.....	Clear ...
4	30.12	35.4	48.4	19.5	.....	.....	Clear ...
5	30.14	33.9	51.5	16.5	.....	.....	Clear ...
6	29.98	44.9	59.4	24.4	.....	.....	Clear ...
7	29.99	39.2	60.3	24.3	.....	.....	Clear ..
8	30.21	38.9	46.6	35.	.....	.....	Cloudy.
9	30.29	34.6	43.5	28.	.....	.....	Cloudy.
10	29.98	37.6	55.	11.	.....	.....	Clear ...
11	29.81	49.8	69.3	31.2	.....	.....	Clear ...
12	30.16	33.8	51.4	30.	.....	.....	Cloudy.
13	30.03	29.5	.....	.....	.....	.....	Clear ..
14	29.66	35.	37.	20.	.....	.....	Cloudy.
15	29.89	25.	37.4	11.5	.....	4 P. M., snow.....0.5	Cloudy.
16	30.42	19.8	29.	11.5	.....	.....	Clear ...
17	30.14	18.	29.5	3.	.....	.....	Clear ...
18	29.58	39.1	53.	25.	.....	.....	Cloudy.
19	29.93	29.6	44.	22.	.....	.....	Cloudy.
20	30.22	21.6	37.	13.	.....	.....	Clear ...
21	30.68	13.	31.5	-6°	.....	.....	Clear ...
22	30.28	23.3	33.	10.	.....	.....	Cloudy.
23	30.36	16.3	31.	10.5	.....	.....	Clear ...
24	30.46	34.3	39.	2.5	.....	.....[P. M.	Clear ...
25	29.77	28.	39.	2.5	.....	Fine mist, commenced 5.30	Cloudy.
26	30.27	16.3	37.	8.	.....	.....	Clear ...
27	30.28	20.1	35.5	9.5	.....	.....	Cloudy.
28	30.41	-4.1	32.	0.	.....	.....	Cloudy.
29	30.46	-6.5	4.	-15.	.....	.....	Clear ...
30	30.11	16.8	32.	-3.5	.....	.....	Fair .....
Summary	29.78	25.1	69.3	-15.	.....	.....0.5	Clear ...

DECEMBER, 1875.

DATE.	Mean daily pressure.	Thermometer exposed in open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.	29.5	43.	13.	.....	.....	Fair .....
2	30.02	36.1	50.	26.	.....	.....	Fair .....
3	30.15	40.6	41.	35.	.....	Rain, 12:30, P. M. 0.15	Cloudy.
4	29.95	41.1	49.	39.5	.....	6 A. M	Cloudy.
5	29.86	44.8	51.5	41.	.....	.....	Cloudy.
6	29.76	24.1	45.	21.	.....	Rain, ... 0.25	Cloudy.
7	29.81	20.5	36.	18.	.....	Snow,..... 0.10	Cloudy.
8	30.02	11.6	22.5	7.	.....	.....	Clear ...
9	30.09	15.3	24.	15.	.....	Snow, ... 0.05	Fair .....
10	30.01	22.5	32.	19.	.....	.....	Cloudy.
11	30.02	18.8	27.	11.	.....	.....	Fair .....
12	29.94	27.	47.	11.	.....	.....	Clear ...
13	30.20	29.	38.	25.	.....	.....	Fair .....
14	30.01	27.7	43.5	*10.5	.....	.....	Fair .....
15	29.98	34.5	43.	32.	.....	.....	Clear ...
16	30.18	11.1	33.	-6.	.....	Snow during night.....	Fair .....
17	30.42	-4.	3.	-14.	.....	.....	Fair .....
18	30.22	14.	21.	.....	.....	.....	Cloudy.
19	29.97	18.	24.	9.	.....	.....	Clear ...
20	29.83	39.6	50.	20.5	.....	.....	Cloudy.
21	30.13	37.5	49.	29.	.....	.....	Clear ...
22	29.89	42.8	57.	34.	.....	.....	Clear ...
23	30.65	30.	42.	28.	.....	Rain, ...	Cloudy.
24	29.50	32.6	39.	28.	.....	..... 0.35	Cloudy.
25	29.94	21.5	29.	15.	.....	.....	Cloudy.
26	30.07	17.5	30.	15.	.....	Light fall of snow during night.....	Clear ...
27	30.25	16.6	25.5	5.	.....	Fine mist 0.05	Cloudy.
28	30.03	25.3	35.	13.	.....	.....	Clear ...
29	29.52	32.1	38.5	28.	.....	.....	Cloudy.
30	29.69	45.3	59.	30.	.....	Rain, ...	Cloudy.
31	30.16	28.6	55.5	27.	.....	..... 0.20	Cloudy.
Summary	30.01	27.2	57.	-14.	.....	..... 1.15	Cloudy.

JANUARY, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.73	30.6	32.	26.	.....	Rain and snow, ...1.65	Rainy ..
2	30.23	9.5	32.	7.	.....	.....	Clear ...
3	30.43	10.5	15.	3.	....	.....	Clear ...
4	30.03	27.1	47.	6.5	.....	.....	Fair .....
5	30.25	18.3	36.	15.	.....	.....	Cloudy.
6	30.24	14.6	41.	5.	.....	.....	Clear ...
7	30.04	34.1	42.	22.5	.....	.....	Clear ...
8	29.63	43.8	46.	31.	.....	.....	Clear ...
9	30.02	7.	42.	4.	.....	Snow,..... .....0.30	Cloudy.
10	30.54	1.3	16.	— 5.5	.....	.....	Clear ...
11	30.26	21.5	30.	— 2.	.....	....	Cloudy.
12	30.53	6.	28.5	—12.	.....	....	Clear ...
13	30.58	.....	26.	—10.	.....	.....	Clear ...
14	30.21	28.	40.	20.	.....	.....	Clear ...
15	30.04	33.	41.	27.	.....	.....	Clear ...
16	29.88	33.5	43.	25.	.....	.....	Clear ...
17	29 66	33.1	43.	31.	.....	.....	Clear ...
18	29.73	31.3	34.5	27.	.....	.....	Cloudy.
19	30.14	15.	26.	12.	.....	.....	Clear ...
20	30.39	14.8	23.	13.	.....	.....	Cloudy.
21	30.36	19.3	29.	11.	.....	Snow and rain.....	Cloudy.
22	30.03	25.5	29.5	18.	.....	.....0.25	Cloudy.
23	33.46	8.8	20.	6.	.....	.....	Cloudy.
24	30.47	10.3	20.	— 4.	.....	.....	Fair .....
25	30.25	15.5	23.5	9.5	.....	.....	Fair .....
26	29.67	27.	34.5	11.	.....	Sprinkle	Cloudy.
27	29.88	24.1	34.5	18.	.....	....	Clear ...
28	29.75	20.	36.	4.	....	.....	Cloudy.
29	30.55	1.	16.	—11.	.....	....	Clear ...
30	30.07	27.5	40.	9.	.....	.....	Clear ...
31	29.90	18.8	31.	6.5	.....	.....	Fair .....
Summary	30.13	15.8	47.	—12.	.....	..... 2.20	Clear ...

FEBRUARY, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.32	—5 5	8.	— 9.	.....	.....	Clear ...
2	30.19	9.3	23.	—10.	.....	.....	Cloudy.
3	30.32	7.6	19.5	2.	.....	.....	Clear ...
4	30.37	.5	26.	—10.	.....	.....	Clear ...
5	30.04	35.1	47.	10.	.....	....	Clear ...
6	30.18	26.6	38.5	23.	.....	.....	Clear ...
7	30.42	21.6	33.5	11.	.....	.....	Fair ....
8	30.11	33.	38.	21.	.....	Rain	Cloudy.
9	29.83	34.5	38.5	33.5	.....	.....	Cloudy.
10	29.53	44.5	57.5	33.	.....	..... 0.30	Clear ...
11	30.04	26.5	47.	16.	.....	.....	Clear ...
12	29.80	38.6	51.5	30.5	.....	... .	Fair ....
13	29.85	25.8	39.	21.	.....	.....	Clear ...
14	29.99	10.1	75.	27.	.....	.....	Fair ....
15	30.06	9.5	20.	0.	.....	.....	Clear ...
16	30.34	14.3	28.	3.	.....	.....	Clear ...
17	30.30	20.3	38.	3.	.....	.....	Clear ...
18	30.18	27.5	49.	22.	.....	.....	Clear ...
19	30 28	22.6	36.	10.	.....	.....	Clear ...
20	29.45	44.	56.	21.5	.....	Rain..... ..... 0.05	Clear ...
21	30.30	25.2	49.	21.	.....	.....	Clear ...
22	30.36	20.7	39.	8.5	.....	.....	Clear ...
23	30.54	7.6	22.	— 5.	.....	.....	Clear ...
24	29.95	47.5	51.	15.	.....	.....	Clear ...
25	29.77	38.	59.	28.	.....	....	Clear ...
26	29.73	39.3	51.	21.	.....	.....	Cloudy.
27	29.68	34.5	41.	.....	.....	Rain..... .0.05	Cloudy.
28	30.17	15.6	.....	13.5	....	....	Cloudy.
29	30.30	20.	.....	7.	.....	Snow	Cloudy.
Summary	30.08	29.9	59.	—10.	.....	..... 0.40	Clear ...

MARCH, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.28	22.1	.....	13.5	.....	Snow 0.45	Cloudy.
2	30.48	12.3	.....	— 5.	.....	.....	Fair.....
3	30.31	24.6	.....	7.	.....	.....	Fair.....
4	29.95	35.	.....	22.	.....	.....	Fair.....
5	29.77	48.6	.....	38.5	.....	Rain.....	Cloudy.
6	29.89	16.3	39.	14.5	.....	.....1 1	Cloudy.
7	30.08	14.3	26.	5.	.....	.....	Clear ...
8	29.80	34.	40.	29.	.....	.....	Clear ...
9	29.68	35.	48.	31.	.....	.....	Cloudy.
10	29.70	28.8	33.	25.	.....	Rain 0.1	Cloudy.
11	30.22	13.3	19.	5.5	.....	.....	Clear ...
12	30.47	10.	17.	2.5	.....	.....	Clear ...
13	30.29	24.6	38.	5.	.....	.....	Clear ...
14	30.18	37.3	46.	31.	.....	.....	Cloudy.
15	29.86	33.	37.	31.	.....	.....	Cloudy.
16	29.54	23.	30.	19.	.....	.....	Cloudy.
17	30.23	12.5	20.	8.	.....	.....	Fair.....
18	30.46	11.	31.	—10.	.....	.....	Clear ...
19	30.38	22.5	35.	12.	.....	Snow 0.05	Cloudy.
20	30.14	3.5	13.	— 8.	.....	.....	Clear ...
21	30.22	9.6	26.	— 8.5	.....	.....	Clear ...
22	30.29	26.5	35.	6.	.....	.....	Clear ...
23	30.07	31.5	37.	24.	.....	.....	Cloudy.
24	29.82	34.	40.	31.	.....	Rain 0.3	Cloudy.
25	29.97	32.3	40.	29.	.....	.....	Clear ...
26	30.11	31.6	42.	26.	.....	.....	Clear ...
27	30.10	30.5	35.	23.5	.....	.....	Cloudy.
28	30.06	27.5	30.	22.	.....	.....	Clear ...
29	.....	.....	.....	.....	.....	.....	....
30	30.02	27.8	37.	17.	.....	.....	Clear ...
31	30.24	.....	27.	.....	.....	.....	Clear ...
Summary	30.09	28.7	48.	—10.	.....	..... 2.00	Clear ...

APRIL, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30 26	32.70	.....	.....	.....	Snow	Snowy...
2	29.89	32.3	.....	.....	.....	.....	Snowy...
3	29.94	34.1	.....	.....	.....	.....	Fair .....
4	29.73	42.6	.....	.....	.....	.....	Cloudy...
5	30.22	36.1	.....	.....	.....	.....	Clear .....
6	30.13	45.3	.....	.....	.....	.....	Clear .....
7	30.15	42.9	.....	.....	.....	.....	Fair .....
8	30.02	54.5	.....	.....	.....	.....	Fair .....
9	29.82	48.8	.....	.....	.....	.....	Rainy....
10	29.88	54.2	.....	.....	.....	.....	Fair .....
11	28.68	62.7	.....	.....	.....	Rain..... .70	Cloudy...
12	29.89	40.8	.....	.....	.....	..... .21	Rainy....
13	29.69	35.3	.....	.....	.....	Snow..... .12	Snowy...
14	29.49	44.	.....	.....	.....	.....	Fair .....
15	29.76	49.1	.....	.....	.....	.....	Fair .....
16	29.11	43.	.....	32.	.....	.....	Fair .....
17	30.28	40.3	.....	31.	.....	.....	Fair .....
18	30.16	48.9	.....	25.5	.....	.....	Fair .....
19	29.77	56.5	.....	42.	.....	.....	Cloudy...
20	30.23	56.2	.....	44.	.....	.....	Fair .....
21	30.24	56.2	.....	37.	.....	.....	Cloudy...
22	30.07	59.3	.....	35.	.....	.....	Fair .....
23	30.03	45.6	.....	46.6	.....	Rain ..... .31	Rainy....
24	30.27	51.4	.....	40.5	.....	.....	Fair .....
25	30.27	54.3	.....	31.8	.....	Rain ..... .06	Cloudy...
26	29.92	66.6	.....	47.3	.....	.....	Fair .....
27	29.72	64.2	.....	55.5	.....	.....	Fair .....
28	30.12	49.1	.....	33.	.....	.....	Fair .....
29	30.04	51.2	61.2.	40.5	.....	.....	Fair .....
30	30.10	46.3	61.	31.7	.....	.....	Fair .....
Summary	30.01	48.1	.....	.....	.....	..... .1.5	Fair .....

MAY, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.24	36.9	44.1	33.	.....	Rain.....03	Cloudy.
2	30.23	46.	55.	34.5	.....	.....	Clear ...
3	29.89	48.5	58.2	38.	.....	.....	Clear ...
4	29.95	38.2	42.	35.5	.....	Rain 26	Rainy...
5	29.92	46.1	55.5	39.	.....	Rain 14	Rainy...
6	29.79	40.4	42.5	40.	.....	Rain 53	Rainy...
7	29.65	47.	56.	40.8	.....	Rain 04	Rainy...
8	30.05	52.2	65.	38.	.....	.....	Fair .....
9	29.88	60.3	74.	39.	.....	.....	Fair .....
10	30.13	56.5	68.	31.5	.....	.....	Fair .....
11	29.97	65.7	82.	49.	.....	.....	Fair .....
12	30.33	56.4	70.	42.	.....	.....	Fair .....
13	30.25	62.9	73.	37.	.....	.....	Fair .....
14	29.86	71.	83.	54.	.....	.....	Fair .....
15	29.78	65.3	72.	62.5	.....	.....	Cloudy.
16	29.97	66.9	76.3	54.	.....	Rain 68	Cloudy.
17	30.06	67.8	81.	51.	.....	Rain 94	Cloudy.
18	29.98	69.2	79.	37.5	.....	Rain 80	Cloudy.
19	29.92	73.2	81.1	64.	.....	.....	Fair .....
20	29.87	73.	82.5	64.5	.....	Rain 73	Cloudy.
21	29.85	67.8	75.5	43.3	.....	.....	Fair .....
22	30.27	60.6	69.	52.	.....	.....	Fair .....
23	30.39	58.9	69.8	69.5	.....	.....	Fair .....
24	30.32	62.7	74.	39.5	.....	.....	Fair .....
25	30.23	66.9	78.	41.	.....	.....	Fair .....
26	30.17	70.7	82.	42.	.....	.....	Clear ...
27	30.04	70.5	82.3	48.	.....	.....	Fair .....
28	29.97	73.7	86.5	57.5	.....	.....	Fair .....
29	29.93	79.1	87.9	58.	.....	.....	Fair .....
30	29.75	75.6	85.	61.	.....	.....	Fair .....
31	29.62	.....	82.	62.	.....	.....	Cloudy.
Summary	30.01	61.4	87.9	31.5	.....	.....4.22	Fair .....

JUNE, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.65	73.3	79.2	66.2	.....	.....	Clear ...
2	29.96	61.3	66.5	48.	.....	.....	Clear ...
3	30.04	55.	65.	41.5	.....	.....	Clear ...
4	30.09	59.7	69.9	41.	.....	.....	Clear ...
5	30.06	73.2	86.1	39.2	.....	.....	Clear ...
6	29.94	70.8	84.	52.7	.....	.....	Clear ...
7	29.78	71.	84.	57.9	.....	Rainy 04	Clear ...
8	29.75	68.9	77.2	57.	.....	.....	Clear ...
9	29.87	77.5	89.5	52.7	.....	.....	Clear ...
10	29.90	65.9	82.	64.2	.....	Rain 10	Cloudy.
11	30.01	69.	84.7	60.8	.....	Rain 2.00	Fair ....
12	30.16	66.5	76.5	57.8	.....	.....	Clear ...
13	30.07	71.1	82.	57.	.....	.....	Clear ...
14	30.02	71.2	84.5	59.8	.....	.....	Clear ...
15	29.98	74.4	84.5	64.	.....	Rain 1.40	Clear ...
16	29.92	56.2	61.	55.	.....	Rain 12	Cloudy.
17	28.80	51.3	54.	46.9	.....	.....	Cloudy.
18	29.73	47.5	53.	45.	.....	.....	Cloudy.
19	29.83	50.7	58.	43.	.....	Rainy 05	Cloudy.
20	29.96	63.5	72.2	42.2	.....	.....	Clear ...
21	29.96	73.6	88.	46.2	.....	.....	Clear ...
22	29.94	83.3	92.	67.1	.....	.....	Clear ...
23	30.01	77.1	87.	68.8	.....	Rain 43	Clear ...
24	29.93	77.8	86.1	66.	.....	.....	Clear ...
25	29.80	78.7	88.9	67.	.....	Rain 09	Clear ...
26	29.75	80.4	89.	69.8	.....	.....	Clear ...
27	30.08	67.8	81.5	54.8	.....	Rain 05	Cloudy.
28	30.19	71.5	79.2	55.	.....	.....	Clear ...
29	30.18	70.5	78.	50.3	.....	.....	Clear ...
30	30.02	72.6	82.5	50.4	.....	.....	Clear ...
Summary	29.94	68.3	92.	39.2	.....	.....4.28	Clear ...

JULY, 1876.

DATE.	Mean daily pressure.	Thermometer exposed in open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.82	63.8	65.2	60.2	.....	Rain .32	Cloudy.
2	29.79	66.	74.	60.5	.....	Rain 1.00	Clear ...
3	29.94	72.3	85.8	58.9	.....		Clear ...
4	29.91	69.3	77.9	58.8	.....	Rain 1.40	Cloudy.
5	29.96	72.8	84.	.....	.....	Rain 1.66	Clear ...
6	29.88	80.4	88.8	65.	.....		Clear ...
7	29.98	82.1	88.5	70.6	.....		Clear ...
8	29.96	82.2	89.	71.1	.....		Clear ...
9	30.02	77.6	83.1	71.	.....		Cloudy.
10	30.12	74.3	83.4	54.8	.....		Clear ...
11	30.05	77.	86.	60.	.....		Clear ...
12	30.11	80.2	91.	60.	.....		Clear ...
13	30.12	80.1	92.	64.5	.....		Clear ...
14	30.09	75.2	87.5	66.	.....		Fair .....
15	30.12	72.3	81.	66.9	.....	Rain .29	Cloudy.
16	30.08	78.2	88.	63.	.....		Clear ...
17	30.06	82.7	92.8	71.5	.....	Rain 1.13	Clear ...
18	30.17	79.4	87.	68.5	.....		Fair .....
19	29.98	82.8	90.8	68.4	.....		Clear ...
20	30.15	74.6	81.4	64.	.....		Clear ...
21	30.23	76.1	85.	57.	.....		Clear ...
22	30.23	72.7	82.2	56.	.....		Clear ...
23	30.25	62.8	70.5	56.	.....	Rain .16	Fair .....
24	30.25	69.9	79.5	49.5	.....		Clear ...
25	30.18	73.3	81.	47.7	.....		Clear ...
26	30.04	70.9	80.	56.5	.....		Cloudy.
27	29.99	75.1	82.	65.8	.....		Clear ...
28	30.	72.6	82.4	53 5	.....		Clear ...
29	30.07	72.1	82.	57.8	.....	Rain .54	Clear ...
30	30.12	75.3	85.	55.	.....		Clear ...
31	30.12	76.5	86.	57.	.....		Clear ...
Summary	30.06	74.8	92.8	47.7	.....	6.5	Clear ...

AUGUST, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	31.17	75.6	84.3	56.1	.....		Clear ...
2	30.17	74.8	87.	55.	.....		Clear ...
3	30.05	77.1	88.	58.	.....		Clear ...
4	29.99	77.2	81.1	62.2	.....		Clear ..
5	29.91	75.3	61.	88.8	.....	Rain .18	Fair .....
6	30.20	70.7	79.	62.8	.....		Clear ...
7	30.27	72.4	84.9	47.1	.....		Clear ...
8	30.11	77 1	89.8	53.8	.....		Clear ...
9	29.93	76.3	86.5	50.2	.....		Clear ...
10	29.96	68.2	86.1	61.8	.....	Rain .33	Cloudy.
11	30.08	69.3	81.3	52.2	.....	Rain 2.47	Clear ...
12	30.05	78.2	90.5	61.	.....		Clear ...
13	30.02	83.3	93.	69.	.....		Clear ...
14	30.15	70.9	75.8	64.1	.....	Rain .70	Cloudy.
15	30.12	72.9	86.8	59.2	.....		Clear ...
16	30.06	7[illegible].5	90.	59.	.....	Rain 1.86	Cloudy.
17	30.04	78.8	89.5	69.	.....	Rain .94	Fair... ...
18	29.95	77.2	85.7	66.4	.....		Clear ...
19	30.07	74.8	84.	61.2	.....		Clear ...
20	30.19	71.3	78.5	62.	.....		Clear ...
21	30.04	68 5	76.9	60.	.....	Rain .36	Cloudy.
22	29.88	82.5	91.2	71.	.....		Clear ...
23	29.96	79.8	89.2	71.	.....		Clear ...
24	30.11	72.3	86.	65.9	.....		Fair .....
25	30.33	63.6	74.	48.5	.....		Clear ...
26	30.32	64.	76.	45.8	.....		Aurora.
27	30.20	66.4	79.2	46.	.....		Clear ...
28	30.03	69.8	83.	55.5	.....	Rain 1.45	Clear ...
29	29.95	79.1	89.5	69.	.....		Clear ...
30	29.95	79.3	86.2	67.8	.....		Clear ...
31	30.02	71.9	.....	.....	.....		Clear ...
Summary	30.07	74.	93.	45.8	.....	8.29	Clear ...

SEPTEMBER, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN IN INCHES.	KIND OF WEATHER.
1	30.27	61.	69.5	56.6	68.		Clear ..
2	30.23	61.3	72.5	51.4	66.6		Clear ...
3	29.97	73.3	85.	62.	74.9		Clear ..
4	30.10	72.5	82.	66.7	85.		Fair ....
5	29.92	57.8	62.	52.	100.	Rain 2.35	Cloudy.
6	29.86	64.2	67.8	60.	91.9		Cloudy.
7	29.89	73.2	80.9	65.	83.2	Rain ..... .19	Cloudy.
8	29.99	67.1	69.5	65.	94.7	Rain ..... .12	Cloudy.
9	29.89	64.2	65.7	61.3	91.5	Rain 1.96	Cloudy.
10	30.09	56.	60.5	52.1	93.1		Cloudy.
11	30.14	57.5	61.	53.5	90.9		Cloudy.
12	30.18	58.1	63.	52.5	87.5		Cloudy.
13	30.07	57.5	62.	55.	86.2	Rain ..... .27	Cloudy.
14	30.18	56.3	65.	51.	80.		Clear ..
15	30.21	57.5	66.	49.	75.5		Clear ...
16	30.09	61.2	72.	51.	69.2		Clear ...
17	29.99	64.9	75.2	55.2	82.3		Clear ...
18	29.99	65.3	71.8	59.1	86.4	Rain ..... .04	Clear ...
19	29.83	65.8	76.	59.5	82.4	Rain ..... .21	Fair ....
20	29.83	59.2	60.8	57.	88.2		Fair ....
21	30.03	64.3	72.3	57.8	87.8		Clear ...
22	29.99	67.6	81.	55.	83.1		Clear ...
23	30.06	64.3	75.1	57.	73.3		Clear ...
24	30.02	68.7	79.2	58.	83 4		Clear ...
25	30.26	60.9	71.5	51.2	63.7		Clear ...
26	30.38	52.1	62.4	46.	65.1		Clear ...
27	30.20	53.5	67.4	37.3	72.6		Clear ...
28	30.13	50 9	53.7	47.	55.1		Fair ....
29	30.20	43.	50.	38.5	73.9		Fair ....
30	20.27	40.1	43.5	40.1	78.5		Fair ....
Summary	30.07	60.6	85.	32.5	80.5	..... 5.14	Fair ....

OCTOBER, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.24	43.	55.	31.	73.7		Clear ...
2	29.81	56.7	70.5	39.	53.		Clear ...
3	29.95	42.9	48.	40.	47.2		Clear ...
4	29.59	38.5	45.5	31.	71.		Fair ....
5	29.59	44.9	55.7	32.	82.		Fair ....
6	30.02	40.8	47.5	37.9	57 6		Fair ....
7	30.14	45.4	61.5	32.8	59.		Clear ...
8	30.31	39.2	53.3	25.5	67.3		Clear ...
9	29.86	58.6	69.4	42.5	61.		Fair ....
10	30.21	36.5	45.9	30.	56.3		Clear ...
11	30.39	36.3	53.	20.4			Clear ...
12	30.19	48.6	64.	35.9	53.		Clear ...
13	30.03	48.5	54.	43.9	88.		Fair ....
14	30.42	31.4	41.	26.2			Clear ...
15	30.43	33.9	49.	17.8			Clear ..
16	30.05	45.3	63.9	25.			Clear ...
17	30 00	54.2	70.5	33.8	53.5		Clear ...
18	29.90	52.3	68.2	39.9	67.	Rain	Fair ....
19	29.60	54.8	57.	51.5	97.6	Rain ..... .26	Cloudy.
20	29.21	49.	49.2	48.8	100.	Rain ..... .27	Cloudy.
21	29.67	51.3	54.	50.	89.6	Rain ..... .22	Cloudy.
22	29.77	45.5	47.8	43.5	93.3		Cloudy.
23	29.78	46.	55.	33.	82.6		Cloudy.
24	30.01	38.9	41.	37.	63.6		Clear ...
25	30.15	36.8	47.	28.5	70.3		Clear ...
26	30.23	39.1	53.5	24.8			Clear ...
27	29.91	57.9	70.5	39.	65.6		Clear ...
28	29.87	54.5	69.	44.5	85.3		Clear ...
29	29.76	60.4	74.	46.5	69.3		Clear ...
30	29.85	56.4	64.8	49.5	85.6		Clear ...
31	30.08	51.2	60.	40.7	67.5		Clear ...
Summary	29.98	46.4	74.	17.8	71.5	..... .75	Clear ...

NOVEMBER, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.05	39.	44.	32.	.....	Rain and snow 75	Cloudy.
2	29.92	36.3	39.	34.	.....	.....	Cloudy.
3	30.04	38.1	48.3	33.	.....	.....	Clear ...
4	30.14	45.2	51.2	40.4	.....	.....	Cloudy.
5	30.02	45.	48.8	40.7	.....	.....	Cloudy.
6	30.02	31.2	38.	26.4	.....	.....	Clear ...
7	30.20	30.8	42.	20.5	.....	.....	Clear ...
8	30.08	38.1	53.8	27.5	.....	.....	Clear ...
9	30.14	39.1	56.	22.5	.....	.....	Clear ...
10	29.39	45.8	63.5	26.5	.....	.....	Clear ...
11	29.66	46.8	63.5	31.	.....	.....	Clear ...
12	29.93	35.1	38.8	33.	.....	.....	Cloudy.
13	30.43	19.5	21.1	18.	.....	.....	Cloudy.
14	30.38	31.	32.	13.	.....	.....	Clear ...
15	30.15	27.5	38.	14.2	.....	.....	Clear ...
16	30.09	31.	39.	24.	.....	.....	Cloudy.
17	30.11	30.	32.	29.	.....	.....	Cloudy.
18	30.21	18.3	22.	13.	.....	Light snow 02	Cloudy.
19	30.19	28.3	37.8	21.3	.....	.....	Fair .....
20	29.85	31.6	39.2	25.	.....	.....	Fair .....
21	29.98	20.	21.5	18.	.....	.....	Fair .....
22	30.30	24.8	33.	15.5	.....	.....	Fair .....
23	30.23	21.	32.	9.	.....	.....	Fair .....
24	30.08	28.1	32.	23.4	.....	.....	Fair .....
25	30.06	26.9	40.8	17.	.....	.....	Clear ...
26	29.74	27.2	31.	24.	.....	Snow 35	Fair .....
27	29.86	17.2	28.2	10.5	.....	.....	Fair .....
28	30.09	11.1	26.2	—7.	.....	.....	Clear ...
29	30.27	18.5	23.	13.5	.....	Snow 6	Cloudy.
30	30.61	—2.5	—1.8	—2.5	.....	.....	Fair .....
Summary	30.09	29.3	63.5	—7	.....	.....1.72	Fair .....

DECEMBER, 1876.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.61	—2.3	6.5	—1.5	.....	.....	Clear ...
2	30.51	—2.2	11.	—9.8	.....	.....	Clear ...
3	30.59	.2	10.	—13.	.....	.....	Clear ...
4	30.60	6.6	17.	—2.	.....	.....	Clear ...
5	30.16	18.6	38.	—2	.....	.....	Clear ...
6	30.11	24.	34.9	17.8	.....	.....	Clear ...
7	30.	18.6	21.	15.9	.....	.....	Fair.....
8	30.11	—8.1	—4.8	—12.	.....	.....	Cloudy.
9	30.33	—8.2	— 1.	—17.8	.....	.....	Cloudy.
10	29.87	18.3	29.	11.	.....	.....	Cloudy.
11	29.80	34.4	41.8	25.	.....	.....	Clear ...
12	29.69	41.9	54.5	32.5	.....	.....	Clear ...
13	30.03	34.	38.	30.5	.....	.....	Fair.....
14	30.41	20.	9.5	3.	.....	.....	Clear ...
15	30.09	20.	39.	4.	.....	.....	Fair.....
16	30.51	2.2	17.2	—9.	.....	.....	Cloudy.
17	30.37	1.1	3.3	—2.	.....	.....	Cloudy.
18	30.33	6.	16.5	—12.5	.....	.....	Clear ...
19	30.31	9.2	16.5	2.2	.....	.....	Clear ...
20	30.17	13.1	21.	6.5	.....	.....	Fair.....
21	29.85	17.4	24.5	6.7	.....	.....	Cloudy.
22	30.11	10.7	15.8	8.	.....	.....	Cloudy.
23	30.52	1.1	7.	— 5.7	.....	.....	Fair ....
24	30.48	9.1	13.	3.	.....	.....	Cloudy.
25	30.25	17.8	21.4	14.	.....	.....	Cloudy.
26	30.06	4.3	18.	—8.	.....	Snow..... .02	Clear ...
27	30.08	8.8	19.	—5.5	.....	.....	Cloudy.
28	30.22	16.5	23.5	11.5	.....	.....	Cloudy.
29	30.22	—1.	6.	—9.	.....	.....	Clear ...
30	30.17	1.4	9.	—13.3	.....	.....	Fair.....
31	30.18	10.9	15.5	5.2	.....	.....	Fair.....
Summary	30.25	11.1	54.5	— 17.8	.....	..... .02	Fair.....

JANUARY, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.24	— 2.4	4.8	— 9.2	.....	.....	Clear ...
2	30.48	— 6.2	0.	—13.	.....	.....	Clear ...
3	30.33	6.8	10.	1.4	.....	.....	Clear ...
4	29.97	18.6	25.	9.	.....	.....	Cloudy.
5	30.07	24.5	26.5	23.2	.....	.....	Cloudy.
6	29.91	25.2	30.	20.5	.....	.....	Cloudy.
7	30.16	.5	4.5	— 5.	.....	.....	Cloudy.
8	30.26	— 5.2	2.5	—14.3	.....	.....	Fair .....
9	29.75	20.4	25.5	12.4	.....	Snow ..... .05	Cloudy.
10	30.	7.5	18.4	— 6.3	.....	.....	Fair .....
11	30.20	7.	14.	— 2.	.....	.....	Cloudy.
12	30.54	— 5.7	—3.3	—10.	.....	.....	Fair .....
13	30.13	5.7	20.	—11.2	.....	.....	Clear ...
14	29.90	10.5	26.4	— 5.	.....	.....	Clear ...
15	29.90	6.1	12.	— 4.	.....	Snow ..... .40	Cloudy.
16	30.25	—10.1	—1.2	—17.	.....	.....	Clear ...
17	30.33	4.2	17.	—10.2	.....	.....	Clear ...
18	30.54	3.1	11.2	— 5.	.....	.....	Fair .....
19	30.03	1.9	11.	—13.5	.....	.....	Fair .....
20	30.13	2.6	10.	— 4.	.....	.....	Fair .....
21	30.10	18.1	28.	10.	.....	.....	Clear ...
22	30.63	.4	7.2	— 6.	.....	.....	Clear ...
23	30.36	10.5	22.5	— 9.	.....	.....	Clear ...
24	30.63	5.3	14.5	— 1.	.....	.....	Clear ...
25	30.29	14.3	30.	— 3.	.....	.....	Clear ...
26	30.21	25.8	39.	8.5	.....	.....	Clear ...
27	30.37	26.5	34.5	17.	.....	.....	Clear ...
28	30.26	33.4	51.	17.	.....	.....	Clear ...
29	30.22	37.8	46.5	25.5	.....	.....	Cloudy.
30	30.11	42.6	46.5	38.	.....	.....	Cloudy.
31	30.09	39.5	51.5	29.	.....	.....	Clear ...
Summary	30.21	12.	51.5	—17.	.....	..... .45	Fair .....

FEBRUARY, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.16	39.2	50.2	30.	.....	.....	Clear ...
2	30.28	34.9	47.	26.9	.....	.....	Clear ...
3	30.41	34.8	48.5	22.	.....	.....	Clear ...
4	30.38	34.6	45.	23.	.....	.....	Fair .....
5	30.33	36.4	44.2	29.2	.....	.....	Fair .....
6	30.14	38.4	49.	30.2	.....	.....	Clear ...
7	30.21	33.	45.	20.	.....	.....	Clear ...
8	30.34	28.5	32.5	25.	.....	.....	Fair .....
9	30.16	30.2	42.	18.7	.....	.....	Clear ...
10	30.05	42.9	53.7	31.	.....	.....	Clear ...
11	30.37	26.7	33.	21.2	.....	.....	Fair .....
12	30.71	17.9	25.5	5.8	.....	.....	Clear ...
13	30.61	24.6	35.5	14.5	.....	.....	Clear ...
14	30.34	31.8	37.5	26.1	.....	.....	Cloudy.
15	30.25	33.9	37.	31.2	.....	.....	Fair .....
16	30.48	28.9	38.5	16.2	.....	.....	Clear ...
17	30.38	29.8	38.	18.4	.....	.....	Clear ...
18	29.99	44.3	60.	31.7	.....	.....	Clear ...
19	30.39	32.5	41.5	25.	.....	.....	Clear ...
20	30.39	37.	50.	18.	.....	.....	Clear ...
21	29.79	42.6	57.	29.	.....	.....	Clear ..
22	29.63	39.4	46.1	36.	.....	.....	Cloudy.
23	30.04	28.5	32.	25.5	.....	.....	Cloudy.
24	30.24	25.6	31.8	16.	.....	.....	Fair .....
25	30.44	28.5	30.	26.5	.....	.....	Cloudy.
26	30.51	30.1	34.	25.	.....	.....	Cloudy.
27	30.47	30.8	45.	17.	.....	.....	Clear ...
28	30.36	36.9	51.	23.5	.....	.....	Clear ...
Summary	30.28	32.9	60.	5.8	.....	0	Clear ...

MARCH, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.92	36.1	43.5	32.	.....	Snow ..... .05	Cloudy.
2	29.80	22.8	26.5	17.	.....	.....	Fair ....
3	30.05	11.5	16 5	8 5	.....	.....	Fair ....
4	30.26	19.6	26.	14.5	.....	.....	Fair ....
5	30.42	14.7	22.5	8.5	.....	.....	Clear ...
6	30.06	28.2	36.	26 5	.....	.....	Fair ....
7	30.01	12.	13.	11.	.....	Snow ..... .05	Cloudy.
8	30.04	3.8	10.	— 4.	.....	.....	Fair ....
9	30.26	6.	12.	— 4.	.....	.....	Clear ...
10	30.25	15.3	29.	— 6.	.....	.....	Clear ...
11	30.1	30.6	38.	22.	.....	.....	Cloudy.
12	30.20	28.6	30.5	27.5	.....	.....	Cloudy.
13	30.03	33.7	37.5	27.5	.....	.....	Cloudy.
14	30.34	16.8	23.	10.	.....	.....	Clear ...
15	30.13	31.1	38.2	24.2	.....	.....	Fair ....
16	30.13	19.6	25.	12.	.....	.....	Fair ....
17	30.34	20.7	30.	7.2	.....	.....	Fair ...
18	30.15	24.	27.	19.	.....	.....	Fair ....
19	30.07	26.4	32.	21.5	.....	.....	Fair ....
20	29.93	29.	30.	28.	.....	Snow ..... .05	Cloudy.
21	29.96	32.8	43.5	15.2	.....	.....	Clear...
22	29.77	32.7	39.	26.	.....	.....	Cloudy.
23	30.21	17.1	22.	12.3	.....	.....	Cloudy.
24	30.32	22.9	33.5	8.2	.....	.....	Clear ...
25	30.12	32.	42.5	19.5	.....	.....	Clear ...
26	30.07	37.6	50.	28.	.....	.....	Clear ...
27	30.21	34.8	43.5	27.5	.....	.....	Fair ....
28	30.35	38.3	48.	29.	.....	.....	Clear ...
29	30.30	39.3	42.5	34.1	.....	.....	Cloudy.
30	29.94	38.8	39.5	38.	.....	Rain 80	Cloudy.
31	29.53	58.8	70.	44.	.....	Rain 46	Cloudy.
Summary	30.11	26.3	70.	— 6.	.....	..... 1.41	Cloudy.

APRIL, 1877.

DATE.	Mean daily pressure.	Thermometer exposed in open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.01	28.3	33.	25.5	.....	.....	Clear ...
2	30 47	26.9	34.9	17.	.....	.....	Clear ...
3	30.03	38.1	44.8	30.5	.....	.....	Cloudy.
4	29.86	38.5	49.	33.	.....	.....	Clear ...
5	29.91	44.6	57.	32.	.....	.....	Clear ...
6	29.98	50.3	64.	36.	.....	.....	Clear ...
7	29.78	51.7	63.3	39.	.....	.....	Fair ....
8	29.84	48.2	59.5	39.7	.....	.....	Clear ...
9	29.90	45.1	52.	37.7	.....	.....	Fair ....
10	30.14	46.5	50.5	39.4	.....	Rain ..... .20	Cloudy.
11	30.13	51.1	62.2	38.7	.....	.....	Fair ....
12	30.11	52.9	64.5	42.2	.....	.....	Fair ....
13	30.14	50.8	64.	37.	.....	.....	Clear ...
14	30.11	51.3	64.	36.	.....	.....	Clear ...
15	29.93	59.2	73.5	42.	.....	.....	Clear ...
16	29.82	61.1	76.9	44.	64.1	Rain ..... .33	Fair ....
17	29.60	62.4	71.2	55.	73.4	Rain ..... .05	Fair ....
18	29.60	57.8	68.2	51.3	79.6	.....	Cloudy.
19	29.66	49.7	51.5	47.	67.5	.....	Clear ...
20	29.98	53.7	68.2	40.	62.4	.....	Clear ...
21	30.11	57.	65.	46.	55.3	.....	Clear ...
22	30.09	64.5	75.5	50.	58.9	.....	Clear ...
23	30.19	53.8	56.8	51.7	73.3	Rain ..... .08	Clear ...
24	30.38	48.	56.8	38.	57.2	.....	Clear ...
25	30.22	54.5	66.2	43.	52.1	.....	Fair ....
26	30.02	54.	59.	50.	51.9	.....	Cloudy.
27	29.79	38.1	41.2	36.	100.	Rain ..... .50	Cloudy.
28	29.77	31.6	32.	31.	100.	.....	Cloudy.
29	29.97	32.	35.	28.	96.4	.....	Cloudy.
30	30.07	42.2	52.	34.2	67.3	Rain ..... .80	Clear ...
Summary	29.91	48.1	76.9	17.	70.6	..... 1.96	Clear ...

MAY, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.12	48.2	57.5	38.	56.5		Clear ...
2	30.10	41.	45.5	37.	88.5		Cloudy.
3	30.02	51.5	59.5	40.	61.4		Clear ...
4	29.85	54.5	63.5	44.	62.2		Clear ...
5	29.82	55.	64.	47.5	67.6		Clear ...
6	29.88	46.7	48.2	45.5	93.5	Rain	Cloudy.
7	30.00	51.3	55.	44.	74.6	.90	Fair.....
8	30.13	56.2	64.	44.	53.2		Clear ...
9	30.11	63.8	72.	57.	65.8		Clear ...
10	30.08	60.6	68.	52.	59.5		Clear ...
11	30.13	54.9	60.7	50.2	72.7	Rain	Cloudy.
12	30.17	52.1	53.2	50.	95.4	.12	Cloudy.
13	30.11	63.1	70.	56.	66.5		Clear ...
14	30.08	63.7	66.7	58.5	89.1	Rain .05	Clear ...
15	29.95	64.1	66.	63.	92.5	Rain .30	Clear ...
16	29.93	68.6	81.	62.5	75.7	Rain .20	Fair.....
17	29.75	73.3	84.5	67.	70.3	Rain	Fair.....
18	29.98	72.6	76.	68.	79.8	1.30	Fair.....
19	29.88	72.2	77.	67.5	67.4		Clear ...
20	29.61	61.2	66.	55.5	89.6	Rain .60	Cloudy.
21	29.78	63.8	68.5	56.	67.5		Fair.....
22	30.10	56.2	60.5	51.	79.2		Cloudy.
23	30.27	59.7	64.3	53.5	69.6		Fair.....
24	30.27	62.2	70.	50.	49.7		Clear ...
25	30.25	67.4	76.	57.5	59.3		Clear ...
26	30.23	66.	73.	60.	59.3		Fair.....
27	30.16	64.9	70.	58.8	65.7		Fair.....
28	30.12	67.5	72.	61.5	60.8		Fair.....
29	29.87	74.8	83.	65.	59.3		Clear ...
30	29.71	74.3	78.	68.5	74.9	Rain .61	Clear ...
31	29.66	73.6	70.5	65.	79.2	Rain .35	Clear ...
Summary.	30.00	61.4	84.5	37.	71.1	4.43	Fair.....

JUNE, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	29.85	65.1	68.	62.	70.2		Clear ...
2	30.07	65.8	74.8	59.8	56.3		Clear ...
3	30.05	65.4	70.	58.8	59.7		Clear ...
4	29.99	67.	75.	59.5	74.7		Fair.....
5	29.89	67.6	76.5	56.5	72.5		Clear ...
6	29.74	67.2	74.	63.8	79.5	Rain .55	Clear ...
7	29.72	68.3	73.	62.	66.6		Clear ...
8	29.91	57.8	61.	53.5	88.3	Rain .20	Cloudy.
9	30.02	51.5	56.5	44.7	64.2		Clear ...
10	29.89	60.6	72.	50.	67.8		Clear ...
11	29.94	59.3	63.5	54.	69.8		Clear ...
12	29.93	60.2	67.	56.7	82.3	Rain .77	Fair.....
13	30.09	62.1	70.5	52.8	77.8	Rain .10	Fair.....
14	29.96	72.2	78.8	60.	75.5		Fair.....
15	29.97	65.9	71.7	62.	86.1	Rain .07	Fair.....
16	30.13	71.7	76.3	64.	65.6		Clear ...
17	30.04	72.	75.5	65.8	77.9		Clear ...
18	29.96	75.8	80.	72.5	78.5		Fair.....
19	30.10	69.6	75.	59.5	88.6	Rain .75	Fair.....
20	29.93	73.5	87.	65.	85.7	Rain 3.00	Fair.....
21	30.13	71.5	76.	64.	71.4	Rain .12	Clear ...
22	30.10	73.8	80.	67.	70.1		Clear ...
23	29.82	72.8	78.5	67.	70.8		Clear ...
24	29.79	72.1	79.5	64.	75.4	Rain 1.23	Clear ...
25	29.77	67.3	69.5	65.	89.5	Rain .93	Cloudy.
26	30.06	62.9	73.2	63.5	68.9		Clear ...
27	30.14	68.8	73.	64.	80.6	Rain .04	Fair.....
28	30.18	74.6	83.	62.8	74.1		Clear ...
29	29.82	78.5	83.5	73.	78.1		Clear ...
30	29.83	73.5	78.	66.5	48.1	Rain .18	Clear ...
Summary	29.96	67.8	87.	52.8	73.8	7.94	Clear ...

JULY, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.00	71.8	79.5	65.	60 5	Rain..... .54	Clear...
2	29.90	71.6	77.	63.8	69.1	.....	Clear...
3	30.00	78.5	84.3	68.6	69.6	.....	Clear...
4	30.02	83.8	88.5	76.	75.4	.....	Clear...
5	29.99	86.6	91.2	77.5	67.	.....	Clear...
6	30.06	82.6	89.	73.	78.8	.....	Clear...
7	29.99	86.5	91.	80.6	65.2	.....	Clear...
8	30.07	75.3	81.5	68.	85.4	Rain..... .57	Clear...
9	30.08	77.2	82.7	70.5	6 .3	.....	Clear...
10	30.12	69.5	76.	62.5	64.2	.....	Clear...
11	30.20	69.9	77.	59.	65.5	.....	Clear...
12	30.22	70.6	79.	59.2	72.6	.....	Clear...
13	30.14	76.8	84.	68.5	64.4	.....	Clear...
14	29.90	76.7	83.	67.2	72.7	.....	Clear...
15	29.86	77.	79.	75.	71.3	.....	Clear...
16	30.06	72.1	81.2	61.	63.	.....	Clear...
17	30.02	72.2	82.	67.	77.1	Rain..... .08	Clear...
18	29.99	63.4	67.	62.	71.1	.....	Clear...
19	30.01	58.8	62.	54.5	82.5	.....	Fair....
20	30.14	64.3	71.	55.	71.5	.....	Fair....
21	30.24	71.5	80.	60.	60.1	.....	Clear...
22	30.27	75.6	85.	64.	58.5	.....	Clear...
23	30.34	75.2	83.	67.2	62.3	.....	Clear...
24	30.20	76.6	86.	67.	63.9	.....	Clear...
25	30.00	81.9	91.8	71.	62.4	.....	Clear...
26	29.88	75.1	83.	70.	78.5	.....	Cloudy.
27	29.91	74.8	85.5	68.	80.6	.....	Clear...
28	30.06	74.5	79.	68.5	67.5	Rain..... .50	Clear...
29	30 07	77.2	86.	67.	70.1	.....	Clear...
30	30.03	75.4	83.5	66.5	68.6	.....	Clear...
31	29.98	69.7	73.	65.2	87.	Rain..... .....1.91	Clear...
Summary	30.05	74.6	91.8	54.5	70.	..... 3 60	Clear...

AUGUST, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.09	78.	84.5	68.5	75.9	.....	Clear ...
2	30.29	72.3	78.5	64.	64.8	.....	Clear ...
3	30.19	74.7	83.7	65.	66.1	.....	Clear ...
4	30.16	73.5	82.	64.5	71.3	.....	Clear ...
5	30.07	75.1	84.	65.5	66.5	.....	Clear ...
6	29.94	77.6	85.8	68.	64.9	Rain..... 1.20	Clear ...
7	30.00	74.3	82.3	63.5	66.7	.....	Clear ...
8	29.98	73.1	80.	66.5	67.9	.....	Clear ...
9	30.05	68.8	75.	61.	72.6	.....	Clear ...
10	29.99	70.9	77.2	64.5	81.1	.....	Fair.....
11	29.97	75.7	82.2	67.	82.4	Rain..... .38	Fair.....
12	30.04	73.4	79.5	68.	69.7	.....	Clear ...
13	30.03	66.0	71.5	60.	77.	.....	Clear ...
14	30.10	67.1	75.	57.2	69.1	.....	Clear ...
15	30.09	70.8	78.4	60.5	68.2	.....	Clear ...
16	30.04	71.9	85.7	60.	71.2	.....	Clear ...
17	30.06	70.5	82.	60.5	75.3	.....	Clear ...
18	30.14	71.8	86.	57.5	74.8	.....	Clear ...
19	30.11	72.5	81.	63.	69.9	.....	Clear ...
20	29.96	72.9	84.2	62.5	75.3	.....	Clear ...
21	29.93	62.6	68.5	58.5	76 2	Rain..... .53	Clear ...
22	30.06	62.8	73.5	51.	71.3	.....	Clear ...
23	30.06	66.	78.	53.	71.7	.....	Clear ...
24	30.09	69.6	81.8	61.	67.6	.....	Clear ...
25	29.97	69.	76.	64.	70.5	.....	Clear ...
26	29.91	73.	80.	65.	73.5	.....	Clear ...
27	30.12	69.4	72.	66.	95.7	Rain..... .25	Cloudy.
28	30.15	69.	71.	66.	94.9	.....	Cloudy.
29	30.21	72.8	80.5	66.	81.9	Rain..... 4.12	Cloudy.
30	29.98	78.1	85.	69.5	74.7	.....	Fair.....
31	30.01	74.	80.5	68.	79.2	.....	Clear ...
Summary	30.06	71.5	86.	51.	73.8	..... 6.48	Clear ...

SEPTEMBER, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.22	58.8	66.	53.5	73.		Clear...
2	30.24	59.	70.	50.	73.		Clear...
3	30.12	62.5	75.	50.	65.		Clear ..
4	30.02	67.6	79.	57.5	72.		Clear...
5	30.10	66.2	78.3	55.5	74.		Clear...
6	30.24	64.2	74.	55.5	80.		Clear...
7	30.23	61.8	73.5	56.	81.		Clear...
8	30.04	66.	76.	56.5	80.		Clear...
9	29.88	61.1	63.	58.5	90.	Rain. .20	Fair.....
10	29.98	63.7	74.	55.	86.		Clear...
11	29.95	64.2	77.5	51.2	78.		Clear...
12	29.97	73.6	84.	62.	78.		Clear. .
13	30.05	74.5	89.5	67.	75.		Clear...
14	29.81	69.6	70.	69.	93.	Rain. .70	Fair.....
15	29.87	63.5	74.	56.5	70.		Clear...
16	30.08	59.5	64.5	56.5	82.		Fair.....
17	30.27	52.	64.	41.	61.		Clear...
18	30.13	58.5	72.	43.	64.		Clear...
19	30.03	65.6	79.	51.	63.		Clear ..
20	30.11	61.6	75.	51.	59.		Clear...
21	30.12	62.8	75.3	48.5	71.		Clear...
22	29.95	68.8	83.5	55.	66.		Clear...
23	30.06	60.3	64.	54.	92.		Fair. ...
24	30.05	70.8	81.	58.	71.		Clear...
25	30.03	70.1	83.	63.	74.	Sprinkle	Clear...
26	29.95	66.	76.	58.	78.		Clear...
27	30.03	64.5	80.	50.5	77.		Clear...
28	30.11	70.	82.	56.5	74.		Clear...
29	29.94	72.	84 5	58.5	71.		Clear...
30	29.90	70.2	83.	60.	73.	Sprinkle	Clear...
Summary	30.05	63.9	89.5	41.	75.	.90	Clear...

OCTOBER, 1877.

DATE.	Mean daily pressure.	Thermometer exposed to open air.	Maximum temperature.	Minimum temperature.	Relative humidity.	AMOUNT OF RAIN OR SNOW IN INCHES.	KIND OF WEATHER.
1	30.05	62 8	69.	55.	81.		Cloudy.
2	29.96	67.9	76.	59.3	82.		Clear...
3	29.95	50.	55.	45.5	93.	Rain .37	Cloudy.
4	30.22	42.6	52.	33.	83.		Clear...
5	30.25	41.8	52.	40.	80.		Clear...
6	30.29	48.9	59.2	33.5	71.		Cloudy.
7	30.05	49.5	55.5	46.	90.		Clear...
8	30.05	44.6	56.	40.	81.		Clear...
9	30.12	46.8	48.5	45.	89.	Rain .42	Cloudy.
10	30.32	45.6	57.	36.	77.		Clear...
11	30.26	45.4	60.3	29.	75.		Clear...
12	29 90	51.4	59.	47.3	88.	Rain .14	Cloudy.
13	29.88	61.3	69.	54.	93.		Fair.....
14	29 97	63.	69.5	57.5	77.	Rain .34	Fair.....
15	30.30	43.4	48.2	37.	84.		Cloudy.
16	30.15	44.6	46.8	42.	100.	Rain .42	Cloudy.
17	30 09	47.2	49.2	44.	92.		Cloudy.
18	30.04	49.1	50.3	47.	100.		Cloudy.
19	30.03	49.	50.5	47.5	87.	Rain .56	Cloudy.
20	30.16	39.1	41.	36 2	91.	Rain .60	Cloudy.
21	30.16	41.1	49.8	30.	74.		Clear...
22	30.07	50.2	65.2	35.5	61.		Clear...
23	29.95	53.	66.	41.	68.		Clear...
24	29.89	59.3	71.	50.	59.		Clear...
25	29.87	50.6	61.5	38.	88.		Clear...
26	29.85	50.3	51.	49.	97.		Clear...
27	29.94	51.	59.	47.	73.	Rain .18	Fair.....
28	29.88	42.2	45.	40.	93.	Rain .11	Cloudy.
29	30.36	39.6	49.	31.	71.		Clear...
30	30.20	38.5	45.5	31.	82.		Clear...
31	30.12	37.7	47.	28.2	71.		Clear...
Summary	30.08	48.7	69.5	28.2	82.7	3.14	Cloudy.

SUMMARY

From November, 1875, to November, 1876

MONTHS.	Mean pressure.	Mean temperature.	Highest temperature.	Lowest temperature.	Rain-fall in inches.	Days clear.	Days fair.	Days cloudy.
November	29.78	25.1	69.3	—15.	0.5	18	1	11
December	30.01	27.2	57.2	—14.	1.15	8	8	15
January	30.13	15.8	47.	—12.	2.20	16	4	11
February	30.08	29.9	59.	—10.	.40	19	3	7
March	30.09	28.7	48.	—10.	2.00	14	4	13
April	30.10	48.1	.....	.....	1.5	2	17	11
May	30.01	61.4	87.9	31.5	4.22	3	17	11
June	29.94	68.3	92.	39.2	4.28	23	1	6
July	30.06	74.8	92.8	47.7	6.5	23	3	5
August	30.07	74.	93.	45 8	8.29	24	3	4
September	30.07	60.6	85.	32.5	5.14	15	6	9
October	29.98	46.4	74.	17.8	.75	20	6	5
Summary	30.02	46.7	93.	—15.	36.93	185	73	104

SUMMARY

From November, 1876, to November, 1877.

November	30.09	29.3	63.5	— 7.	1.72	11	9	10
December	30.25	11.1	54.5	—17.5	.02	13	7	11
January	30 21	12.	51.5	—17.	.45	16	6	9
February	30.28	32.9	60.	5.8	.0	17	6	5
March	30.11	26.3	70.	— 6.	1.41	9	11	10
April	29.91	48.1	76.9	17.	1.96	16	7	7
May	30.00	61.4	84.5	37.	4.43	15	8	8
June	29.96	67.8	87.	52.8	7.94	18	9	3
July	30.05	74.6	91.8	54.5	3.60	28	2	1
August	30 06	71.5	86.	51.	6.48	25	3	4
September	30.05	63.9	74.5	52.	.90	26	4	0
October	30.08	48.7	67.9	37.7	3.14	16	3	12
Summary	30.08	45.6	91.8	—17.5	32.05	210	75	80

SUMMARY FOR 1876.

	30.07	45.7	93.	—17.5	37.02	183	80	99

ON INJURIOUS FUNGI.

THE BLIGHTS, (*Erysiphei.*)

By C. E. BESSEY.

The Blights (*Erysiphei,*) constitute a quite well marked group of microscopic fungi. All are parasitic upon plants, generally affecting the leaves of their hosts, in some cases, however, attacking the young fruits and stems. Although usually not so violently hurtful as some other fungi, their abundance, and the rapidity of their multiplication, enable them to become frequently quite fatal in their attacks upon vegetation. No less than fifty different species of plants, many of which are of high value to us, are the hosts of the Blights already known in this country.

The group has been a difficult one to study, on account of the scattered condition of the literature of the subject; to many descriptions it has been utterly impossible for more than a very few people to obtain access. It has consequently happened that comparatively little attention has been given to our species, and in such work as has been done, without any doubt, species have in some cases, been re-described and re-named, in ignorance of the work previously done.

This paper is presented as a contribution to the literature of the group; it includes an enumeration of the species (except some doubtful Schweinitzian ones) known to us to have been catalogued, with descriptions of all but three. It will be observed that some of the descriptions are very meager, and that in no case are the original ones as complete as they should be.

No attempt has been made to revise or correct the descriptions, but they are printed as found; and where material at our command enabled us to describe more fully, such descriptions have been separately given. References to English descriptions (the same as here printed) are given in order that those who have the opportunity, may verify and extend our work. In this we have followed the valuable paper, by Cooke and Peck, on the *Erysiphei of the United States*, published in 1872.

No attempt has been made to determine questions of synonomy, and undoubtedly many species are here introduced under two or more names. Any effort made to reduce the number of names without full and authentic specimens of all the described species, would only result in increasing the confusion which already exists. It will be far better for North American Mycology, if in all its departments, the present names of species are retained until the needed changes and reductions can be made with an abundance of specimens in hand.

The two accompanying plates were drawn directly upon stone by the aid of the camera lucida; they not only show the characteristics of the particular species they represent, but also serve to illustrate generic differences.

The papers referred to in the following pages, are:

1. The Erysiphei of the United States, by M. C. Cooke, M. A., and C. H. Peck, in the January number of the *Journal of Botany*, for 1872.

2. Supplementary Notes on the Erysiphei of the United States, by M. C. Cooke, M. A., and C. H. Peck, in the June number of the *Journal of Botany* for 1872.

3. Notices of North American Fungi, by the Rev. M. J. Berkeley, M. A., F. L. S., in *Grevillea*, Vol. V, 1876.

4. Report of the botanist, C. H. Peck, in the twenty-fifth, twenty-sixth, and twenty-eighth Reports of the New York State Museum of Natural History.

5. Various papers in the *Bulletin of the Torrey Botanical Club*, Vols. IV, V and VI.

6. A List of Fungi found in the Vicinity of Boston, by Dr. W. G. Farlow, in the *Bulletin of the Bussey Institution*, Vol. I.

7. Handbook of British Fungi, by M. C. Cooke, M. A., London, 1871.

8. Outlines of British Fungology, by the Rev. M. J. Berkeley, M. A., F. L. S., London, 1860.

A few other references are given in full in the text.

NOTE.—All measurements are given in decimals of a millimeter; for conversion to inches 1 mm. = .03937 inches.

ERYSIPHEI.

KEY TO GENERA.

A. Perithecium containing a single ascus.
- Appendages floccose - - - *Sphærotheca.*
- Appendages dichotomous. - - - *Podosphæra.*

B. Perithecium containing many asci.
- Appendages needle-shaped, rigid. - *Phyllactinia.*
- Appendages hooked - - - *Uncinula.*
- Appendages dichotomous. - - *Microsphæria.*
- Appendages floccose. - - - *Erysiphe.*
- Appendages none. - - - *Erysiphella.*

SPHÆROTHECA, Lev.

Mycelium arachnoid: perithecia globose, containing a single globose ascus; appendages numerous, floccose. *Berk. Outl., p.* 404.

1. S. pannosa, Lev. Mycelium thickened, woolly, felted, persistent; perithecia minute, globose, scattered; appendages floccose, white; ascus many-spored.—*Cooke. Handbook, p.* 645.

Found on the stem, leaves and fruit of wild Gooseberry. The brown mycelium so abundant as to form thick felted masses .5 to 1 mm. in thickness, covering up and obscuring the short and delicate appendages; perithecia .085 mm. in diameter; spores 7.—(Plate II. Figs. 33 and 34.)

Although this species has not been observed by us on anything but wild gooseberries, from its habits we should expect it to prove quite harmful, when once brought into contact with the cultivated varieties.

2 S. Castagnei, Lev. Amphigenous; mycelium effuse, web-like, commonly evanescent; perithecia minute, (.131 mm.) scattered, globose; appendages numerous, short, flexuose above; ascus many-spored.—*Cooke. Handbook, p.* 645.

On Bidens frondosa, Taraxacum, and Spiræa opulifolia. *Farlow.*

3 S. pruinosa, C. & P. Amphigenous; mycelium effused, arachnoid, sub-persistent; perithecia minute, globose, scattered; appendages few, interwoven, colorless; spores .017 to .020 mm. by .010 mm.—*Cooke and Peck. Erysiphei of the United States.*

On leaves of Rhus glabra.—*Peck.*

4. S. Mors Uvæ, B. (*Schwein.*)

We have no description of this species. Berkeley in *Notices of N. A. Fungi.* determines Curtis' No. 5416, on grapes, to be this species, with simply the remark that the spores are .105 mm. long.

PODOSPHÆRA, Kunze.

Mycelium effuse, web-like, evanescent; perithecia spherical, containing one sub-globose eight spored ascus; spores ovate: appendages few, dichotomous, thickened at their extremities, hyaline.—*Cooke. Handbook, p.* 647.

5. P. Kunzei, Lev. Amphigenous; perithecia minute, scattered, globose; appendages three times the length of the diameter of the perithecia.—*Cooke. Handbook, p.* 647.

Abundant on the leaves of Cherries, and seedling Apples, frequently producing much injury.

Perithecium dark-brown, almost black, .09 to .11 mm. in diameter, finely and irregularly reticulated; appendages .11 to .27 mm. long, about eleven, septate, thick, brown or fuliginous in basal half of their length, the remainder hyaline, dichotomously 3 to 4 times branched; ascus ovate, .07 by .06 mm., with thick hyaline walls, a thin spot at each end; spores light yellow, .025 by .014 mm. (Plate I. Figs. 1 to 8.)

In the year 1871 the seedling apple trees in the College nursery were greatly injured by this species. It covered the leaves with a white mold-like growth, and so injured them that the trees made but very poor growth during the season. We have observed that this fungus does not come to perfection so frequently upon the young apple trees, as upon the cherry, though it does fully as much injury. Upon the cherry the *conidial* stage (*Oidium*) appears to continue for but a short time, while on the apple it persists for a long time: it is in fact difficult to find perithecia upon leaves of the latter. This may indicate that originally it did not inhabit the apple.

6. P. biuncinata, C. & P. Epiphyllous: perithecia globose, minute, scattered; appendages 6 to 10, from three to five times as long as the diameter of the perithecia, furcate at the tips, and uncinate, extremities obtuse, ultimate ramuli rarely sub-divided.—*Cooke and Peck. Erysiphei of U. S.* 2.

On leaves of Witch Hazel.—*Peck.*

7. P. minor, Howe. Perithecia scattered, or crowded; appendages 10 to 20, as long or a little longer than the diameter of the perithecia.—*Howe, in Bull. Torrey Bot. Club, Vol. V, p.* 3.

On leaves of Spiræa.—*Howe.*

PHYLLACTINIA, Lev.

Perithecia hemispherical, at length depressed, seated on a persistent or evanescent membranaceo-granular receptacle. appendages straight, rigid, acicular, at length bent back.—*Berk. Outl., p.* 404.

8. P. guttata, Lev. Amphigenous: mycelium web-like, often evanescent; perethecia large, scattered, hemispherical, at length depressed; appendages hyaline, rigid, simple; asci 4 to 20, containing 2 to 4 spores.—*Cooke. Handbook, p.* 646.

On leaves of many trees.

This species was found in great abundance, in November, 1877, on the under surface of the leaves of Ironwood (*Ostrya*).—(Plate II. Figs. 28, 29 and 30). A careful examination of the leaves of Hazel growing in the same place, failed to discover any of this fungus on them.

9. P. Candollei, Lev.

We have no description of this species. Berkeley refers Curtis' specimen No. 6164, from Canada, to this species without comment, description or habitat, in *N. A. Fungi.*

UNCINULA, Lev.

Mycelium floccose; perithecia globose; appendages rigid, simple, bifid or dichotomous, uncinate, at length bent upwards.—*Berk. Outl., p.* 404.

10. U. Bivonæ, Lev. Mycelium arachnoid, evanescent; perithecia generally scattered, minute; asci 4, sub-globose, with 2 spores; appendages 10 to 20, a little longer than the diameter of the perithecia, simple, uncinate. *Cooke and Peck. Erysiphei of U S.* 6.

On leaves of Elm.—*Peck.*

11. U. macrospora, Pk. Mycelium effused, persistent; perithecia subglobose; appendages numerous, thirty or more, about equal in length to the diameter of the perithecium; asci 8 to 12; spores two, very large, elliptical, .03 to .038 mm. long.—*Peck. Twenty-fifth Rept. N. Y., Mus. Nat. Hist., p.* 96.

On leaves of Elm trees.—*Peck.*

12. U. intermedia, B. & C. Perithecia situated in broad, white spots, black, surrounded by numerous appendages, (more than 30) which are spiral at the apices; spores three, elliptic.—*Berkeley. Notices of N. A. Fungi,* 995.

On leaves of Elm.—*Berkeley.*

13. U. adunca, Lev. Mycelium variable; perithecia scattered or gregarious, minute; appendages simple; asci 8 to 12, sub-pyriform, containing four spores.—*Cooke. Handbook, p.* 646.

On Willow.—*Farlow.*

14. U. heliciformis, Howe. Mycelium obscure; perithecia scattered, minute, globose; appendages 15 to 30, once or twice the length of the diameter of the perithecia, spirally coiled above, colored at base; asci 4 to 6, with 3 to 6 spores.—*Bulletin of Torrey Bot. Club, Vol. V, p.* 4.

On leaves of Populus balsamifera.—*Howe.*

15. U. Ampelopsidis, Pk. Amphigenous; mycelium web-like, thin, evanescent; perithecia minute, globose, black; appendages 10 to 20, in length once or twice the diameter of the perithecium, simple, obscurely septate toward the base, colored, a little paler at the tips; asci 4 to 6, subglobose or ovate, containing 4 to 6 spores.—*Twenty-fifth Rept. N. Y. Mus. Nat. Hist., p.* 96.

On Virginia Creeper.—*Peck.*

16. U. subfusca, B. & C. Perithecia seated on mealy spots; appendages about 16, more than twice as long as the diameter of the perithecia, brownish below, almost spirally twisted at the apex; asci short; spores about six.—*Berkeley. Notices of N. A. Fungi.* 994.

On Virginia Creeper.—*Berkeley.*

It is highly probable that this is the same plant previously described by Peck as *U. Ampelopsidis,* (No. 15.)

17. U. Clintonii, Peck. Amphigenous; mycelium thin, persistent; perithecia small, globose, black; appendages fifteen to twenty-five, about equal in length to the diameter of the perithecium, colorless, slightly thickened toward the uncinate-coiled tips; asci 4 to 6, containing 4 to 6 spores. *Peck. Twenty-fifth Rept. N. Y. Mus. Nat. Hist., p.* 96.

On Basswood leaves.—*Peck.*

18. U. spiralis, B. & C. Perithecia dark brown; appendages long, flexuous, with two spiral turns at the apex; spores about 6, rather narrow, elliptic.—*Berkeley. Notices of N. A. Fungi.* 992.

On grape leaves.—*Berkeley.*

Perithecium .07 to .12 mm. in diameter; appendages 15 to 32, from three to five times as long as the diameter of the perithecium, septate, occasionally branched, brownish at base, hyaline at the tip; asci from 4 to 8, more frequently 6; spores generally 6.—*Farlow. Bull. Bussey Inst. Vol. II, p.* 110.

This fungus is the one which, under the name of *Oidium Tuckeri,* has done a good deal of injury to cultivated grapes. Dr. Farlow has, however, shown that it is doubtful whether we can properly apply the latter name to this *Uncinula,* although the conidial stages are "practically indistinguishable." He says, "whether or not it is precisely the same thing, can never be known until European botanists have found out to what perithecial form their own grape mildew belongs. ** What is called *Oidium Tuckeri* in this country is nothing more than the conidia of *Uncinula spiralis,* and we have repeatedly received specimens bearing the former name, which had

been exhibited at horticultural meetings, and learnedly explained, without the slightest reference to the abundant perithecia, which clearly showed the species to be *Uncinula spiralis.*"—*Bull. Bussey Inst. Vol. V, pp.* 111 and 112.

We have not yet detected this fungus on the grape in Iowa.

19. U. Americana, Howe. Mycelium web-like, evanescent; perithecia minute, globose, scattered; appendages colored, simple, numerous, 3 to 6 times longer than the diameter of the perithecia; asci 4 to 6 ellipsoid, pedicillate, with 4 to 6 spores.—*Erysiphei of U. S. Supp.*

On leaves of Grape.—*Howe.*

Cooke and Peck say of this species that "it seems to be the same" as the one just above (No. 18). We are not prepared to determine the question of priority in case No. 18 and No. 19 are shown to be identical, as they appear to us to be.

20. U. parvula, C. & P. Hypophyllous; mycelium effused, delicate, evanescent; perithecia scattered, globose, minute; appendages simple, numerous, scarcely as long as the diameter of the perithecia; asci elliptical, rostrate; spores 6.—*Cooke and Peck. Erysiphei of U. S. Supp.*

On Hackberry leaves.—*Peck.*

21. U. geniculata, Gerard. Hypophyllous; mycelium in roundish spots or sometimes covering nearly the whole surface, persistent; perithecia .1 mm. in diameter; appendages 30 to 40, one and a half times the length of the diameter of the perithecia; asci 5 to 8, ovate, rostrate; spores 6. The appendages have a tendency to become angularly bent, whence the specific name.—*Gerard. Bull. Torrey Bot. Club, Vol. IV, p.* 48.

On Red Mulberry.—*Gerard.*

22. U. circinata, C. & P. Amphigenous; mycelium effused, evanescent or sub-persistent; perithecia large, sub-globose, scattered or crowded; asci 8 to 16, narrowly ovate, 8-spored; appendages numerous, simple, as long as the diameter of the perithecia, circinate at the apex.—*Cooke and Peck, Erysiphei of U. S.* 8.

Perithecia brown, large, .18 mm. in diameter; asci 20 to 22; spores 8. (Plate I, Figs. 16, 17, and 18.)—Very abundant on the lower surface of leaves of Silver Maple, at Ames. We have not yet observed whether this fungus produces much injury or not; its great abundance would, however, render it probable that it does a good deal of harm to our Maple trees, especially when they are young.

23. U. Wallrothii, Lev. Amphigenous; mycelium web-like, evanescent; perithecia minute, scattered; asci 12 to 16, pear-shaped, 6-spored; appendages numerous, twice the length of the diameter of the perithecia.—*Cooke. Handbook, p.* 647.

On Virginia Creeper.—*Howe in Erysiphei of U. S.*

24. U. polychæta, B. & C. Amphigenous; mycelium effused, arachnoid, evanescent or sub-persistent; perithecia scattered, globose; appendages very numerous, not longer than the diameter of the perithecia, simple, uncinate.—*Erysiphei of U. S.* 9.

On leaves of Hackberry.—*Curtis.*

In *Notices of N. A. Fungi*, Berkeley describes this species in the following terms, viz: "Perithecia scattered; appendages abont 28, one and a half longer than the diameter of the perithecia, hyaline."

24. U. flexuosa, Peck in *Trans. Albany Inst. (Vol. VII?)*

We have no description of this species at hand, not having access to the Transactions in which it was published. From the 26th *Rept. of the N. Y. St. Mus. Nat. Hist.* we learn that "the wavy flexuous appendages are peculiar to this species, and with its more numerous spores separate it from *U. adunca*, to which it is sometimes referred." From *Am. Naturalist, Vol. VII, p.* 58, it appears that the appendages are "less than thirty" and of a white color.

On leaves of Horse Chestnut.—*Peck.*

MICROSPHÆRIA, Lev.

Mycelium arachnoid; appendages straight, dichotomous; branchlets swelling at the tip, or filiform.—*Berk. Outl., p.* 404.

25. M. Mougeotii, Lev. Amphigenous; mycelium web-like, persistent; perithecia minute, scattered or gregarious, globose, at length depressed; appendages loosely dichotomous asci 12 to 16, on a short pedicel, 2-spored.—*Cooke. Handbook, p.* 649.

On Tick Treefoil.—*Berkeley.*

26. M. divaricata, Lev. Hypophyllous; mycelium arachnoid, evanescent; perithecia scattered, globose, minute; asci 4, ovate, rostrate; spores 4; appendages few, five times and upward, the length of the diameter of the perithecia ["sporangia" in text].—*Cooke and Peck. Erysiphei of U. S.* 10.

On Alder; on the authority of Schweinitz. The editors of *Erysiphei of U. S.* say of this species that it "requires comfirmation."

27. M. Hedwigii, Lev. Hypophyllous; mycelium web-like, evanescent; perithecia minute, globose, scattered; appendages few, very little longer than the diameter of the perithecia; asci 4, ovate, containing 4 spores.—*Cooke. Handbook, p.* 648.

On Elder.—*Farlow.*

28. M. semitosta, B. & C. Mycelium sparing; appendages forked three times, more than twice as long as the diameter of the perithecia, abruptly brown at the base; spores 4.—*Berkeley. Notices of N. A. Fungi.*

Cooke and Peck in *Erysiphei of U. S.* described this species from a figure in *Berk. Introd.* p. 278, as follows: "Perithecia globose; asci pyriform, 4-spored; appendages few (about 6), not exceeding the diameter of the perithecia, 3 to 4 times dichotomously branched above."

On Button-Bush.—*Curtis, in Catalogue of the Plants of North Carolina.*

29. M. Dubyi, Lev. Amphigenous; mycelium effused, interwoven, evanescent or sub-persistent; perithecia scattered or gregarious, globose, minute; asci 4, ovate, 4-spored; appendages few (7 to 10) scarcely longer than the diameter of the perithecia, ramuli bicornute.—*Cooke and Peck. Erysiphei of U. S.* 20.

On Honeysuckle.—*E. C. Bolles.*

30. M. Russellii, Clinton. Amphigenous; mycelium arachnoid, evanescent; appendages 8 to 18, very long, flexuous, colored, paler toward the tips, which are simple, or one to three times divided; asci ovate, 4 to 8; spores 4, elliptical .017 to .02 mm. long. *Twenty-sixth Rept. N. Y. State Mus. Nat. Hist.*

On Oxalis.—*Farlow.*

31. M. holosericea, Lev. Amphigenous; mycelium arachnoid, evanescent; perithecia minute, globose, scattered or gregarious; appendages 12 to 16, many times as long as the diameter of the perithecia, vaguely dichotomous, setulose at the tips, or slightly incrassated; asci 4 to 8; spores 4 (rarely 5).—*Cooke and Peck. Erysiphei of U. S. Supp.*

On Milk Vetch.—*Peck.*

32. M. Platani, Howe. Mycelium evanescent; perithecia minute, globose, scattered; appendages 10 to 18, longer than the diameter of the perithecia, tips of the ramuli strongly curved; asci 4 to 5; spores 4 to 5.—*Bulletin Torrey Bot. Club, Vol. V, p.* 4.

On leaves of Buttonwood.—*Howe.*

33. M. abbreviata, Pk. Mycelium thin; perithecia small; appendages 6 to 15, hyaline, rough, shorter than the diameter of the perithecia, many times dichotomous at the tips, the ultimate ramuli curved; asci 3 or 4; spores 3 to 5, mostly 4, large, .025 to .033 mm. long by .0167 mm. broad.—*Twenty-eighth Rept. N. Y. Mus. Nat. Hist., p.* 64.

On Oak leaves.—*Clinton.*

34. M. Symphoricarpi, Howe. Mycelium effused, sub-persistent; perithecia, scattered or crowded; appendages 8 to 16, 2 to 4 times the length of the diameter of the perithicia, 3 to 5 times dichotomous, ramuli divaricate, tips variable, often truncate, never curved; asci 4 to 6; spores 3 to 5.—*Bull. Torrey Bot. Club, Vol. V, p.* 3.

On Snowberry.—*Howe.*

35. M. Menispermi, Howe. Mycelium webby, effused, often evanescent; perithecia, scattered or gregarious, minute, globose; appendages 10 to 20, about as long as the diameter of the perithecia; asci 5 to 6; spores 3 to 6. —*Bull. Torrey Bot. Club, Vol. V, p.* 3.

On Moonseed.—*Howe.*

36. M. diffusa, C & P. Amphigenous; mycelium arachnoid, evanescent; perithecia minute, globose, scattered; asci 4 to 6 ovate; spores 4 to 6; appendages rather numerous, (18 to 25) twice the length of the diameter of the perithecia, about four times dichotomously branched above; ramuli lax, tips obtuse, not swollen.—*Cooke and Peck. Erysiphei of U. S.* 17.

On Tick Treefoil.—*Peck.*

37. M. pulchra, C. & P. Amphigenous; mycelium effused, arachnoid, evanescent, or sub-persistent; perithecia globose, crowded or scattered; asci 4 to 6; spores 4 to 6; appendages 10 to 20, nearly twice as long as the diameter of the perithecia, four times dichotomously branched above, apices swollen.—*Cooke & Peck. Erysiphei of U. S.* 14.

On Dogwood.—*Farlow.*

38. M. Viburni, Howe. Mycelium web-like; perithecia scattered, globose; appendages less than 20, longer than the diameter of the perithecia, dichotomously branched, the tips slightly or much curved; asci 6 to 10; spores usually 6, (*M. sparsa*, Howe).—*Bull. Torrey Bot. Club, Vol. V, p.* 43.

On Sheepberry.—*Howe.*

39. M. Friesii, Lev. Amphigenous; mycelium arachnoid, fugacious or persistent; perithecia minute, globose, scattered or crowded; asci 4 to 6, ovate; spores 5; appendages few (4 to 8), not exceeding the diameter of the perithecia.—*Cooke & Peck. Erysiphei of U. S.* 15.

Perithecia rather coarsely reticulated, .09 mm. in diameter; appendages 6 to 15, mostly about 10, .077 to .11 mm. long; asci (observed) 4 to 7; spores 6. (Plate I, Figs. 9 to 15.)

This Blight is the one which occurs so generally upon the leaves of the Lilac, covering them at first with a white mould-like growth, which soon becomes of a darker color from the dust which it gathers. This earlier growth consists of white threads (hyphæ) from which vertical conidia-bearing branches are sent up, looking not greatly unlike Fig. 19 of Plate I. This is termed the conidial or *Oidium* stage, and in it, doubtless, the greatest injury is done to the plant upon which it grows. After a while, when the growth of conidia becomes somewhat less, there may be observed at first the young, light-yellow perithecia, which become darker with age, until at maturity they are nearly black. At any time during the autumn months the perithecia may be readily observed, for there is scarcely a Lilac shrub to be found, which is not discolored and rendered more or less unsightly by this fungus. Our observation has shown that the Persian Lilac is not so badly affected as the common species. As this fungus is not found in Europe, although the Lilac is largely grown there, it would be interesting to inquire from whence our plants received this parasite.

40. M. extensa, C. & P. Epiphyllous; mycelium arachnoid, sub-persistent; perithecia minute, globose, scattered; asci 4, ovate; spores 4 to 8; appendages 8 to 12, four times as long as the diameter of the perithecia, 4 to 5 times dichotomously branched above, tips of the ultimate ramuli swollen.—*Cooke and Peck. Erysiphei of U. S.* 11.

On leaves of Red Oak.—*Peck.*

41. M. Vaccinii, C. & P. Amphigenous; mycelium arachnoid, evanescent; perithecia globose, scattered; asci 6 to 8; spores 6 to 8; appendages rather numerous, (12 to 20) 4 to 6 times as long as the diameter of the perithecia; 3 to 4 times dichotomously branched above, tips swollen.—*Cooke and Peck. Erysiphei of U. S.* 16.

On low Blueberry.—*Peck.*

42. M. Grossulariæ, Lev. Amphigenous; mycelium web-like, fugacious or persistent; perithecia scattered or gregarious, globose, minute; appendages 10 to 15, vaguely dichotomous, ultimate branchlets bidentate; asci 4 to 8, ovate; spores 4 to 5.—*Cooke. Handbook, p.* 649.

On Elder leaves.—*Berkeley.*

43. M. elevata, Burrill. Epiphyllous; mycelium web-like, rather evanescent; perithecia, .1 mm. in diameter, conspicuously reticulated, raised from the leaf; appendages about 12, colored at base, often simple, sometimes branched near the base, usually 2 to 4 times dichotomously forked, very long; asci 4 oval, strongly rostrate.—*T. J. Burrill. Bull. Ill. Mus. Nat. Hist., No.* 1, *p.* 58.

On Catalpa leaves.—*Burrill.*

This description alone is not sufficient, it appears to us, to separate this from No. 40; in the absence, however, of either specimens or full descriptions, we leave this species as we find it described. [In a figure of this plant, in Burrill's paper, two asci are shown, one with 6 and the other with 8 spores.]

44. M. penicillata, Lev. Amphigenous; mycelium web-like, effuse, evanescent; perithecia scattered, minute, globose; appendages 8 to 12, equal to the diameter of the perithecia; asci 4, rostrate; spores 8.—*Cooke. Handbook, p.* 649.

On Blue Beech.—*Farlow.*

45. M. densissima, C. & P. Hyphasma very dense, between filamentose and himantioid, in definite sub-orbicular patches 12 to 50 mm. broad, somewhat radiating at the margin, persistent; perithecia few, scattered; appendages 6 to 10; asci 4 to 8; spores 8. Remarkable for the definite orbicular patches of mycelium.—*Cooke and Peck. Erysiphei of U. S. Supp.*

On leaves of Oak.—*Peck.*

46. M. Van Bruntiana, Gerard. Amphigenous; mycelium dense, white, persistent; perithecia globose, scattered or gregarious; appendages 12 to 15, about equal in length to the diameter of the perithecia, several times dichotomous, truncate at their apices; asci.....?, spores 8.—*W. R. Gerard. Bull. Torrey Bot. Club, Vol.* VI, *p.* 13.

On Elder leaves.—*Peck.*

Peck in 28th *Rept. N. Y. Mus. Nat. Hist.* says: "This species is described as having eight spores in each ascus, but I have not been able to detect more than four in the specimens which I have examined."

47. M. fulvofulcra, Cooke. Mycelium arachnoid; perithecia minute, globose, gregarious; appendages 8 to 12, brown at base, hyaline and compact at tip, 2 to 3 times dichotomous; spores oval. *Grevillea, Vol. V, p.* 110.

On leaves of Spiræa, in California.—*Harkness.*

48. M. Euphorbiæ, B. & C. Mycelium effuse; appendages many times longer than the diameter of the perithecia, once or twice forked, then lobed at the tips. *Notices of N. A. Fungi.* 997.

On leaves of Spurge.—*Berkeley.*

49. M. Ravenelii, B. Mycelium effused, dirty white; appendages repeatedly forked towards the apex. *Notices of N. A. Fungi.* 998.

On leaves of Honey Locust.—*Berkeley.*

ERYSIPHE, Hedw.

Mycelium arachnoid; appendages floccose, simple or irregularly branched.—*Berk. Outl., p.* 405.

50. E. lamprocarpa, Lev. Amphigenous; mycelium web-like, fugacious, or persistent; perithecia minute, globose, scattered, or gregarious; appendages colored, interwoven with the mycelium; asci 8 to 16, shortly pedicellate; spores 2.—*Cooke. Handbook, p.* 650.

In our specimens from *Helianthus doronicoides*, the perithecia are .13 mm. in diameter, and the appendages short and considerably curled and bent. (Plate II, Figs 31 and 32.) It occurs also on other composites, and while not known to have done any injury to any of our cultivated plants, it may prove to be harmful when once our farmers grow the so-called Jerusalem Artichoke, (*Helianthus tuberosus*). In England it is found on Salsify and Scorzonera, but we have no evidence of its having affected these plants in this country.*

*Note.—Since the above was written, we have carefully examined our specimens of *Erysiphe* on *Verbena stricta* and *V. urticifolia*, and find, contrary to our anticipations, that the species is *E. lamprocarpa*. On *V. stricta* it differs in no way whatever from the form on *Helianthus doronicoides*, and on the other plant it only presents lighter colored appendages, due probably to the younger condition of the specimens. Cooke and Peck, in the *Supp. to Erysiphei of U. S.*, in speaking of *E. communis*, say: "Dr. Curtis refers to this species, the *Erysiphe Verbenæ* of Schweinitz, but our specimens are too old for satisfactory determination." Verbena Blight has been wandering vaguely about for many years; is it possible that all this while it has been nothing but *E. lamprocarpa?* It seems at first sight scarcely possible that so well marked a species as *E. lamprocarpa* should have been mistaken, but as it rarely is found in fruit on the Verbena (at least this has proved to be the case with us) the confusion may have arisen from a study of imperfect specimens.

51. E. Montagnei, Lev. Amphigenous or hypophyllous; mycelium web-like, evanescent; perithecia minute, globose, gregarious, or scattered; appendages distinct from the mycelium; asci 8, ovate, rostrate; spores 2 to 3.—*Cooke. Handbook, p.* 651.

On Cocklebur.—*Berkeley.*

52. E. horridula, Lev. Amphigenous; mycelium web-like, sometimes persistent; perithecia minute, globose, scattered or clustered; asci 20 to 24, oblong-ovate, attenuated downwards; spores 3 to 4; appendages short, flexuose, and bent upwards.—*Cooke. Handbook, p.* 652.

On Cocklebur.—*Berkeley, in Notices of N. A. Fungi.*

As the "Notices" were upon specimens distributed by Rev. M. A. Curtis, there may be some doubt as to whether we have the above named species in this country, for we find that Cooke and Peck in the supplement to *The Erysiphei of U. S.*, say in speaking of *E. lamprocarpa*, "the *Erysiphe* on the leaves of *Xanthium* [Cocklebur] distributed by Dr. Curtis under the name of *E. horridula*, Lev. seems to us to be also the same species" [*i. e. E. lamprocarpa.*]

53. E. Euphorbiæ, Peck. Mycelium thin; perithecia small; .089 mm. in diameter; appendages few, long, flexuous, colored; asci broadly ovate, 3 to 4; spores 3 to 4, large, .025 mm. long, by .016 mm. wide.—*Twenty-sixth Rept. N. Y. State Mus. Nat. Hist.*

On leaves of *Euphorbia hypericifolia.*—*Peck.*

54. E. spadicea, B. & C. Perithecia scattered, rich brown; appendages flexuous, three times longer than the diameter of the perithecia; spores 4.—*Berkeley. Notices of N. A. Fungi.* 989.

On Cocklebur.—*Berkeley.*

55. E. tortilis, Lk. Hypopyhllous; mycelium web-like, effuse, evanescent; perithecia minute, globose; appendages ten times as long as the diameter of the perithecia, free from the mycelium, flexuose; asci 4, ovate, rostrate; spores 4.—*Cooke. Handbook, p.* 651.

Our specimens from *Clematis Virginiana* are amphigenous; perithecia, .09 mm. in diameter; appendages 10 to 12, very long (8 to 12 times the diameter of the perithecia,) colored for two-thirds their length from the base, sometimes simply forked and usually somewhat attenuated at the tip; sporangia 4, 5, or 6, .055 mm. long; spores 3, 4, or 5, mostly 4 or 5, (Plate II, Figs. 26 and 27.)

The plants from which we obtained our specimens were in a languishing condition, whether entirely on account of the presence of this parasite or not we cannot say. The fungus was certainly abundant enough to do a great deal of harm.

56. E. Martii, Lk. Amphigenous; mycelium web-like, very often evanescent, globose;* appendages short, interwoven with the mycelium; asci 4 to 8, globose, pedicellate; spores 4 to 8.—*Cooke. Handbook, p.* 651.

Our specimens, which occur in great abundance upon cultivated peas, furnish us with the following characters, which, it will be observed, vary somewhat from those given above:—On all parts of the stem, leaves and fruit: mycelium effuse, web like, persistent: perithecia globose, dark brown, reticulated, .12 to .14 mm. in diameter: appendages many; mostly about as long as the diameter of the perithecia, some about twice as long; the former colored throughout, the latter colored in their basal half, the remaining half hyaline; irregularly bent and crooked, almost nodulose; usually blunt and unbranched, a few forked at the tip: asci 4, oblique-ovate, or some oval, (not globose,) scarcely pedicellate: spores oval, 5 to 8. (Plate II, Figs. 24 and 25.)

This fungus, which is known as Pea Blight, has for many years been very destructive to late peas in the West; it has, in fact, rendered the growth of the later varieties, in some instances, almost impossible. It appears, at first, as a white mould on the leaves, and from these it spreads to all parts of the plant, causing the leaves to turn yellow, and the whole plant to languish, and finally die. So far as we are aware, there are no remedies which have come into general use among gardeners, for preventing the depredations of this pest, but as we have observed that it thrives best where the peas are thick on the ground so that they produce a dense shade, this would appear to suggest the advisability of planting less thickly, and of providing for loose supports, so as to admit the sunlight freely to all parts of the plant.

57. E. communis, Schl. Hypophyllous; mycelium effuse, web-like, evanescent or persistent; perithecia minute, globose, scattered or gregarious; appendages short; asci 4 to 8, ovate, rostrate; spores 4 to 8.—*Cooke. Handbook, p.* 652.

We have this in abundance on the stems of *Anemone Virginiana* growing in rank grass. From our specimens we get the following characters:—Mycelium effuse, web-like, persistent; perithecia imbedded in the mycelium, .1 to .11 mm. in diameter; appendages variable in number, from 15 to 25 or more, 3 to 5 times as long as the diameter of the perithecia, colored for more than half their

*Is not this an error? Should it not read, "very often evanescent; perithecia globose"?

length, hyaline at tip; asci 4 to 7, mostly 5; spores 6 to 8. (Plate II, Figs. 22 and 23.)

The grass (*Poa pratensis*) in which our specimens were obtained, was covered in the early part of July with the conidial stage of what we took to be the same species. We have however no specimens now at hand for verifying our opinion. In October we detected a conidial growth on the leaves of *Poa pratensis*, which bears so close an external resemblance to that usually seen to precede the perithecia of *E. communis*, that we have little doubt it is also that species. This opinion is strengthened by recent examinations of the late growing specimens, which, however, failed to reveal perithecia. Probably this conidial growth was too late to produce perithecia, as it ordinarily (if it be the same) appears in June and July.

Our specimens may be described as follows: Hyphæ abundant, minute, .004 mm. in diameter, bearing numerous suckers (haustoria); conidial branches long, club shaped, bearing about 7 conidia; first (lowermost) cell broadly fusiform, those immediately above very narrow; full grown conidia oval, truncate at both ends, .028 mm. long, and .013 mm. wide. (Plate I, Figs. 19, 20 and 21.*) Forming white patches on the upper surface of leaves of Blue Grass, especially in damp places.—October.

58. E. graminis, D. C. Amphigenous or epiphyllous; mycelium effuse, floccose, persistent; perithecia large, gregarious or disseminated, hemispherical, at length depressed and semi-immersed; appendages simple, or interwoven with the mycelium; asci 20 to 24, ovate, pedicellate; spores 8. *Cooke. Handbook, p.* 651.

On wheat.—*Berkeley.*

59. E. fuscata, B. & C. Perithecia bright brown: appendages dark, sometimes forked at the apex; spores 8. *Berkeley. Notices of N. A. Fungi.* 991.

On leaves of Bidens frondosa.—*Berkeley.*

60. E. polychæta, B. & C. Spots orbicular, yellow brown in the center from the young perithecia; appendages about equal in length to the diameter of the perithecia, straight; asci elongated, clavate.—*Berkeley. Notices of N. A. Fungi.* 990.

On leaves of Hackberry.—*Berkeley.*

*We would have it distinctly understood that although we have placed this *Oidium* under *E. communis*, we are by no means certain that it belongs here. The figures of different so called species of *Oidium*, to which we have access, give us no aid whatever.

ERYSIPHELLA, Peck.

Perithecia destitute of appendages; spores definite.—*Peck. 28th Rept. N. Y. Mus. Nat. Hist., p.* 63.

61. E. aggregata, Peck. Mycelium obscure, or concealed: perithecia numerous, densely crowded, sub-globose, glabrous, reddish-brown, or black; asci numerous, 10 to 20, varying from oblong-ovate to sub-clavate; spores 8, broad, elliptical, .02 to .022 mm. long, by .013 to .015 mm. broad.—*Ibid. l. c. with Figs.* 1 *and* 2 *in Plate* 2.

In fertile aments of Alder.—*Peck.*

"The perithecia are densely aggregated in the interstices of the aments, giving them a compact, blackened appearance. Usually a white meal-like substance more or less involves and, with the crowded perithecia, conceals the mycelium. Sometimes nearly all the aments in a cluster are covered by this fungus."—*Ibid.*

☞ After the stone for the plates was ready, and while this paper was going through the press, I learned, much to my regret, that the State would not pay the expense of printing the plates. They will, in consequence, be found in only a part of the edition.

C. E. B.

DESCRIPTION OF PLATE I.

DESCRIPTION OF PLATE I.

PODOSPHÆRA KUNZEI, Lev.

Fig. 1. Perithecium and its appendages from a Cherry leaf, magnified 165 diameters.

Fig. 2. A ruptured perithecium, showing the single ascus, magnified 165 diameters.

Fig. 3. Ascus and spores, magnified 385 diameters.

Fig. 4, 5, 6, 7, 8. Tips of appendages, showing successive stages of development, magnified 500 diameters.

MICROSPHÆRIA FRIESII, Lev.

Fig. 9. Perithecium and its appendages, from a Lilac leaf, magnified 165 diameters.

Fig. 10. Outline of a ruptured perithecium, with asci, magnified 165 diameters.

Fig. 11. An ascus and its spores, magnified 650 diameters.

Fig. 12, 13, 14, 15. Tips of appendages, showing successive stages of development, magnified 500 diameters.

UNCINULA CIRCINATA, C. & P.

Fig. 16. Perithecium and its appendages, from a Silver Maple leaf, magnified 100 diameters.

Fig. 17. Tip of an appendage, magnified 400 diameters.

Fig. 18. Asci and spores, magnified 300 diameters.

ERYSIPHE COMMUNIS, Schl.?

Fig. 19. Conidia and hyphæ of *Oidium* stage, from a leaf of Blue grass, magnified 270 diameters.

Fig. 20. Portions of hyphæ, with haustoria attached, magnified 800 diameters.

Fig. 21. Detached conidia, magnified 270 diameters.

DESCRIPTION OF PLATE II.

DESCRIPTION OF PLATE II.

ERYSIPHE COMMUNIS, Schl.

Fig. 22. Perithecium and its appendages, from a stem of *Anemone Virginiana* magnified 165 diameters.

Fig. 23. Asci and spores, magnified 325 diameters.

ERYSIPHE MARTII, Link.

Fig. 24. Perithecium and its appendages, from a stem of the Cultivated Pea, magnified 165 diameters.

Fig. 25. Asci and spores, magnified 330 diameters.

EYPSIPHE TORTILIS, Link.

Fig. 26. Perithecium with two appendages of full length, the remaining ones broken off; from a leaf of *Clematis Virginiana*, magnified 165 diameters.

Fig. 27. Asci and spores, magnified 420 diameters.

PHYLLACTINIA GUTTATA, Lev.

Fig. 28. Perithecium with two appendages of full length, the remaining ones broken off; from a leaf of ironwood, magnified 100 diameters.

Fig. 29. An ascus with its two contained spores, magnified 165 diameters.

Fig. 30. Detached spores, magnified 165 diameters.

ERYSIPHE LAMPROCARPA, Link.

Fig. 31. Perithecium and its appendages, from a leaf of *Helianthus doronicoides*, magnified 100 diameters.

Fig. 32. Asci and spores, magnified 185 diameters.

SPHÆROTHECA PANNOSA, Lev.

Fig. 33. Perithecium and its appendages, with several hyphæ; from a green fruit of the Wild Gooseberry, magnified 165 diameters.

Fig. 34. Ascus and spores, magnified 240 diameters.

A PRELIMINARY CATALOGUE OF THE ORTHOPTERA OF IOWA.

BY C. E. BESSEY.

This list is a revision of one presented to the Iowa Academy of Sciences, at its June meeting in 1876. Since the presentation of that paper some species have been added, which are here incorporated in their proper places. The notes have been considerably expanded, and the paper otherwise considerably modified so as to meet the requirements of an article published in this Report. It is given in the hope that it may stimulate others to take up the study of this most interesting group. That it is very incomplete, will be evident to an entomologist at a glance; but it represents, so far as the writer is aware, our present accurate knowledge of the species found within the boundaries of our State. It is based upon collections made mostly in Central Iowa, and all the species here admitted are represented by specimens in the Cabinet of the College. A considerable number of species could have been added from their known general distribution, but it was deemed best to wait until they had actually been found, before admitting them to the list.

The arrangement throughout is essentially that of Dr. Packard, as given in his "Guide to the Study of Insects"; in the Acrydii, the arrangement as given by Dr. Thomas in his "Synopsis" of that group is followed.

ORTHOPTERA.

GRYLLIDÆ, Latr. (The Cricket Family.)

1. *Gryllotalpa longipennis*, Scudder. (The Mole Cricket.)

This insect appears to be uncommon, though we have quite frequently heard gardeners describe the work of what we take to be the one here named. If *G. longipennis* and *G. borealis* are specifically distinct, it is interesting to note the fact that our specimens are the former or *southern*, instead of the northern species.

2. *Gryllus abbreviatus*, Serville. (The common Black Cricket.)

Occasionally, this species has been so abundant as to prove quite destructive to garden crops. It is frequently infested by parasites which are apparently the larvæ of the Flesh Fly (*Sarcophaga.*)

3. *Nemobius vittatus*, Harris. (The Little Cricket.)

This field cricket is not more than half as large as the preceding, and is of a brown color instead of black. Although frequently abundant, we do not know of its doing any appreciable harm to crops.

4. *Œcanthus niveus*, Serville. (The Snowy Tree-Cricket.)

The depredations of this Cricket are too well known to call for description. In the town of Ames some years since, the Rose bushes were severely injured by the punctures of these insects, and more than once within the past six years, the Raspberry canes in the College gardens have suffered greatly from the same cause.

5. *Phalangopsis lapidicola*, Burm. (The Black Stone-Cricket.)

We doubtfully place this insect with the *Gryllidæ*, but we cannot see the propriety of classing it with the Grasshoppers, though it may be said to connect the two groups. The anal stylets of the male seem to show its relationship to the Crickets rather than to the Grasshoppers. The absence of pulvilli on the tarsi has the same significance ; but on the other hand it must be said that the *four-jointed tarsi* show a relationship to the subsequent group.

It is apparently nocturnal in its habits, as we have taken it in pans of water set near a burning lamp at night.

LOCUSTARIÆ, Latr. (The Grasshopper Family.)

6. *Cyrtophyllum concavum*, Say. (The Katy-did.)

Among a number of insects which bear this common name, this is the only one which strictly merits it, as it alone possesses a note which clearly imitates the words, " katy did." They appear to be abundant from the noise they make some seasons, but on account of their shy habits they are not very frequently taken.

7. *Phaneroptera curvicauda*, De Geer. (The Green Grasshopper.)
8. *Conocephalus ensiger*, Harris. (The Sword bearer.)
9. *Xiphidium, fasciatum*, Serville. (The little Green Grasshopper.)

The three foregoing species are very common in meadows, but they are probably not voracious enough to be considered particularly harmful.

10. *Orchelimum vulgare*, Harris. (The larger Green Grasshopper.)

This species we have not found to be so abundant as any of the three immediately preceding.

ARCYDII, Latr. (The Locust Family.)

TRYXALINI, Thomas.

11. *Opomala bivittata*, Serv.

This curious and strange looking Locust is quite rare. We have seen but two specimens; both were found in the grass.

ŒDIPODINI, Thomas.

12. *Chrysochraon viridis*, Thomas.
13. *Chrysochraon conspersum*, Thomas.
14. *Chrysochraon punctulatum*, Thomas.
15. *Stenobothrus tricarinatus*, Thomas.
16. *Stenobothrus curtipennis*, Scudder.

The foregoing species are peculiar in having short wings, giving to the insects an appearance of immaturity. They are abundant in the early part of the season, in the grass on the prairies. They appear to be very variable, as individuals otherwise alike will frequently be found to differ very greatly in their colorational markings.

17. *Tragocephala infuscata*, Harris.
18. *Tragocephala viridifasciata*, Harris.
19. *Tomonotus xanthopterus*, Thomas.
20. *Tomonotus carinatus*, Thomas.
21. *Œdipoda collaris*, Scudder.

22. *Œdipoda æqualis*, Uhler.
23. *Œdipoda sordida*, Burm.

The species from 17 to 23, inclusive, are found in the grass on the prairies. We cannot, at present, believe that all named are good species, as there is much variability among them. *Œ. collaris*, is particularly doubtful.

24. *Œdipoda carolina*, Serville. (The Dust Hopper.)

This insect is most frequently found in roads and dusty places, differing in this respect from its near relatives.

25. *Œdipoda haldemanii*, Scudder.

Our insect which is found, not abundantly, however, with the next species, does not agree well with Scudder's description as quoted in Thomas' "Synopsis." The fuliginous band on the posterior wings does not quite reach the anal angle, and the posterior femora are not "bright coral red" on their inner sides, nor are the posterior tibiæ so colored. In one specimen (a male) the posterior tibiæ are orange, while in the others, they, as well as the internal femoral surfaces are a pale yellow. The above characters would indicate that our specimens belonged to Scudder's *Œ. rugosa*, and we have sometimes thought that perhaps this latter name would be better than the one given above. However, in our insect, the median carina of the pronotum is not "cut rather behind the middle," as it is said to be in *Œ. rugosa*, but is cut decidedly in front of the middle. It can hardly be said either that the "antennæ of the females are small," although they do not reach much if any beyond the posterior angle of the pronotum (apex?) when bent backwards over the body.

26. *Œdipoda paradoxa*, Thomas.

Much more abundant than the preceding species. Occasionally they are to be found on the high dry ground on the prairies in considerable numbers. So far as we have observed, this species and the preceding are to be found together, as if they were not specifically distinct. They are so much alike in habits and otherwise, that one is tempted to ask whether the differences in color are not merely *individual* peculiarities.

27. *Brachypeplus magnus*, Girard.

This is called by Riley the Clumsy Locust, and it fully deserves its name. It occurs in western and southern Iowa, and we are informed that it occasionally does a considerable amount of damage in gardens.

ACRIDINI, Thomas.

28. *Caloptenus femur-rubrum*, Burm. (The Red-legged Locust.

While this species is common in Central Iowa, it is less so than in the East. If we are not mistaken, this species is less common in those years when *C. spretus* is most abundant.

29. *Caloptenus spretus*, Uhler. (The Rocky Mountain or Migratory Locust.)

We have repeatedly taken the young insects, on the College farm. In the spring of 1877, a large number hatched out from eggs deposited by the invaders of the autumn previous. They, however, did but little injury to crops. This is probably the most easterly point recorded for their hatching, (93° 38′ West: height above the sea, one thousand feet). From 1870 to 1873, inclusive, we did not notice any specimens of this species on the College farm, although there may have been a few present. In 1874 a few stray specimens were picked up; in 1875 they were quite abundant late in the season; and in 1876 they were still more numerous. The present season, although more hatched than in previous years, they have been much less abundant. Few if any eggs were laid this fall.

30. *Caloptenus bivittatus*, Uhler. (The Two-striped Locust.)
Common, but not abundant.

31. *Caloptenus differentialis*, Thomas. (The Differential Locust.)

It is unfortunate for us that there is no good common name for this species, as it is the most destructive native locust we have. From its olive color it might very properly receive the easily remembered name of the Olive Locust. In the year 1873, and for a year or two previous to that date, this species was so abundant on the College farm as to do a good deal of injury; since then it has been less abundant.

32. *Acridium americanum*, Scudder.

We are in doubt as to whether our specimens are *A. americanum* or *A. emarginatum*. We at one time determined them to be the latter species, but now incline to place them in the one first named above. Found in high grass, on low lands.

33. *Acridium obscurum*, Burm.
Found with the last.

TETTIGINI, Thomas.

34. *Tettix granulata*, Scudder.
In low woodland. June.

35. *Tettix ornata*, Scudder.
August.

36. *Tettix cucullata*, Scudder.
On sandy river bank. June.

37. *Tettigidea lateralis*, Scudder.
In road. June.

38. *Tettigidea polymorpha*, Scudder.

PHASMIDA, Leach. (The Walking-Stick Family.)

39. *Diapheromera femorata*, Say. (Common Walking-Stick.)

We probably have a second species, but our specimens are too poor to decide the question at present.

BLATTARIÆ, Latreille. (The Cockroach Family.)

40. *Blatta orientalis*, Linn. (The Cockroach).

Besides this species, which is not numerously represented in the immediate vicinity of the College, we have seen several others, but have not had the opportunity of determining them.

FORFICULARIÆ, Latreille. (The Earwig Family.)

We have not yet observed any species of Earwigs in the State, but as *Forficula aculeata*, Scudd. occurs in Northern Illinois, it no doubt belongs to our Orthopteran fauna.

LAWS OF BREEDING.

By PRESIDENT WELCH.

LIKE BEGETS LIKE.

DEFECTS TRANSMISSIBLE.

The defective structure or absence of any part or organ, arising from a cause that is unknown, is exposed to the danger of reproduction. The instances of their reappearance in children and in young animals, are, I am glad to say, far less numerous than the failures. And yet abundant examples are on record that prove the hazard to be always present. Col. Hallam, as reported by Darwin, described before the zoological society in 1833, a race of pigs in which the hind legs were wanting, a deficiency that descended through three generations. Instances which are authentic, are given of the harelip being descendible. A striking example is furnished by Mr. Sproule, in the British Medical Journal, April, 1863, in which he declared that a harelip with a cleft palate, had been hereditary in his own family for a century. A citizen of Michigan, with whom I am acquainted, has malformed hands with only two fingers, which he has transmitted to two of his children.

Some forty years ago a clergyman of Rochester, New York, was accused of being the father of an illegitimate child. The case created great interest and excitement at the time. The defense set up was of so plausible a character that the defendant would probably have been acquitted but for the fact that the child was brought into court and shown to have a crooked finger precisely similar in all respects to a malformed digit on the hand of the reputed father. On this evidence mainly the jury convicted him of the crime of bastardy. It was indeed a thousand times more probable that this slight manual malformation came by inheritance than that so wonderful a coincidence should have sprung from mere accident. Mrs. Clarissa Beaumont gives an account of a negro family in the Parish of Avoyelles in Louisiana, in which a sixth finger was hereditary. This abnormal

digit grew out from the side of the little finger at the second joint, was over an inch in length, had no joint of its own, but terminated with a perfect nail. Mrs. Beaumont had helped to amputate this singular growth from each hand of the negro child, when the mother showed the scar left on her own hand by the amputation of a like appendage, and declared that fingers of a similar character grew on the hands of both her father and grandfather.

These instances selected from a great number of kindred facts, serve to show how minute is the operation of the law by which a defective organ or an abnormal growth, suddenly acquired by an ancestor, is carried down through many generations. They warn the breeder of valuable stock not to use, for breeding, animals of either sex which are imperfect by reason of any blemish in form, or structure, or any malformation of parts, or spontaneous excrescence of whatever kind.

TRIFLING PECULIARITIES INHERITABLE.

So minute is the law of inherited resemblances that trifling bodily characteristics not organic, often reappear in the descendants of individuals so affected. A thing so slight as a small point on the edge of the ear, may be found in both the parents and children of many families. Darwin expresses the singular belief that this point is the remnant of a pointed ear which belonged to our primeval ancestors, and which is now often inherited in a rudimentary condition. My daughter has three cow-licks derived from her mother with whom they originated. Darwin gives us the following striking fact which I quote from his "Variations of Animals and Plants:" "I knew an Irish gentleman who, on the right side of his head, had a small white lock in the midst of his dark hair; he assured me that his grandmother had a similar lock on the same side, and his mother on the opposite side." On the hands of a gentleman of my acquaintance, the little fingers are slightly bent, the rest being straight. On visiting his mother in Connecticut twenty years ago, my attention was called to the fact that her little fingers were similar in shape.

Parents who were left handed, have certainly sometimes bequeathed the habit to some of their children. If the ears of a Berkshire boar droop ever so little, it may cause a like droop in the ears of the pigs he begets. Anderson, in the "Recreation in Agriculture," states that a rabbit produced, in a litter, a young animal having only one ear, and, from this animal, a breed was formed which steadily produced one eared rabbits.

MUTILATIONS SOMETIMES THOUGH RARELY INHERITED.

Cases of the inheritance of *mutilated limbs* or other parts of the body, are extremely rare. The people of uncivilized nations have, under the influence of barbarous customs, inflicted various injuries upon their persons one generation after another for many centuries, without any inherited effect. Some tribes of Africa perforate the lip and insert a disk of wood, causing horrible distortion; yet this mutilation, though practiced by each generation, shows no tendency to become hereditary. The Jews have performed the rite of circumcision over two thousand years, and, it is generally believed, without rendering the effect, in any instance, transmissible.

Men who have lost a limb or received serious wounds in battle or from accident, have no fears that such injuries will effect, in the least, the soundness or symmetry of their children born subsequently. And yet such a long catalogue of instances wherein mutilations have been inherited, has been given that we are compelled to admit their occasional transmission. And especially may this happen, I opine, in cases where disease induced by the injuries, has caused suppuration of the injured part. Dr. Prosper Lucas, referred to by Darwin as the most voluminous writer on this subject, furnishes some examples which are instructive to breeders of improved animals. "Thus a cow that had lost a horn from an accident with consequent suppuration, produced three calves which were hornless on the same side of the head.

"With the horse there seems hardly a doubt that bony enlargements on the leg caused by too much traveling on hard roads, are inherited." It is asserted by breeders of horses that spavin in a colt is not unfrequently derived from a spavined progenitor. These facts, while they excite wonder, tend to confirm the opinon that animals selected for the purpose of breeding, should show a development of form and structure that is absolutely free from blemishes, injuries and mutilations whether small or great.

DISEASES HEREDITARY.

If, as we have seen, animals are liable to transmit every property, character and quality they possess, even to trifling defects, they will

of course, transmit diseases. It is, indeed, a matter of common observation, that, in the human family, numerous diseases are hereditary. Let it be understood, however, that in general those ailments only which are chronic and which spring from imperfect organs or constitutional weaknesses, become lineal. Temporary deviations from a healthy state, disorders that are due to present causes and that leave no *unsoundness* of organ or texture, bodily derangements of functions which soon subside, are not bequeathed to the next generation. It is rather the *tendency* to disease, the permanent taint, the organic or constitutional weaknesses, that are transmitted. Neither among men nor the lower animals, can we find an example of perfect physical soundness, and all permanent variations from this condition, are liable to descent. The actual diseases induced by hereditary imperfection or weakness, may not be serious, may be consistent with general good health and long life, may indeed become latent in one or two generations, but the *causes* of such disease are nevertheless subject to the law of reproduction.

But the minuteness with which constitutional unsoundness or a tendency to disease, are transmitted, may be shown by the actual instances which have been observed and recorded. In my wife's family two sons and three daughters were afflicted with periodical sick headaches and I find that their mother and grand-mother suffered from the same ailment. In this case, the disorder which is thus entailed, may consist in some weakness or defect of the nervous system which induces this periodical malady. Many other examples of the hereditary character of sick-head aches, are given by medical men and attributed to different sources. Holland says "it is extraordinary in what minute peculiarities the hereditary character of nervous affections shows itself and that even the *habits* of parents which arise from the condition of the nerves, reappear in the children." It is not then surpising that disorders of the brain and nerves so serious as to produce apoplexy, epilepsy or palsy, manifest a stong hereditary tendency.

The same author tell us that the shaking palsy is recorded as having, in several instances, attacked three successive generations. He has noted, in his practice many examples of hereditary heart disease—that in one of these four brothers died between sixty and sixty-four of organic disease of the heart, with prior cases of the same kind in their family, and that, in another instance, he noted three

cases of the same disease in three successive generations. He records also an example of hereditary corpulency which producing, by its excess, the disease known as dropsical effusion, caused the death of four persons out of two generations. There were two more cases in the same family, but not serious enough to result in death.

It is a singular fact that all or nearly all the diseases and defects of the eye that produce imperfect sight or total blindness, are likely to be reproduced in the offspring. Near-sightedness is extremely liable to transmission. I have known several instances of it which were evidently derived by inheritance. A professor in the Iowa Agricultural College and his daughter were both near sighted. In my wife's family three children are near sighted, and so was Dr. Beaumont, their father. Even the inability to distinguish certain colors, termed color blindness, is a transmissible defect. Dr. Holland records his acquaintance with a family wherein the father and two children could not detect red as a color; also three brothers and several of their children none of whom could discover the difference between blue and pink. The same writer affirms that in one instance which he knew, where both parents were squint-eyed, every one of five children inherited the same defect. To these examples is added the case of a family in which four children out of five lost their sight entirely at the age of twelve from amaurosis, which visual disease was evidently a legacy, by atavism, from a remote female ancestor who was represented on an old monument, with several children around her, all of whom were recorded as blind. It is proved, moreover, by similar observation of instances, that cataract is among the descendible diseases.

So well known is the fact that deaf mutes often inherit and reproduce their deafness, that it is superfluous to give examples. It is equally well known that consumption in all its forms, is a family disease frequently clinging with melancholy persistence, to many generations. "I get my weak lungs from my mother," or "I have my father's narrow chest" is a remark that is often heard and that bears sad testimony to the inheritable character of this terrible scourge. Numerous kindred diseases such as asthma and bronchitis are likewise subject to the law of likeness. Gout and inflammatory rheumatism both of which arise probably from a peculiar condition of the blood, are well known to be lineal diseases. Chomel, who had the advantage of a wide observation, declares that at least half the

cases of acute rheumatism that had fallen under his notice, had been derived from parents. The scrofulous taint which exhibits its presence in the blood by a great variety of manifestations, is not only a family inheritance but it appears under one invariable form in the same family and the most terrible of these is tubercular consumption.

DISEASES OF THE HORSE.

Darwin sums up the result of his researches on this subject in the following compact paragraph :

"Even if no single fact had been known with respect to the inheritance of diseases and malformations by man, the evidence would have been complete in the case of the horse, and this might have been expected, as horses breed much quicker than man, are matched with care and are highly valued. I have consulted many works and the unanimity of belief by veterinarians of all nations, in the transmission of various morbid tendencies, is surprising. Authors who have had wide experience, give, in detail, many singular cases, and assert that contracted feet, with the numerous contingent evils, of ringbones, curves, splints, spavin, founder, and weakness of the front legs, broken and thick wind, melanosis, specific opthalmia, and blindness, (the great French veterinarian, Hugard, going so far as to say that a blind race could soon be formed) crib biting, jibbing, and ill-temper, are all plainly hereditary." Youatt sums up by saying that "there is scarcely a malady to which the horse is subject that is not hereditary," and Mr. Berard adds that the doctrine "that there is scarcely a disease that does not run in the stock," is gaining new advocates every day. I may add to these facts, established by such weight of concurrent testimony, what I have before remarked in general, namely that it is not the actual ailments, such as contracted feet, ring bones, curbs, splints, and spavin, but the predisposing *causes* that are transmitted. The disposition of parts, the imperfect shape and size or the faulty texture of any tendon, bone or muscle most favorable to a particular disease are transmitted from sire to son.

The same may be said of those disorders that affect the internal organs, or the whole body. The abnormal condition of the blood, and not the scrofulous symptoms it produces, is hereditary. The weakness in some of the muscles of the larynx that causes roaring, has a hereditary tendency. The narrow loins and flat sides that give

a proneness to attacks of diarrhea and colic, belong to a certain lineage.

This constant tendency of morbid condition or defective organs to reappear in the line, shows how important it is that horses selected for breeding, should be sound in wind, limb and condition.

DISEASES OF CATTLE.

From being less exposed to capricious treatment, irregular feeding and sudden changes of cold and heat, cattle are not so liable to disease as horses. Especially are they, for obvious reasons, comparatively free from those ailments that effect the eyes and limbs. The very purpose for which they are maintained, namely, the production of milk and beef, protects these parts of the body from the severe usage that induces disease. They are, however, subject, in common with horses, to a variety of diseases that affect the internal organs, and the morbid condition of organs so affected, is transmissible. There are, also, hereditary diseases to which cattle are liable, that vitiate the blood and affect the condition of the entire body. Scrofula, one of the most fatal of these, evincing its presence by swelled joints, indigestion or water on the brain, and terminating often in consumption, is almost sure to descend to the calves of the diseased sire or dam. Among the most common of the inherited maladies which cause death is consumption. This disorder whether arising from the tuberculous condition brought on by scrofula, or from pneumonia caused by weakness or other defects of the lungs, probably destroys more cattle than any other disease whatever. A tendency to consumption is often indicated by the form and touch of an animal, the chest being narrow, the ribs flat, the hair wiry and the skin hard and dry. But instances are not infrequent where cattle of valuable breeds have inherited a model form and with it a consumptive tendency.

Another hereditary disease frequent among cattle is dysentery or bloody flux. A proclivity to this malady shows itself by clearly defined peculiarities of form. The animal liable to dysenteric attack, exhibits a contracted chest, hollow crops, narrow loins, high flanks and a long lean body, and thin neck; altogether the last creature in the world to breed from; since these characteristics persistently reappear in the line. Such serious defects of form, even if attended by no disease, render the animal well nigh worthless for any purpose.

Still another hereditary disorder, less common indeed than those mentioned, yet quite prevalent in some localities, is chronic rheumatism. Rheumatism in an acute form is often the result of sudden cold, and soon subsides or may be easily cured; but when it arises from constitutional tendency, is frequently incurable. Malignant tumors indicating a scrofulous or cancerous state of the blood, must, beyond all question, be added to the list of diseases inherited by cattle. Scrofulous swellings and scirrhus cancers especially such as appear in the form of abscesses on the neck, beneath the jaws, or on the cheek bones, belong to the constitutional ailments that cling to particular families and descend in the family line.

To the breeder of cattle any form of hereditary disease, whether local or generic, is often a source of bitter disappointment and constant loss, and his only safeguard lies in rigidly eliminating from his herd, every animal of unsound constitution or defective organs. The signs of imperfect health reveal themselves to experienced eyes and the wisest policy is to regard every disorder not due to temporary causes, as transmissible and to *run no risk*. Never breed from an unhealthy animal. Select or reserve both male and female, specially the first, with rigid reference to their freedom from constitutional taint of whatever sort. The improved breeds of cattle are among the soundest animals in the world. The indications of health, though not infallible, are easily noted. The value of a fine cow or bull lies largely in perfect constitutional vigor. The development of points which come nearest the model form, whether for milking or for beef, is also a sign of sanitary excellence. The small head, fine muzzle, eye well open and lustrous, broad forehead, delicate muzzle, neck slender at the head, full at base; the chest wide and deep, indicating large vital organs, the broad shoulder, full crops, staight chine, wide loins and hips, low flanks, the hind quarter long and large by reason of the symmetrical development of rump, buttocks, twist, and flank; the soft thick hair, flexible hide and elastic touch, and the short legs and fine form generally—all these in harmonious union, are not only the points of a model form, but they are signs of good health and a sound constitution also.

TRAITS OF CHARACTER, HABITS, &C.

From the marvelous exactness with which, as we have seen, bodily qualities and characters are apt to be propagated in the family line,

we would naturally look for a similar tendency to the reproduction, in offspring, of the mental peculiarities of the parent. And we have the most ample evidence both from recorded cases and from common observation, that mental traits, even the slighter matters of manner and habit, are hereditary. Whatever intellectual or moral element marks the character of a man, will be very likely to crop out more or less in his children. It is frequently remarked in families, that a son or daughter shows the disposition or talent peculiar to one of the parents, and we are compelled to believe that the proclivity to transmit the mind as well as the body, extends to minute particulars. Not only strong will, intellectual capacity, and quick sensibilities, but the special lines of their activity, are hereditary. The acute perception, a powerful memory, a vivid imagination, the ability to think logically or the lack of these, are very likely, other things being equal, to manifest, in the son, the strength they attained in the sire. In like manner, irritable temper, over-sensitiveness to praise or blame, a taste for any special department of beauty or its absence, love of truth or its opposite, a disposition to unlimited self-indulgence of whatever sort, extreme selfishness or great benevolence, are liable to go by descent. No one who has read Galton's able work, lately published, on "Hereditary Genius," can doubt the transmissible character of intellectual and moral qualities in all their variety.

It is impossible to give the immense number of instances which have been noted wherever some special form of virtue or vice, of quickness or stupidity clings to families. These instances certainly warrant the opinion that all the gradations of character from mediocrity up to genius and down to idiocy, are wont to follow the lines of dessent. I have found from a close observation of students for thirty years in schools and colleges, that not only does a capacity for general scholarship, but aptness for special lines of study characterize the children of certain families. In Michigan Normal School, for example, three sisters showed marked ability in all the studies they pursued, while their brother was deidedly slow of comprehension. I subsequently learned that their father was intellectually sluggish, and their mother unusually intelligent. At the same school, three brothers graduated in different years, all having led their classes in nearly every study. The father of these young men was a man of mediocre intellect, but their mother was a woman of great intellectual energy. I have known many instances where a decided pro-

clivity for mathematics or for linguistic studies, was derived from the father.

Everybody knows that the extreme sensibility, fertile imagination and wealth of language that belong to the Beecher family, were a legacy from Rev. Lyman Beecher, who was distinguished for these high qualities. John Adams, second President of the United States, John Quincy Adams, the sixth President, and Charles Francis Adams, the writer, father, son and grandson—all men of eminent ability—were singularly alike in mental characteristics. Lord Bacon, the great statesman and philosopher, owed his remarkable powers to a union of natural gifts in both his father and mother. The father of Macaulay, the brilliant essayist, and historian, was a clear and forcible writer, and his grandfather a preacher of commanding eloquence. Undoubtedly, the wonderful memory of the great essayist was a family trait. Hon. Myron Holley, of Rochester, New York, who died in 1841, was a man of marked intellectual power and a gifted conversationist. Several of his children and grandchildren are likewise highly gifted in conversation. A public intellect, defective moral perception, and a full development of the lower propensities, as I have before said, tend, with equal probability, to follow the lines of hereditary descent.

Galton declares that he knows two good instances of hereditary silliness short of imbecility and has reason to believe he could obtain a large number of similar facts. An instance or two may be given of the inheritance of special tastes or genius in art. It is a well recognized fact that decided musical gifts run in families. The children of celebrated singers are very apt to possess a good natural ear and a fine voice. The Bachs of Germany, a musical family of marvelous attainments, extended through eight generations and comprised more than fifty individuals all distinguished either as performers or composers of music. Sebastian Bach of the sixth generation, in whom the family characteristic culminated, was a transcendent musical genius.

But the examples already given and many more which my space will not admit, prove that traits of character, and qualities and states of body are alike prone to reappear and sometimes with a minuteness that is amazing.

ACQUIRED HABITS AND INSTINCTS IN ANIMALS.

It will be easily seen that many of the domestic animals have been first trained to the performance of certain new acts and that the specific expertness thus gained has finally come to be transmitted, so that comparatively little instruction is needed to bring the acquired proclivity into exercise. Thus the rat terrier, as soon as his teeth are fully grown, requires little more than the presence of rats and men to set about their extermination. A tiny terrier pup which I once brought home, pricked up his ears and became excited, whenever he heard a scratch upon the carpet. The pointer coursing over the wheat stubble to find the trail of prairie chickens, stops when the scent reveals to him that they are close at hand and waits, with raised foot, the report of the sportsman's gun, then, at word of command, finds the dead bird. All this is an instinct acquired in the first instances from training, and inherited, at last, as a characteristic of the breed. The maltese cat transfers to her progeny, not merely her peculiar color but her mousing capacity as well.

In the variety of horses known as American trotting stock, the gait, courage, endurance, and the "time made," are the combined results of training and transmission. The same may be remarked of the pacers. Mr. T. A. Knight, in a paper read thirty-five years ago, before the Royal Agricultural Society, says that "the ancestors of the Norwegian ponies have been in the habit of obeying the voice of their riders and not the bridle, and the horse breakers complain that it is impossible to produce this last habit in colts; they are notwithstanding exceedingly docile and obedient when they understand the commands of their master." Beyond all question, horses inherit the effects of the training that their progenitors received and the breeders rely with perfect confidence, on the reproduction of spirit, gait, style of action, and capacity for speed.

In reference to cattle bred for the production of beef or milk, it is essential that they should possess a mild temper, a gentle disposition, and the degree of intelligence that usually attends these qualities. Quiet and peaceable habits go with facility in fattening and abundant yield of milk. I own a Durham cow bought from Dr. A. C. Stevenson, of Indiana, which is wild and fractious, and her calf, now a heifer two years old, has inherited her untamable spirit. No petting or coaxing has availed to win the confidence of either dam or daughter.

A broad forehead, a clear, quiet, well-open eye, are the signs of a kind and docile temper, but a forehead that is narrow and an eye that is glassy and restless, betrays an intractable disposition, and all these are hereditary.

REVERSION OR BREEDING BACK.

THE VALUE OF PEDIGREES.

Reversion is that singular phase of inheritance wherein any characteristic or quality of the parent disappears in the immediate offspring, but re-appears in the grandchildren, or in succeeding generations. Cases are by no means rare in which a child bears less resemblance to the father or mother than to one of the grand-parents, or to some ancestor even more remote. Hon. Caleb Baldwin once showed me a portrait of his great grandfather, which was a striking likeness to one of his own sons. A son of mine has the figure, the gait, and something of the features of his grandfather on his mother's side. Several of the grandchildren of the Hon. Myron Holly, of New York, bore so striking a resemblance to him, rather than to their parents, as to have been recognized by strangers when away from home as being closely related to him. The remarkable instance, cited by Sir Henry Holland, of four children out of five, otherwise healthy, becoming blind at about the age of twelve, from amaurosis, a disease which they had evidently inherited from a remote female ancestor who was the mother of several blind children, is also a case of reversion. It is indeed a well known fact that many family diseases, both bodily and mental, are often lost in one generation and reappear in the next. Any peculiarity of body or of mind which is hereditary, may be transmitted through parents in whom it is apparently absent.

Reversion, then, is the deriving of an inheritable characteristic or trait from any progenitor except the immediate parents.

The instances of inheritance from the grand-parents are, of course, far more numerous than from more distant ancestors; but there are many cases wherein a peculiarity has reappeared after an absence from the family line for several generations. There is, indeed, abundant evidence that no remoteness of ancestry lies beyond the possibility of reversion, and some naturalists hold that every organization has a latent tendency, under favoring conditions, to return to the type from which it originally sprung.

REVERSION IN PURE RACES.

The descendants of any pure breed are liable to obtain, through reversion, any characteristic long since eliminated by treatment and selection or surrounding conditions. The production of an occasional black or black-spotted lamb, in almost every flock, is an example of reversion to dark colored sheep from which, it is highly probable, the present races were derived. No race of sheep, however purely bred, have ever been quite free from the danger of furnishing, here and there, a dingy specimen of the old stock from which they descended. And since, with the exception perhaps of the Spanish breeds, sheep have been bred white since the period of the earliest history, the black lamb is an instance of reversion to a variety that existed several thousand years ago.

The occasional appearance of rudimentary horns on the heads of the hornless varieties of sheep, is a sample of reversion to a horned variety of much later date. The absence of horns in such races as the South-Downs, is probably an accidental variation from the normal form to which there is constant liability to return. Horns might probably be restored to the polled breeds, by persistent and careful selection.

REVERSION IN CATTLE.

Another case of reversion is furnished by Youatt:

"The most singular horn is that which now and then hangs from the brow of some polled cattle. It is no prolongation of the frontal bone; is not attached to that or any other bone of the head, but grows from the skin and hangs down from the side of the face."

The Galloway breed has been polled for over a century, and its departure from the horned condition is due to no known cause.

REVERSION IN SWINE.

The breeder of Berkshire swine gets occasionally from two animals which are perfectly marked, a litter of pigs that are badly spotted with white, and consequently valueless for breeding. These spots are a return by reversion to the colors of either the old Berkshire or the Sussex or Chinese pig with which the Berkshire was crossed at a later date. Last spring I paired two Berkshire sows (sisters) with the Bacon boar, a fine Berkshire owned by the Iowa Agricultural

College. This boar has the requisite "four white feet," but the rest of his body including his face is perfectly black. One sow brought a fine litter of seven pigs all perfectly marked except three, which lacked only the white spot on the face. The other sow produced six pigs, all, except one, badly spotted with white.

REVERSION IN FOWLS.

The Houdan fowls are well known as a non-sitting variety from France, whose principal value lies in their capacity, when well cared for, to lay large white eggs without stint. My son Willie, who breeds these fowls, tells me that in several cases the instinct of sitting has returned, and that, though not good mothers, two Houdans of his have raised each a brood of chickens. This was of course a reversion to the original instinct of incubation natural to the entire class, and bred out of the "non-sitters" probably by an over stimulation of the laying power.

REVERSION OF SHORT HORN COWS TO MILK.

Occasionally among the Short-horns which are bred to beef, is found a cow which yields a wonderful flow of rich milk. Such a case is undoubtedly an instance of reversion to the old milking stock from which the improved beef cattle were bred.

THE VALUE OF A PEDIGREE.

In this tendency of the pure breeds to resume, by reversion, the form or qualities of any ancestor preceding the immediate parents, lies the great value of pedigrees. For when it is proven by an authentic record that the grandparents, great-grandparents, and beyond these, the progenitors of any animal for many generations back, all possessed, substantially, the same qualities, as size, soundness, beauty of form, and fineness of fibre, then, any reversion to a given ancestor will be only a renewal of the excellence of the immediate parent. If all the animals of the lineage had, in equal fullness of development, all the characteristics sought in the breed, in such case it would be a matter of indifference whether the offspring derived its character and qualities from an *immediate* or a *remote* parent. The result in either event would be the same.

But the truth is that uniform excellence in all the individuals of a lineal ancestry, is not attainable. Even in the best families of the

present breeds, there will occasionally appear an animal whose qualities are below the average, and if such an animal used in breeding, perpetuates *himself* simply, he will beget an inferior progeny. But if, on the contrary, as not unfrequently happens, he begets by reversion the form and qualities of a superior progenitor, he will prove a far more valuable stock getter than an animal that fills the eye, yet reproduces, in breeding, some inferior predecessor.

Two principles are at work to mold the form and qualities of the offspring, namely *prepotence* and *reversion*. The prepotent parent duplicates himself. In the lack of prepotence in one parent, the offspring may be formed in the likeness of the other by reason of its greater procreative force, or it may revert to some progenitor in the line of either. To secure therefore, a certainty of profitable results in breeding pure blooded stock, it is essential that both parents should be good animals, and that both should be backed by a good pedigree.

SELECTION OF BREEDING ANIMALS.

Among the many facts which prove that in selecting breeding animals, a good pedigree is quite as important as "good looks," is one from the pen of L. F. Allen that is quite in point. The case referred to was that of a young bull calf imported to America some years ago, from one of the best and most carefully bred herds of England. The bull, though vigorous and showing some of the marked features of his race, proved on maturity to be an "inferior looking beast." For this reason, the importer after offering him for sale two or three years, sold him at last for a low price. The purchaser knowing the excellence of his ancestry, employed him in his own herd composed of cows, some good, some ordinary, yet all pure Short-horns. His calves even from coarse Durham cows, exhibited remarkable fineness and, in not one instance, did they fail to show, strikingly, the characteristics of his lineage. The stock he got when bred to the cows referred to—cows which were very diverse in quality—being wonderfully superior to both sire and dam—sold for advanced prices.

"The sole value of this bull," says Mr. Allen, "was in his blood and pedigree. Of himself, he was nothing; in his blood and pedigree he was everything. So, on the contrary, we have seen a bull,

almost perfect to the eye, pure of blood and of good pedigree; but his pedigree traced through ancestors whose qualities were *incongruous*, both *coarse* and *fine* or otherwise defective. His stock were *uncertain* in their good qualities, and many of them decidedly inferior. The first named bull could trace his lineage through a long line of ancestry possessing *uniform* good qualities; the latter one could not. He was patch-work, although thoroughbred as his pedigree showed; but there was no *fixed* standard of excellence, and through him their bad qualities all scattered into his stock and his own good ones as seen in his stock amounted to nothing positively certain. Thus pedigree is indispensable; and apparent excellence in the animal himself unsupported by a pedigree of undoubted excellence in a long line, is of minor value."

Manifestly, the first bull lacking in himself many of the points which round out the bovine form into perfect symmetry, uniformly reproduced *by reversion* some one of his ancestors *which were all superior;* while the second bull, though possessing in *himself* all the required points harmoniously blended reproduced, *not himself*, but one or other of his ancestors, some of which were inferior animals.

These facts make it evident beyond all cavil, that to secure uniform success in breeding, it is, in the first place, indispensable that the breeding animal should have such a lineage that, if he propagates by reversion, he can breed back to nothing but excellence in his ancestry, and secondly, it is equally vital that he should be himself a model in form and quality, so that if prepotent, he may propagate his individual perfections.

The first requisite is certified by an unexceptional pedigree; the second is verified by the practical eye and the skillful hand, and both will find their full fruition in securing to the owner a progeny that is without exception, beautiful, vigorous and thrifty.

PREPOTENCE IN BREEDING.

It would be an error to suppose that, when two animals are coupled, the resulting offspring will derive its characteristics equally from both. It rarely happens that the copulating male and female have the same power of transmitting the constitution and qualities belonging to each. Unite a Devon bull and a Durham cow and the calf that follows will not be precisely half Durham and half Devon.

Cross a Berkshire boar with a Poland-China sow, and you will not get, in the litter you look for, an exact balance between the two either in qualities or in the number of pigs resembling each. Neither does a Short-horn male and a native heifer produce an animal in which the peculiarities of the scrub and the short-horn are equally divided.

The reason is obvious. In nearly every fertile connection between two animals one is *prepotent*, that is, has a greater power than the other to propagate its own peculiarities to the exclusion of those of the other. The offspring will be, in a greater or less degree, a reproduction of the prepotent parent rather than of the parent that lacks this power. Prepotence then is the power which the sire has over the dam or the dam over the sire, to transmit, in the act of generation, a preponderance of its own qualities to the young.

PREPOTENCE IN CLOSELY RELATED SPECIES.

This remarkable characteristic reveals itself in the sexual connection of animals belonging to closely related species that interbreed. Cross, for example, the jackal and the dog and the creature that results is much more of a jackal than a dog. The mule, which is the joint product of the jackass and the mare, though much superior in its size, is in voice, ears, shape, endurance, and disposition a veritable ass. The jack is prepotent over the mare. The evidence given by Mr. Hewit as referred to by Darwin (1) is a warrant for saying, that the male pheasant crossed with the common fowl, gives the preponderating marks to the hybrid chickens. Mr. Hewit says that in all the hybrids raised from hens of several breeds by a cock pheasant "the head was destitute of wattles, comb and ear lappets, and all closely resembled the pheasant in the shape of the tail and general contour of the body." This prepotence of one species over another when crossed, has been shown to exist also in closely related species of plants.

PREPOTENCE OF ONE PURE BREED OVER ANOTHER.

Prepotence further shows itself in the pairing of animals which belong to different breeds, and it appears all the more striking in proportion as the breeds are farther apart in their characteristics.

(1) Variation Domestic Animals, p. 88, Vol. 2.

The offspring which follows from such a cross, often shows many distinct characters which may be attributed with certainty to one or the other parent. The Manx cat, bred pure on the Isle of Man, has long hind legs and no tail. Darwin (2) tells us that Dr. Wilson crossed a male Manx with a common female cat and out of twenty-three kittens seventeen were destitute of tails. Clearly the Manx tom possessed a procreative energy, which, so far as the tail and its correlated parts were concerned, prevailed over that of the common tabby.

Another instance cited is that given by Godive. A ram from a breed of sheep on the Cape of Good Hope which resembled the goat was crossed with ewes of twelve other breeds and produced lambs that when full grown were fac similes of their sire. M. Nouel, Director of the Agricultural School of La Charmoise, in an article on the method of forming a new breed of sheep, translated by Philip Pusey, President of the Royal Agricultural Society of England, says that when rams of any English breed whatever were connected with French ewes "Most of the rams resembled the mother more than the father; some showed no trace of the father, a very few represented equally the features of both." He says farther that it required the products of a second cross before the lambs were more like the English ram than the French ewe. Many instances are given of the widely different degrees of prepotence among the numerous breeds of pigeons; some though perfectly pure showing great weakness of transmission when crossed with other breeds, and others great strength. The pouters and the barbs, for example, are said to prevail in reproduction over the fan-tails. The trumpeter, though an old breed, when paired with other races, loses his distinctive tuft over the beak and his peculiar coo; and these he does not regain, even though the mongrel is crossed back with the pure trumpeter until he has seven-eighths of the trumpeter blood.

The improved Short-horns, in impressing their distinctive features on their calves, very generally prevail over other breeds of cattle. Especially are they wont, in pairing with a different breed, to beget an animal that in respect to size, fattening quality, and early ripeness, shows the peculiarities of the Short-horn. The sure renewal, in the beef, of such valuable beef-making qualities when crossed with other

(2) Variation Dom. Animals, p. 86, Vol. 2.

breeds, is one of the elements of the high estimation in which the Short horns are held. In pairing with other races of cattle, the Devons also exhibit great pertinacity in reproducing the Devon type. Particularly is this true of the cherry red color which is a distinctive characteristic of the race and which is sure to attend the Devon blood whether pure or mixed.

Among the improved breeds of swine the Berkshire when bred on other breeds, seems to display a remarkable degree of reproductive power, probably surpassing in this respect all other races of swine.

It has been held that the prepotence of any race of domestic animals depends on its purity and relative antiquity, but facts do not verify such an opinion; for some races comparatively modern, beyond all question, excel in this regard others of more remote origin. Fixedness and uniformity of characteristics are undoubtedly made more secure by the greater length of time during which they have been bred exclusively, but prepotence itself is often transmitted by the remarkable animal that is sometimes the founder of a race and becomes, like its other distinctive qualities, one of its own peculiar inheritable traits. Prepotence is the superior power of any animal to impress his own likeness and image on the offspring, to the exclusion of the likeness of any other animal with which he couples, of any blood whether pure or mixed; and as prepotence is itself an inheritable capacity, it must be a very different thing from breeding true to the type on which a race is formed.

PREPOTENCE OF THE PURE BREEDS OVER SCRUBS.

The pure breeds, though differing as to relative strength of transmission among themselves, are generally prepotent over animals of impure or mixed blood. This fact greatly facilitates the process of "breeding up," or, in other words, of improving scrub stock by successive crossing with a pure breed.

Thus the product from a union of a Short-horn bull with a native cow, is usually a much better animal than if it were a half and half compromise between the sire and the dam. It inherits the weight, shape, feeding quality, and quickened maturity of the Durham, and something of the hardiness of the native. The other pure breeds of cattle, in like manner, prevail over the mixed breeds with which they are coupled and so give to the calves a preponderance of their own characters. Thus a first-class Ayrshire bull crossed with a good

native cow will produce a stock which is decidedly superior to the natives in constitution, fine points, and in flow of milk. The same may be said of the Jersey, though of this cross we have a less number of examples. A cross of the common sow with a Berkshire or a Poland-China boar, beyond all doubt, makes the best cheap pigs for easy fattening. In further illustration of the prepotence of pure races over other animals of mixed blood, I quote from M. Nouel, Director of the French Agricultural School, who, by means of the prepotence of an English bred ram over ewes of mixed blood, formed a new and valuable breed of sheep.

"It appeared there that in order to untie the Gordian knot whose threads I have traced, inasmuch as one could not increase the purity and antiquity of the blood of the rams, one must diminish the resisting power, namely, the purity and antiquity of the ewes. With a view to this new experiment, one must procure English rams of the purest and most ancient race and unite them with French ewes of modern breeds or rather of mixed blood forming no distinct breed at all. It is easier than one might suppose, to combine these conditions. On the one hand I selected some of the finest rams of the New Kent breed regenerated by Goord. On the other hand we find in France many border counties lying between distinct breeds in which it is easy to find flocks participating in the two neighboring races. Thus on the borders of Berry and La Sologne, one meets with flocks originally sprung from a mixture of the two distinct races that are established in those two provinces. Among these, then, I chose such animals as seemed least defective, approaching in fact the nearest to, or rather departing the least from the form which I wished ultimately to produce. These I united with animals of another mixed breed, picking out the best I could find on the borders of La Beauce and Touraine which blended the Touraingelle and native Merino blood of those two districts. From this mixture was obtained an offspring combining the four races of Berry, Sologne, Touraine and Merino, without decided character, without fixity, with little intrinsic merit certainly, but possessing the advantage of being used to our climate and management, and bringing to bear, on the new breed to be formed, an influence almost annihilated by the multiplicity of its component elements."

Now what happens when one puts such mixed blood ewes to a pure New Kent ram? One obtains a lamb containing fifty hundredths of the purest and most ancient English blood, with twelve and a half hundredths of four different French races which are individually lost in the preponderance of English blood, and disappear almost entirely, leaving the improving type in the ascendant. The influence, in fact, of this type was so decided and so predominant that all the lambs produced, strikingly resembled each other and even Englishmen took them for animals of their own country. But what was still more decisive, when these young ewes and rams were put together they produced lambs closely resembling themselves, without any marked return to the features of the old French races from which the grandmother ewes were derived.

PREPOTENCE OF ONE SEX OVER THE OTHER.

But one of the most noticeable facts respecting prepotence is that, in many cases, it does not exist equally in both sexes of the same breed, and Darwin affirms, though it sometimes runs equally in both sexes, it is frequently the case with animals (but not with plants) that it is much stronger in one sex than the other.

A grade from a scrub bull and a Short horn cow, is not generally equal to a grade from a native cow and a Short-horn bull. The Short-horn bull is not only prepotent over the females of the species generally, but over the females of his own breed as well. For this reason, the Short-horn male may be relied on for improving the beef-making qualities of all mixed breeds.

The prepotence of the male Manx cat was manifest in the experiment of Dr. Wilson already referred to. The progeny of the male Manx and the common tabby were seventeen out of twenty-three tailless, but the kittens of the common tom and the female Manx were mostly ornamented with that appendage. The hinny, which is a cross between the jenny (female ass) and the stallion, has much less of the ass in his nature and form than his cousin, the mule. His voice, ears, head, neck and tail, as also his bearing and behavior, are certainly more horse-like. Hence the female ass is prepotent in a less degree, if at all, than is the jackass over the mare. It may be inferred, consequently, that the jack is prepotent over the jenny.

I venture the opinion, which these facts and careful observation have helped to confirm, that the males of all pure races are, with a few exceptions, stronger in the power of transmission than the females. Earl Spencer, President of the Royal Agricultural Society

of England, declares that among cattle and sheep, to whose breeding he had given much attention, the qualities of the male parent predominate in the offspring. It is, therefore, a matter of vital moment that in keeping up and improving the breeds, the breeder should secure the best breeds possible.

DIFFERENCE IN THE PREPOTENCE OF INDIVIDUALS.

But not less interesting is the fact that individuals of the same breed differ, remarkably, as to the possession or the lack of this singular power To such an extent does this difference obtain, that no pure blooded animal of either sex can be accurately judged of as to its breeding capacity, without scrutinizing its progeny. The purchase of cattle for breeding that are too young for parentage is, therefore, attended with a degree of risk which materially diminishes the price, but the breeder that buys a bull or cow without inspecting its calves when within reach, takes a risk which he might easily avoid. The bull, for example, may approach the beauty of a perfect model —may display such faultless symmetry of form as to well nigh reach the breeder's ideal—still his actual value lies, not in his own perfection, but in the beauty, size and symmetry which are conspicuous in the animals of his siring. Great excellence of points and parentage will, if prepotence be added, justify the high prices often paid by the purchaser, but no perfection of points or pedigree, if prepotence be wanting, can save the owner from bitter disappointment.

The history of pure races presents many specimens of distinguished animals that are prepotent. Among these stands Blackhawk, founder of the well known race of roadsters. This remarkable horse was endowed with great constitutional vigor and endurance, which qualities, by reason of his prepotence, he was able to reproduce uniformly in his colts, and these in turn propagated the same qualities with equal procreative energy.

The bull owned by Charles Colling a hundred years ago, Hubback, progenitor of the improved Short-horns, showed great mellowness and other valuable qualities, but his crowning merit was, that he proved a most excellent stock getter, renewing himself in every one of his calves. The same may be said of the bull Favorite, bred subsequently by Colling, which possessed the power of self-renewal in a wonderful degree.

As an example of individual prepotence, I may mention an Ayrshire bull called the "Lad of Kyle," bought by the Agricultural College from Col. King, of Minnesota, some four years ago. This bull is now five years old—a rather small, compact, fine-boned animal; symmetrical in form, but showing no remarkable development of points. His real value lies in the fact that he uniformly and strikingly impresses himself upon the calves of his own getting. They all show, without exception, the unmistakable marks of the sire. Whether the cow he serves be native, grade or pure, well proportioned or otherwise, their calves display invariably the color, the slender head and neck, and the broad hind quarters of the Ayrshire.

An indifferent cow of my own produced a heifer calf which was sired by the "Lad of Kyle," and which at five months old has all the outward seeming of a thorough-bred. Likewise a cow belonging to my employee, which was specially scrawny and narrow chested, brought a calf of the same siring whose shape and size are equally satisfactory. The value of such an animal in the improvement of milking stock can hardly be over-estimated.

On the other hand, an instance of the *lack of prepotence* is furnished by a pure Berkshire sow which I purchased of the Agricultural College two years ago. She was large and long-bodied; just the form for the successful production of pigs, but her nose was coarse and somewhat too long, and her hind quarters lighter than I could wish. It was consequently desirable *that she should not be prepotent;* and happily the event proved that such was the case. Her first litter by Alexis, a prime Berkshire boar, were all modeled after the sire. The sows, especially, having broad backs, full hams and delicate dishing faces.

In coupling for breeding it is extremely fortunate if the superior animal is also the prepotent one.

All these parts will be found when carefully considered, to warrant the assertion that it was prepotence, mainly, which enabled certain distinguished animals to become the parents or founders of races; and this we will attempt to develope more fully in a subsequent article.

REVERSION TO PECULIARITIES GAINED FROM CROSSING*

FROM CROSSING DIFFERENT BREEDS.

When two animals of different breeds are crossed, the resulting offspring will generally inherit the characteristics of both commingled in varying proportions. The product of the Poland China sow and the Berkshire boar will show, in form, size and compactness, something of the qualities of each. The grade calf, sired by a Short-horn bull on a native cow, blends the peculiarities of the dam and the sire, those of the latter, however, predominating.

It might be inferred from this, that, if the mongrels which spring from the crossing of different breeds, are coupled, the young that follow, will possess the characteristics of the two breeds in the same proportion as their parents. In other words, that mongrels will continue, like pure races, to breed true to the principle that like begets like. Such, however, is by no means the case. *For several generations of cross-bred animals after the first, there is constant tendency to revert to one or other of the parent breeds*, and this tendency increases in proportion as the breeds so united are farther apart in their characteristics.

We have it from Mr. Sidney, as quoted by Darwin, "that in a litter of Essex pigs, two young ones appeared which were the image of the Berkshire boar that had been used twenty-eight years before in giving size and constitution to the breed." There are not wanting those who declare that the Short-horns, which are the descendants of the famous Lady, a Colling Short-horn cow, one-quarter Galloway blood, still reveal, by occasional reversion, some points of the Galloway breed. The Poland China hog, a late breed whose model form was gained from a cross, as the name implies, and whose points have probably been supplemented by careful selection of animals outside of the breed whose name it bears, is liable under harsh treatment, to revert to any one of its original parents. On the other hand, each succeeding generation tends, with careful breeding, to fix more securely the remarkable symmetry of this excellent cross. Our native cattle, as is well known, are derived from several races mingled together without care or judgment. Though generally coarse boned,

*These articles are written for stock raisers who are not experts in breeding.

they exhibit every variety of form from extreme lankness to moderate fullness of outline. Especially do the native milk cows display a marked difference as to the quality of the milk they yield.

Now this striking diversity in all prominent points—this utter absence of all uniformity in shape and quality—comes from a constant reversion to one of the many kinds of cattle, bred, by design or accident, into our native stock. Hence the impossibility of bringing our home cattle by a system of selection and breeding up, in any assignable time, to a permanence of valuable qualities. The coupling of the best animals, and careful feeding would undoubtedly improve the stock, but such a policy, if adopted for the purpose of securing the staple qualities of a *breed*, would be defeated, at any rate for many generations, by frequent reversion along one of the many lines which concentrate in every native cow or bull. The better policy is, of course, to cross successively the best native cows with Short-horn bulls. In this way, by the process known as grading up, we can obtain, in a few years, a stock which shall combine the growing, feeding, and ripening properties of the Short-horn, with the endurance of the native. The larger the moiety of Short-horn blood infused into this cross, the stronger will be the tendency of reversion to the Short-horn side. Thus both reversion and (as shown in the last article) prepotence in the Short-horn bull, help to strengthen and intensify the qualities of the beef producing breed.

A similar policy may be pursued to improve the milk cows of the Northwest, whether for the making of butter or cheese. By repeated crossing of the best native milk cows and their progeny with Ayrshire or Jersey bulls, a milking stock may be gained that will be scarcely inferior, in yield and richness, to the pure Jersey or the Ayrshire cow. Since the Jersey or Ayrshire blood largely predominates in the cross, reversion will point towards the superior breed. This subject, however, will be more fully and minutely treated in a future article on the best method of improving the cattle of the West.

REVERSION IN THE SAME BREED FROM CROSSING INDIVIDUALS OF DIFFERENT FAMILIES.

Whenever two animals of different families in the same breed are paired, any of the resulting progeny for several generations following the first, may inherit by reversion the marked traits or qualities

of either parent. In this way, a stallion, bull, or boar of remarkable excellence, may impart his valuable characteristics to the other families of his race. It was through reversion and prepotence that Hubback,—a Short horn bull of great vigor and mellowness, became, nearly a century ago, the progenitor of the improved Short-horns. Through the same principle, the bulls of the Duchess family are used to improve Short-horn herds of different pedigree. Hence, when the lineage of any pure animal terminates in a distinguished ancestor, this fact is apt to inspire great confidence in its breeding properties.

There is a great variety of belief as to the number of generations which must pass away before a peculiarity derived from a cross is beyond the possibility of recurrence. All breeders agree that the least number is *five*, while the maximum number has never been settled. The importation of '17 whose pedigree is in doub', have been crossed with families of improved lineage for nearly sixty years and yet the value of a Short-horn whose veins contain even the smallest fraction of their blood, is thought by some to be seriously impaired thereby.

CROSSING AN IMMEDIATE CAUSE OF REVERSION TO REMOTE ANCESTORS.

This phase of reversion is very curious. When two animals of different breeds or closely related species are crossed, the immediate offspring are often found to possess characteristics which do not exist in their parents, but are derived by reversion from an ancestor more or less remote.

Eighteen months ago I crossed a pure Berkshire boar with a Poland-China sow not quite pure. The sow brought a litter of six pigs, three of which were spotted like the dam and shaped like the sire. The other three had the form of the Berkshire but their color was *sandy*. The cross had undoubtedly produced a reversion in these pigs to the color of one of the ancestors in the Poland-China breed.

CROSSING OF PIGEONS.

Darwin details, in the sixth chapter of his Variation of Animals, etc., several experiments which he made to test the question whether the act of crossing tends, in itself, to restore to the offspring, peculiarities which had long since disappeared from the two breeds to which the immediate parents belong. He selected pigeons from

long established races which, when kept pure, would not, in a hundred generations, show any departure from their own proper colors. Yet, though none of these breeds had the slightest tinge of blue, when crossed they produced, in many instances, birds of the *slaty blue color and black barred wings* that mark the wild rock pigeon, which is the probable progenitor of all the improved varieties. In the seventh chapter he gives the result of his experiments for the same purpose, in the crossing of purely bred fowls. Crossing old and pure breeds which had not, for many years, shown a single red feather he produced fowls in which this color appeared from reversion to *the original wild stock*. A black Spanish cock and a white silk hen whose colors are invariable, by pairing, gave life to a fine fowl in which the red feathers and other markings of the *wild Gallus Bankiva* were conspicuous. Rev. W. D. Fox crossed a white drake with a slate colored duck both belonging to different varieties of the musk duck, and obtained white pied black birds which closely resembled the wild musk duck which was the parent breed.

CROSSING OF HORSES.

When the horse and the jenny, or female ass, two closely related species, are crossed, the product is a hybrid (the mule) which, in a majority of instances, has *dark bands or stripes* across the legs and sometimes on the shoulders, though no such stripes are found on either parent. Many of the mules on which the stripes show most plainly, are light dun color. From the fact that offspring of a similar color with dark stripes have been produced from other crosses of related species with the horse, there is reason for believing that all such are cases of reversion to the colors of a light dun, dark black-striped horse which was the primitive ancestor.

REVERSION PRODUCED BY CROSSING CATTLE.

Undoubtedly reversion to primitive forms sometimes results from the crossing of bovine breeds which are widely diverse in their characteristics. Thus Darwin refers to the experiment of J. Beasley, of Northamptonshire, who crossed some carefully selected West Highland cows with purely bred Short-horn bulls. The bulls were red and white or dark even; and the Highland cows were all of a red color inclining to a light or yellow shade. But a considerable number of the offspring were *white or white with red ears*. Now

since several writers have given testimony that, in England, there existed, in ancient times, a breed of half-wild cattle which were *colored white with red ears*, there certainly is ground for the inference that the color of the mongrels from the above mentioned cross, was gained by reversion to these wild cattle as the original progenitors of both breeds.

The fact that cross breeding often induces reversion in cattle to early ancestral forms, is an additional obstacle to the formation of intermediate breeds by crossing.

All these facts which we have gathered and given respecting reversion, indicate, beyond all question, that our best policy is to improve the pure breeds of cattle already established and to cross the pure bulls with our best native cows as a means of grading up our native stock to a higher condition of the milk and beef producing qualities.

CLOSE BREEDING.

Close breeding is the fruitful pairing of two animals that are related by blood. The terms *close breeding*, *interbreeding*, and *breeding in and in*, have the same significance and may be used interchangeably. In close breeding, the *degree* of *closeness* will, of course, be determined by the nearness of kinship between the animals coupled. The consanguinity of brother and sister is the nearest of all, because two animals so related derive their blood from the same sire and dam. The fertile connection of brother and sister is, therefore, an example of the closest breeding possible. The blood of both parents being *identical*, is intensified in the offspring. The next degree of kinship not quite so near, is that of sire and daughter or dam and son. The daughter, for example, has the mingled blood of her sire and dam and the sire has, consequently, only half the blood of the daughter. The fruitful union, therefore, of sire and daughter or of dam and son, is an instance of breeding which is not so close as that of brother and sister. Another remove in closeness of kinship, is that of grand sire and grand daughter or of grand dam and grand son. The grand daughter has one-half the blood of the sire and one-fourth of the blood of the grand sire, and, consequently, in a fertile connection with the latter, the interbreeding would not be so close as the coupling of sire and daughter. In this way, the degree of consanguinity between animals of the same family, may be clearly ascertained.

THE EFFECTS OF CLOSE BREEDING ON THE OFFSPRING.

The entire effects of close breeding on the young that follow, have never been completely settled. The different species of animals, when interbreeding, show varying results, but the more important consequences for good or evil, are so manifest that they may be reduced to definite statement.

In the first place, close breeding intensifies all hereditary tendencies whether good or bad. It augments in the offspring, not only the valuable characteristics but the defects and diseases which are *common* to both the parents. It brings out qualities that are latent in the copulating animals and makes them *apparent* in the progeny. Take a cow and bull of the Duchess family that have sprung from the same parents; the blood of these two animals is identical. All the valuable points, the slender bone—the delicate muzzle—the broad loin and shoulder—the quickness to mature and fatten, are the same in both. The tendency in pairing, to transmit these qualities is, therefore, intensified by reduplication. Their full development in the calf is insured by a two-fold guaranty. Prepotence, reversion, and the law of likeness point the same way and run in the same line. All the forces of inheritance are doubled and concentrated upon each character and quality whether visible or latent. The result is that, in the young animal which is the product of this consanguineous union, every excellence of the parents is enhanced and every defect aggravated.

WHAT ANIMALS MUST BE REJECTED IN CLOSE BREEDING.

It is evident from the principle just explained, that, when defective animals, related by blood, are paired, their offspring will be inferior to the parents. If a contracted chest and pinched vitals are common to sire and dam, they will be still more contracted and pinched in their immediate descendants. Hollow crops, high flanks, coarse bones, will all be aggravated in the next generation. The disease which, as a mere family tendency, is latent in the pair, will be apparent and pronounced in the progeny, and a family weakness of structure in any part, may become a positive malformation. Beyond all question, a rapid degeneracy follows the breeding of imperfect animals which are closely akin. Only here and there can a family be found whose members are so surpassingly excellent, vigorous and

sound, as to make interbreeding a profitable policy. Even in such families it cannot be safely continued through many generations. No animals are perfect. Some imperceptible morbid tendency, some slight latent weakness, will finally be developed into a real disease, a delicate constitution or hopeless infertility. In an article written nearly thirty years ago and published by the Royal Agricultural Society of England, Mr. John Wright describes the evils which he had observed to spring from the in and in breeding of the improved Short-horns. I quote a single passage as bearing directly on this subject. Great improvement in the Short horns was secured by close breeding, but there is little doubt that in many cases it was carried too far. We think Mr. Wright indulged somewhat in the rhetoric of over-statement.

"The writer's opposition to this principle of breeding in and in" proceeds from having witnessed so many serious losses in herds so allied, which, previous to the affinity of blood, were healthy and strong constitutioned. In the early Short-horns no cough, no delicacy of constitution was known; but as affinity of breeding progressed a delicacy of constitution accompanied it. It has often been exultingly said that *Comet* was the finest bull of his day, and at the same time had the greatest affinity of blood of any animal we had; this is a truth which cannot be denied, but it might be the exception and not the rule. It was notorious that the stock got by him out of cows that were strangers in blood, were far superior to such as were more nearly akin. It will be remembered that Comet had a deformed shoulder; who can say that this did not proceed from close affinity in the parents? In the human frame it is a very common thing to see deformed shoulders proceed from disordered lungs.

In the Short horns of close affinity of blood, how many bulls do we find with lame shoulders! how many called cripples, and how many cripples in reality that never meet the public eye! We see no other race of animals with this defect except those Short-horns bred in and in. It has been said that this disease might arise through breeding from animals of bad constitution, and thus perpetuate their disease in their offspring; but when we find this disease originating and prevailing in animals of the same family, after repeated crossing in and in, though unknown in their ancestors, it is a fair presumption that the practice is inimical to the constitution."

OTHER EXAMPLES OF THE MISCHIEF WROUGHT BY CLOSE BREEDING.

From the same writer, we learn that Mr. Wm. Clarke, of Shencliff, who had become distinguished for the fighting qualities of his game cocks, being desirous of preserving the peculiar excellence of his own stock, kept breeding them together, until they lost their notorious *gaminess*, and would stand passively while they were torn to pieces. Under this close breeding they lose also the required weight. However, by means of a judicious cross, these degenerate game cocks, in a single generation, regained both pluck and size.

Mr. Wright gives further *his own* test of the effects of close breeding. He put a boar to two or three sows of the same parentage and continued to breed this boar to his own litters for seven generations, until finally many became barren; some died soon after birth, and not a few showed such a lack of sense that they could neither suck nor keep a line when attempting to walk, but the last two sows of this interbred stock were crossed with boars of *other blood* and produced healthy litters.

As an instance of the deleterious effects from the interbreeding of dogs, Sir John Sebright, author of "The Art of improving the Breed" declares, as quoted by Darwin, that, by breeding *in and in* by which he means matching brothers and sisters, he has actually seen strong spaniels become weak and diminutive lap-dogs. Darwin adds that "the Rev. W. D. Fox, had communicated to him the cast of a small lot of blood hounds, long kept in the same family, which had become very bad breeders, and nearly all had a bony enlargement of the tail. A single cross with a distinct strain of blood hounds, restored their fertility and drove away the tendency to malformation in the tail."

WHAT ANIMALS MUST BE PAIRED IN CLOSE BREEDING.

Since close breeding duplicates, in the offspring, the qualities and points that belong to a family whether good or bad, it is a vital necessity that the related animals, which are paired, *should be models of excellence in every respect.* From the intensifying effect of close breeding, every latent defect being common to the parents, may become a visible blemish. Every weakness may turn to a deformity, every imperfect organ or part to a positive malformation. Close breeding aggravates and develops all faults whether of form,

quality, or constitution. Even those tendencies which are so slight as to be hidden in the parents, are likely to stand revealed in the progeny. A lank carcass will be still lanker, flat ribs flatter, and shrunken crops still more shrunken. It is, therefore, imperative that interbred animals should be, as nearly as possible, sound in constitution, perfect in health, and faultless in form. Such animals are extremely rare, and to discover them, whenever they exist, requires an acuteness of perception which few breeders possess. The finest *looking* animals often carry within, some organic flaw or the germ of an inheritable disease. A beautiful stallion I knew in Michigan, produced fine stock when crossed with ordinary mares, but begot a colt with deformed legs, when bred with his sister.

The improved Short-horns are the result of close breeding, but their progenitors were wonderfully vigorous, sound and symmetrical. Hubback, their original ancestor, was in many respects, well nigh faultless. Yet of all the breeders in the neighborhood of Ketton, England, Charles Colling was the only one who discovered his surpassing excellence. Mr. Colling, perceiving intuitively the rare qualities of Hubback, produced by the interbreeding of his calves, a most remarkable and permanent improvement in the Short-horn race. The descendants of this famous bull preserved and intensified his characteristics by close breeding and showed the deep, wide chest, the soft hair and mellow hide, the quick ripeness, the fine, evenly diffused flesh, the short legs and delicate offal, that distinguished their progenitor. From the interbreeding of the progeny of Hubback, sprang some of the most marvelous cattle the world has ever known. Thus *Comet*, a distinguished bull bred by Colling, was the result of interbreeding with the offspring of Hubback for several g nerations.

I quote from Sanford Howard: "It will be seen at a glance how close was the affinity in the immediate progenitors of this animal. Thus, the bull Bolingbroke being coupled with the cow Phœnix—both of which were begotten by Foljambe, whose dam, was by Hubback—the produce was the bull Favorite, which, being coupled with his dam (Phœnix,) the produce was young Phœnix, and she coupled with her sire, produced Comet. The dam of Comet, therefore, had three-fourths of the blood of her dam, Phœnix; the sire of Comet, Favorite, had half of the blood of the same cow; so that Comet himself had five-eighths of the blood of Phœnix, his grand dam on both sides."

CROSS-BREEDING.*

Cross-breeding is the fertile copulation of two animals which are not related by blood. In cross-breeding we may couple a male and female which belong to different closely related species, or to different breeds, or to different families in the same breed. Furthermore, we may cross an animal belonging to a pure breed, with another which is of mixed blood, or we may couple animals, both of which have sprung from the mingling of different breeds.

The offspring of a cross between two closely related species, is called a *hybrid*. The mule, for instance, is a hybrid—the product of the mare and the jackass. The offspring of a cross betw en two animals belonging to different breeds in the same species, is called a *mongrel*. Cross-breeding between a shepherd-dog and rat-terrier, for example, would produce mongrel dogs. The offspring of a cross between an animal of pure breeding and a mongrel, is termed *a grade*. The calf which springs from the crossing of a Durham bull and a native cow, is a Short-horn grade. An animal which has resulted from the crossing of different families in the same breed, may be termed a thorough-bred of *mixed strains*.

THE EFFECT OF CROSSING ON THE CHARACTERISTICS OF THE OFFSPRING.

The general effect of crossing, whether of species, breeds, or families, is to produce an animal in which the qualities of both parents are blended. The calf which springs from the crossing of a coarse-boned, mongrel cow with a pure-blooded, fine-boned bull, will ordinarily be a compromise in qualities between the coarseness of the dam and fineness of the sire. Inspect cross-bred fowls, pigs, horses, or cattle, and you will find abundant illustrations of the fact. The dog which is half Shepherd and half St. Bernard, resembles both varieties of dogs, in form and qualities. He has gained somewhat of the points and peculiarities of each breed, but he has lost their perfection, as shown in his pure-blooded parents. A cross between the male bronze turkey and the common hen turkey, is superior to the latter, but does not reach the size and excellence of the full bronze.

It must not be forgotten that prepotence plays its part in deter-

* Written for those who are not experts.

mining the *proportion* in which the characteristics of the parents are mingled in the cross-bred animal. The prepotent sire or dam inevitably transmits the larger moiety of form and qualities to the offspring of the cross. The cross-bred animal will, therefore, show a greater likeness to the prepotent parent than to the parent which lacks this power. The pig which is a cross between the Berkshire boar, and a sow of another breed, resembles the sire rather than the sow, because of his prepotence. It is indeed extremely fortunate in the crossing of pure and mixed races, that the pure-blooded animal is generally prepotent; since, for this reason, the preponderance of qualities in the young will be derived from the more excellent parent. It may be noted also, that in crossing one pure race with another, such, for example, as the Devon and the Ayrshire, the male is usually prepotent over the female.

We must not forget, moreover, that crossing often produces reversion to the lost characteristics of some ancestor in either line, and that, on this account, the progeny may, in some features, be quite unlike either of its immediate progenitors. (See article on Reversion.)

THE INVIGORATING EFFECT OF CROSS-BREEDING.

The invigorating effect of a cross on the offspring is admitted on all hands. All experienced breeders have concurred in declaring that judicious crossing improves the resulting animals. The most distinguished writers on this subject have borne testimony to the same fact. Darwin says that, "as crossed animals are generally of large size and vigorous, they are raised in great numbers for immediate consumption " *

Mr. Spooner says that crossing distinct breeds certainly improves cattle for the butcher. Youatt affirms that "selection with careful and judicious *admixture* is the true secret of forming and improving the breed." Lord Somerville, a celebrated breeder, distinctly states that his half-breeds from Ryelands and Spanish sheep, were *larger* animals than either the pure Ryelands or the pure Spanish sheep. These statements are verified by hundreds of farmers who have raised cross-bred animals for the market. The general experience is that, when derived from a cross of carefully selected parents, they gain in constitutional vigor and are often even better feeders

* Variations of animals, &c.

and more thrifty growers than the pure bloods from which they sprang. A Short-horn grade heifer of mine is as large as the pure-bloods of the same age, though her dam was much smaller than the pure Short-horn cows. I have raised cross-bred swine that, in growth and thrift, outstripped the pure blooded parents.

CROSS-BRED ANIMALS NOT PROFITABLE FOR BREEDING.

It must be kept in mind, however, that mongrel animals are available only for immediate use or for the market. When sprung from well selected parents, they are strong and healthy, and therefore profitable for the dairy or the block. But they are generally valueless as breeders. The absence of permanent qualities and the tendency in their progeny to reversion make it a very precarious business to breed them together. We can get excellent grades from coupling good native cows with a Short-horn bull, but we should probably get quite inferior mongrels from the crossing of grades. It is of vital importance that, in all crossing, whether of swine, sheep, horses or cattle, the *male should be pure.* With pure males of a uniform breed, successive crosses infuse more and more of the superior blood. On the other hand, when the paired animals are *both* mongrels, their progeny are exceedingly variable and often comparatively worthless. Consequently, every judicious farmer will, at all sacrifices, breed from pure blooded sires.

CROSSING SPECIES TO PRODUCE HYBRIDS.

A *species* is a group of animals having uniform characteristics, living on like food, and capable, in pairing, of reproducing their kind, through successive generations without limit. Take notice that the definition includes the power of reproduction in *successive* generations. Two animals from *different* species that are closely related may, in many cases, have fertile connection but their *progeny* are generally barren. The other results of crossing different species, are the same as in the crossing of breeds. The crossing of species whenever possible, produces hybrids that show increased size, vigor, endurance and rapidity of growth. But these hybrids are, with few exceptions, incapable of procreation. Otherwise, the different species would become interminably mixed and confused together. The mule and the hinny which are the hybrid offspring of the horse and the ass, are the more common illustrations of the above facts. The mule, especially, is stronger and tougher than his parents.

THE CROSSING OF BREEDS.

The crossing of breeds of pure bloods with mongrels, is the best means of obtaining animals that are profitable for immediate consumption or use. No stock man can afford, under ordinary conditions, to raise pedigree animals merely for the production of beef and pork, or butter and cheese. The pure bloods have been brought up to great excellence, by skillful selection, high feeding, and careful treatment. By the same means, their valuable qualities are maintained. It is the unusual skill and care which are brought into play in raising thoroughbreds, that make their cost too great for the ordinary uses of the farm. On the other hand, if the expensive treatment which the pure bloods require, were withdrawn, they would soon degenerate. These animals belong to the *breeder* not the butcher. Their value lies in *breeding*, not in beef or butter. The fullness of valuable qualities they exhibit, do not belong to them as individuals, simply, but have characterized their ancestry in a line so far backward that they are sure, if maintained, to be projected forward to coming generations. They bring high prices only as *links* in the line of inheritance. Incapacity *to breed* would reduce the high price of any pure-blood, to common rates.

But if we cannot afford to raise pure-bloods for purposes other than breeding, we may, by crossing, transfer their valuable qualities to animals which, being far less expensive, are available for milk or meat. Couple an Ayrshire bull with a good native milch cow, and, if the calf is a heifer, you will be likely to get a far better milker than the same cow would bring if coupled with a native bull. Continue to breed the grade heifers so obtained, to different pure Ayrshire males, and in three or four generations, you will own cows that, in the yield and richness of milk, will be scarcely inferior to pure Ayrshires. The same may be said of the Jerseys. By a similar process, as we already know, the Durham bull transmits his points and peculiarities to the grade which comes from his service on a native cow. This grade, if a male, may be converted into a steer, which will often show the early ripeness and facility in fattening of the Durham with the hardiness of the native. The grade heifers crossed with Short-horn bulls for three or four generations, produce *high* grade cattle which frequently, as shown in our last number, attain remarkable size, and furnish the finest beef in the world. By

pursuing a similar method, also, the farmer who desires simply to improve his swine for a quicker growth and more economical feeding, may secure a stock which is better for this purpose than any of the pure breeds, even. The crossing of large healthy common sows with vigorous Berkshire boars for a few generations, will surprisingly increase the margin between the cost of production, and the price of pork in the market. With these facts before them, it is passing strange that so many farmers should persist in breeding and feeding the old scrub stock.

CROSSING OF FAMILIES.

The crossing of families will be dwelt upon more fully in a subsequent article on the methods used in making and improving *the breeds*. Meantime, we may indicate the main features of the purpose it answers, in producing sound and healthy thoroughbreds. We have seen that *close* breeding heightens both merits and defects, by combining the identical qualities and tendencies of both parents, and that, consequently, none but animals of remarkable excellence can be profitably bred to their kindred. Even then, close breeding cannot be long continued without harmful results. For not only does it develop, finally, incipient diseases and latent defects, but it impairs the constitution, reduces the size, and brings on sterility. We have seen that, on the contrary, crossing strengthens the constitution, stimulates growth, increases size, and cures sterility. It is, therefore, the true remedy for all the evil effects of close breeding. Thus, we gave an instance in our last article, of a family of blood-hounds, which had, by interbreeding, been reduced to the size of diminutive lap-dogs with a bony enlargement of the tail. Breeding these degenerate blood-hounds, with an unrelated male blood hound, not only restored at once their proper size, but gave back a normal condition of the tail. Mr. Wright renewed the lost fertility of two sows which were the product of close breeding for seven generations, by crossing them with an *unrelated* boar of the same race.

Many breeders insist that cattle may be interbred with advantage, for a much longer period than most other domestic animals. "Bates' herd" says Darwin, "was esteemed the most celebrated in the world. For thirteen years he bred most closely in and in; but during the next seventeen years, though he had the most exalted notion of the value of his own stock, he *thrice* infused fresh blood into his herd. It is

said that he did this, not to improve the form of his animals, but on account of their lessened fertility. Mr. Bates' own view, as given by Willoughby Wood, in Gardiner's Chronical, was that, "to breed in and in from a bad stock was ruin and devastation; yet that the practice may be safely followed within certain limits when the parents so related are descended from first rate animals."

PART V.

FINANCIAL REPORTS

AND

ABSTRACT OF

THE PROCEEDINGS OF THE BOARD OF TRUSTEES.

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

REPORT OF SUPERINTENDENT WARDEN.

IOWA AGRICULTURAL COLLEGE,
May 4, 1877.

To the Board of Trustees:

Under an act of the last General Assembly making an appropriation for a new heating apparatus and engine house, and for general repairs of the College building, the Board at its meeting in May, 1876, let the contract of putting in the steam heating apparatus to the Haxtun Steam Heater Company, of Kewanee, Illinois, upon their bid of $10,677.00. At that meeting I was appointed to superintend the work and let the remaining contracts. After advertising for bids, the following contracts were let in the latter part of May:

To Peter Raff & Son, of Ames, the building of the engine house and cistern; also taking up air-ducts and refilling with dirt, cleaning brick, pointing building, putting in stone keys and caps, taking out brick and rebuilding walls, and removing bell tower. To R. A. Wilson, of Ottumwa, the painting of the exterior of the College building. To Wright & Little, of Ames, the putting up of valleys and conductors and repairing tin-work. To the Mechanical Department of the College, plumbing and repairing water-closets, repairing interior wood work, and taking down and rebuilding wall over the chapel. Removing the old furnaces, cleaning out the sub-cellar and much other necessary work was performed by students.

In letting the various contracts, I deemed it proper to receive and consider bids from the Mechanical Department of the College on the same basis as from private parties, the contract being given to the lowest responsible bidder. In October of the same year, the following additional contracts were let: To T. R. Bickley of Ottumwa, repairs to plastering in College building, and to R. A. Wilson, painting interior wood work.

All contracts and bonds taken in connection with the work over which I have had charge have, previous to this report, been submitted to your honorable body and by you approved. These contracts are now entirely completed, and, acting under your authority, I have

made final settlement with the various contractors. The work has all been done to my satisfaction, and in no case has any allowance for extra work been made.

After letting the contracts for putting in the steam heating apparatus and for building the engine house and air ducts, it was found, owing to the low figures at which the contracts for the performance of this work had been secured, that quite a large balance remained to the credit of these appropriations. In the act of the Sixteenth General Assembly making these appropriations to the Agricultural College, it was provided, "that any sum remaining after the specific object for which the same was appropriated should be completed, might be used so far as necessary for any other of the purposes specified in the act."

Under this provision I made use of the surplus, mentioned above, in making necessary repairs upon the College building, being careful, at all times, to keep within the spirit and letter of the law.

Your attention is called to the exhibit of receipts and expenditures marked "A," and attached to this report. As required by law duplicate receipts have been taken for all moneys expended and the same have been forwarded to the Auditor of State.

EXHIBIT A.

Statement of Expenditures and Receipts on account of Appropriations of the Sixteenth General Assembly to the Iowa State Agricultural College.

RECEIPTS.

By amount received from State Treasurer on estimates of work performed and material furnished				$24,820.00

EXPENDITURES.

REPAINTING BUILDING EXTERIOR.

		1876.				
Vou. 1.	May	30.	To paid Iowa State Register for advertising..	$	3.75	
Vou. 2.	May	30.	To paid McFadden & Robinson for advertising		1.50	
Vou. 3.	July	30.	To paid R. A. Wilson on estimate for June and July		800.00	
Vou. 4.	Aug.	18.	To paid R. A. Wilson on estimate for August		700.00	
Vou. 5.	Sept.	16.	To paid R. A. Wilson on estimate for September		500.00	
Vou. 6.	Oct.	19.	To paid R. A. Wilson balance on contract		213.00—	$ 2,218.25

STEAM HEATING APPROPRIATION.

		1877.				
Vou. 1.	May	15.	To paid State Register for advertising	$	6.60	
Vou. 2.	May	15.	To paid Chicago Tribune Company for advertising		6.72	
Vou. 3.	May	15.	To paid Davenport Gazette for advertising		3.00	
Vou. 4.	June	28.	To paid Hitchcock for cleaning old brick		49.50	
Vou. 5.	June	29.	To paid C. C. Warden, services as Superintendent		50.00	
Vou. 6.	July	22.	To paid Haxtun Steam Heater Company, estimates		3,000.00	
Vou. 7.	July	27.	To paid C. C. Warden, services as Superintendent		125.00	
Vou. 8.	Sept.	7.	To paid Haxtun Steam Heater Company, estimates		5,541.60	
Vou. 9.	Sept.	7.	To paid Haxtun Steam Heater Company for material		3.84	
Vou. 10.	Sept.	16.	To paid C. C. Warden for services as Superintendent		100.00	
Vou. 11.	Nov.	15.	To paid C. C. Warden for services as Superintendent		60.00	
		1877.				
Vou. 12.	Feb.	14.	To paid Haxtun Steam Heater Company, balance on contract		2,135.40 -	$11,081.66

REPAIRS TO PLASTERING.

		1876.				
Vou. 1.	Nov.	15.	To paid T. R. Bickley's estimate in November		200.00	
Vou. 2.	Dec.	9.	To paid T. R. Bickley's estimate in December		600.00	
		1877.				
Vou. 3.	Jan.	18.	To paid T. R. Bickley's estimate in January		500.00	
Vou. 4.	Jan.	19.	To paid T. R. Bickley, balance on contract		723.10—	2,023.10

ENGINE HOUSE AND AIR DUCTS.

		1876.				
Vou. 1.	May	30.	To paid Iowa State Register for advertising		3.75	
Vou. 2.	May	30.	To paid McFadden & Robinson		1.50	
Vou. 3.	June	30.	To paid C. C. Warden for services as Superintendent		50.00	
Vou. 4.	July	22.	To paid Peter Raff & Son for work and material		1,000.00	
Vou. 5.	July	25.	To paid G. A. Shockley for cleaning brick		27.50	
Vou. 6.	Aug.	11.	To paid Peter Raff & Son for work and material		300.00	
Vou. 7.	Aug.	18.	To paid Peter Raff & Son for work and material		800.00	
Vou. 8.	Sept.	15.	To paid Peter Raff & Son for work and material		330.54	
Vou. 9.	Sept.	15.	To paid Peter Raff & Son for work and material		500.00	
Vou. 10.	Dec.	18.	To paid C. C. Warden for services as Superintendent		100.00—	3,113.29

REBUILDING BRICK WALLS.

		1876.			
Vou. 1.	July	24.	To paid College workshop on estimates	$ 350.00	
Vou. 2.	Sept.	15.	To paid Raff & Son's bill for work	360.00—	$ 710.00

CHANGES AND REPAIRS TO WATER CLOSETS.

		1876.			
Vou. 1.	May	30.	To paid State Register for advertising	3.75	
Vou. 2.	May	30.	To paid McFadden & Robinson for advertising	1.50	
Vou. 3.	July	14.	To paid Workshop—College—estimates	500.00	
Vou. 4.	Aug.	22.	To paid Workshop—College—estimates	225.00—	730.25

REPAIRS TO INTERIOR WOOD WORK.

		1876.			
Vou. 1.	July	26	To paid College workshop, estimates	875.41	
Vou. 2.	Aug.	15.	To paid A. Thomson's expenses to Chicago	28.60	
Vou. 3.	Aug.	21.	To paid College workshop, estimates	594.59	
Vou. 4.	Nov.	15.	To paid College workshop, estimates	681.00—	2,179.60

PAINTING INTERIOR WOOD WORK.

		1876.			
Vou. 1.	July	20.	To paid R. A. Wilson's estimates for June and July	154.00	
Vou. 2.	Sept.	16.	To paid R. A. Wilson's estimate for September	38.59	
		1877.			
Vou. 3.	Jan.	3.	To paid R. A. Wilson's estimate for December, 1876	311.80	
Vou. 4.	Jan.	29.	To paid R. A. Wilson's estimate for January	1,000.00	
Vou. 5.	Feb.	8.	To paid R. A. Wilson's estimate for February	422.97—	1,927.36

NEW GUTTERS AND CONDUCTORS.

		1876.			
Vou. 1	May	30.	To paid State Register for advertising	3.75	
Vou. 2.	May	30.	To paid McFadden & Robinson for advert'sng	1.50	
Vou. 3.	July	25.	To paid Wright & Little's bill	789.91	
Vou. 4.	Sept.	13.	To paid Wright & Little's bill	41.33—	836.49
Total					24,820.00

REPORT OF THE TREASURER.

[FOR THE YEAR ENDING NOV. 15, 1876.]

The following are the Receipts and Expenditures on account of the different College Funds for the Year ending November 15th, 1876.

PERMANENT ENDOWMENT FUND.

RECEIPTS.

	Dr.	Cr
Balance from last year		$41,330.92
Amount from sales of College lands		24,331.95
Total receipts		65,662.87

EXPENDITURES.

Total paid State Treasurer for investment	$65,662.87	
	65,662.87—	65,662.87

INTEREST FUND.

RECEIPTS.

Balance from last year, Endowment Interest Fund, $1,477.00, Interest Fund, $3,164.91		9,641.91
Amount from G. W. Bassett, College land agent		29,213.47
Amount from State Treasurer, interest on investments		1,197.32
Amount from Farm Household, balance over expenditures		167.32
Total receipts		40,220.02

EXPENDITURES.

Paid for salaries	24,786.02	
Paid for contingent expenses	2,191.40	
Paid for fires and lights	1,401.95	
Paid for furniture	236.04	
Paid for water supply	49.12	
Paid for deficiency in laundry account	14.54	
Paid for department of Agriculture	3,489.27	
Paid for department of Horticulture and Forestry	1,171.72	
Paid for department of Mechanics	1,737.09	
Paid for department of Chemistry	576.51	
Paid for department of Physics	775.07	
Paid for department of Botany and Entomology	279.24	
Paid for department of Journalism	1,271.01	
Paid for department of Military Tactics	39.05	
Paid for department of Civil Engineering	40.63	
Paid for ornamental grounds	528.56	
Paid for field experiments	147.16	
Paid for museum	682.29	
Paid for library	350.97	
Paid for new pianos	1,286.54	
Paid for sidewalk from College to Physical Laboratory	377.49	
Paid for repairs to water and gas works	130.00	
Paid for preparing wood samples for the Centennial	58.41	
Total expended	41,619.78	
Amount overdrawn		1,399.76
	41,619.78—	41,619.78

CONTINGENT FUND.

RECEIPTS.

Balance from last year		$ 3,209.16
Amount from leases of Sioux City lands		4,410.87
Total receipts		7,620.03

EXPENDITURES.

Amount appropriated by Board of Trustees to close account of Main Laboratory Building of 1872	$ 1,725.84	
Amount appropriated by Board of Trustees to close account of Farm Improvement appropriation of 1872	1,963.86	
Paid for repairs to College farm house	29.40	
Paid for repairs to farm buildings	36.77	
Paid for repairs to College building	132.19	
Paid for building ice house	364.15	
Paid for repairing water and gas works	500.00	
Paid sundry bills per order of Board of Trustees	468.60	
Total expenditures	5,220.81	
Amount unexpended	2,399.22	
	7,260.03—	7,620.03

FREIGHT DRAWBACKS.

RECEIPTS.

Balance from last year		38.91
Amount from Chicago & N. W. R. R.		103.41
Amount from Chicago & N. W. R. R.		1,250.00
Total receipts		1,392.32

EXPENDITURES.

Paid R. S. Finkbine's bill	25.00	
Paid on printing press	1,250.00	
Total expended	1,275.00	
Amount unexpended	117.32	
	1,392.32—	1,392.32

APPROPRIATIONS OF 1868.

Balance from last year		59.74
Amount unexpended	59.74	

COLLEGE EXTENSION.

Balance from last year		63.52
Amount unexpended	63.52	

INTEREST ON NOTES.

RECEIPTS.

Balance from last year		182.76
Amount from interest on sundry notes		114.51
Total receipts		297.27
Amount unexpended	297.27	
	297.27—	297.27

COLLEGE BRICK.

RECEIPTS.

Amount from Peter Raff & Son		$ 397.50
Amount from College workshop		27.75
Total receipts		425.25

EXPENDITURES.

Paid sundries by order of C. C. Warden	$ 305.87	
Amount unexpended	119.38	
	425.25—	425.25

FURNACE APPROPRIATION.

RECEIPTS.

Balance from last year		151.64

EXPENDITURES.

Paid sundry bills	64.00	
Amount unexpended	87.64	
	151.64	151.64

FURNACE PIPING APPROPRIATION, 1874.

Balance from last year		150.00
Amount unexpended	150.00	

FARM HOUSE PAINTING APPROPRIATION, 1874.

Balance from last year		1.45
Amount unexpended	1.45	

DIPLOMAS.

RECEIPTS.

Balance from last year		131.25
Amount for diplomas in 1876		100.00
Total receipts		231.25

EXPENDITURES.

Paid sundry bills	3.35	
Amount unexpended	227.90	
	231.25—	231.25

DONATIONS.

RECEIPTS.

Balance from last year		400.00

EXPENDITURES.

Paid Stevens' and McCarthy's bill	7.00	
Amount unexpended	393.00	
	400.00—	400.00

HALL MATTING APPROPRIATION, 1874.

Balance from last year		$1.22
Amount unexpended	$ 1.22	

SEED APPROPRIATION.

RECEIPTS.

Balance from last year		142.67

EXPENDITURES.

Paid express bills	1.00	
Amount unexpended	141.67	
	142.67—	142.67

BOARD DEPARTMENT.

RECEIPTS.

Balance from last year		860.33
Amount from students and others		14,233.58
Total receipts		15,093.91

EXPENDITURES.

Paid on account of supplies, labor and furnishing	13,933.77	
Amount unexpended	1,160.14	
	15,093.91—	15,093.91

SCHOOL BOOKS.

Amount from school book department		91.29
Balance from last year	389.55	
Debit balance		298 26
	389.55—	389.55

STATE TREASURER.

Balance from last year from sales of College lands	41,330.92
Amount from same source in 1876	24,331.95
Total in hands of treasurer	65,662.87

BILLS RECEIVABLE.

Balance from last year	2,377.75	
Notes received	2,338.74	
Total notes received	4,716.49	
Notes paid		3,870.50
Amount notes on hand		845.99
	4,716.49—	4,716.49

PERSONAL ACCOUNTS.

Amount due from sundry persons	673.79

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

Total amount received	20,995.00	
Total amount expended		19,026.73
Balance cash on hand		1,968.27
	20,995.00	20,995.00

CASH.

RECEIPTS.

Balance from last year	$ 8,067.18	
Amount from all sources except State appropriations	58,789.40	
Total receipts	66,856.58	

EXPENDITURES.

Amount paid out as per vouchers		$ 64,854.91
Amount of cash on hand to the credit of the various College funds		2,001.67
	66,856.58—	66,856.58

SUMMARY OF CASH.

Balance cash on hand from appropriations	1,968.27
Balance cash on hand from College sources	2,001.67
Total amount of cash on hand	3,969.94

SUMMARY.

	DR.		CR.
School books	298.26	Freight drawbacks	117.32
State treasurer	65,662.87	Appropriations of 1868	59.74
Bills receivable	845.99	College extension	63.52
Cash on hand	2,001.67	Contingent fund	2,399.22
Personal accounts	673.79	Interest on notes	267.27
Interest fund	1,399.76	College brick	119.38
		Furnace appropriation	87.64
		Furnace piping appropriation	150.00
		Hall matting appropriation	1.22
		Farm house painting appropriation	1.45
		Diplomas	227.90
		Permanent endowment fund	65,662.87
		Donations	393.00
		Seed appropriation	141.67
		Boarding department	1,160.14
Total	$ 70,882.34	Total	$ 70,882.34

Respectfully submitted,

J. L. GEDDES,

Deputy Treasurer Iowa State Agricultural College.

REPORT OF THE SECRETARY OF THE BOARD OF TRUSTEES.

[FOR THE YEAR ENDING NOVEMBER 15, 1876.]

IOWA STATE AGRICULTURAL COLLEGE,
December 12, 1876.

To the Honorable Board of Trustees:

GENTLEMEN: As required by section 1613 of the Code of 1873, I herewith submit my report of the proceedings of the Board of Audit, and also a statement of the account kept by myself with the Treasurer of the College for the year ending November 15, 1876.

During the year the Board of Audit have examined each bill presented for payment, auditing such as they deemed, by law, properly payable from the funds of the College. They have also made monthly settlements with the Treasurer. In so doing, a thorough and complete examination has been made of the books and vouchers of the Treasurer. As a result, we find: *first*, that each voucher has been properly audited; *second*, that all vouchers have been receipted with the exception of voucher 1422. In this case the bill was paid with Lucas' draft No. 1266, on the First National Bank of Chicago, but the receipt has failed to come to hand; *third*, that each original entry in the day-book agrees with its voucher; *fourth*, that all the accounts have been closed into their proper funds; *fifth*, that the books of the Treasurer have been kept in a clear and accurate manner; *sixth*, that the report of the Deputy Treasurer is a correct exhibit of the transactions of the office.

In accordance with section 1612 of the Code, I have, as Secretary of the Board of Trustees, kept an account with the Treasurer of the College, charging him with all moneys paid him from whatever source, and crediting him with the amounts paid out by him on the order of the Board of Audit. At the beginning of the year, there was a cash balance in the hands of the Treasurer of $8,067.18. Since then he has received from all sources, not taking into account the moneys received from the sale of land, the sum of $79,784.40. During the same time he has paid out, as per his vouchers, the sum of $83,881.64, leaving as the balance in the hands of the Treasurer, at the close of the year, $3,969.94. Of this balance $1,968.27

belongs to the State appropriations, while $2,001.67 is to the credit of the various College funds.

From the sale of land the Treasurer has received from agent Bassett and forwarded to the State Treasurer, during the year, the sum of $21,357.45.* This amount, added to $44,305.42, received from the same source in previous years, makes a total of $65,662.87 realized from the sale of Endowment Fund land. Of this sum the Treasurer of State had, previous to the present fiscal year, invested in bonds of the State of Iowa the sum of $12,200.00. During the present year he has invested in State, city, and independent school district bonds the sum of $52,800.00, making a total invested of $65,000.00 and leaving a cash balance, in the hands of the State Treasurer, of $662.87.

Of the Sioux City lands, one piece of 160 acres was sold and the money received therefor, $360.00, forwarded to the Treasurer of the College. By mistake this amount was not reckoned in the receipts of last year, but has been charged to the Treasurer on the account of the present year.

In all of the examinations it has been my aim to make them full and complete, and as a result I am able, without reservation, to certify that the accounts of the Treasurer for the year ending November 15, 1876, are correct.

Respectfully submitted,

E. W. STANTON, *Secretary.*

*NOTE.—In the Report of the Treasurer of the College, found on page 255, the amount stated as received, during the year from the sale of Endowment Fund land is $24,331.95, or $2,974.50 more than the amount given above. This difference arises from the fact that the Treasurer includes in his report one payment made by agent Bassett, on September 30, 1875, which the Secretary included in his report of the previous year, and has, therefore, omitted from the receipts of the present year.

REPORT OF THE TREASURER.

[FOR THE YEAR ENDING NOV. 14, 1877.]

The following are the Receipts and Expenditures on account of the different College Funds for the Year ending November 14, 1877.

PERMANENT ENDOWMENT FUND.

RECEIPTS.

Balance from last year		$65,662.87
Amount from sales of College land		3,120.00

EXPENDITURES.

Total amount paid State Treasurer for investment	$68,782.87	
	68,782.87—	68,782.87

INTEREST FUND.

RECEIPTS.

Amount from G. W. Bassett, College land agent		30,914.35
Amount from T. J. Stone		360.00
Amount from State Treasurer, interest on investments		4,575.91
Amount from Farm Department, balance over expenditures		62.61
Amount from Chemical Laboratory, balance over expenditures		26.72
Amount from Printing Office, balance over expenditures		33.54
Total receipts		35,973.13

EXPENDITURES.

Paid for Salaries	24,806.86	
Paid for Museum	217.63	
Paid for Library	1,280.59	
Paid for Ornamental Grounds	465.79	
Paid for Farm Experiments	5.85	
Paid for Fires and Lights	1,947.54	
Paid for Experimental Kitchen	34.87	
Paid for Furniture	235.00	
Paid for Deficiency in Laundry account	37.23	
Paid for Deficiency in Farm House account	419.81	
Paid for Contingent Expenses	2,084.61	
Paid for Department of Mechanics	1,626.68	
Paid for Department of Physics	215.56	
Paid for Department of Botany and Entomology	209.37	
Paid for Department of Horticulture and Forestry	297.21	
Paid for Department of Military Tactics	31.01	
Paid for Department of Civil Engineering	441.37	
To balance from last year	1,399.76	
Total expended	35,756.74	
Amount unexpended	216.39	
	35,973.13—	35,973.13

CONTINGENT FUND.

RECEIPTS.

Balance from last year		$2,399.22
Amount from leases of Sioux City lands		1,934.07
Total receipts		$4,333.29

EXPENDITURES.

Paid sundry bills by order of the Board of Trustees	$2,992.79	
Amount unexpended	1,340.50	
	4,333.29—	4,333.29

BOARDING DEPARTMENT.

RECEIPTS.

By balance from last year		1,160.14
Amount from sundry persons		14,864.94
Amount from decrease of inventory		573.99
Total receipts		$16,599.07

EXPENDITURES.

Paid on account of supplies, labor and furnishing	15,243.44	
Amount unexpended	1,355.63	
	16,599.07—	16,599.07

INTEREST ON NOTES.

RECEIPTS.

Balance from last year		297.27
Amount from interest on sundry notes		49.65
Total receipts		346.92

EXPENDITURES.

Paid sundry bills, by order of Board of Trustees	317.82	
Amount unexpended	29.10	
	346.92—	346.92

DONATIONS.

RECEIPTS.

Balance from last year		393.00
Amount received		5.00
Total receipts		398.00

EXPENDITURES.

Paid workshop bill, by order of the Board	243.00	
Amount unexpended	155.00	
	398.00—	398.00

SEED APPROPRIATION.

Balance from last year		141.67
Amount unexpended	141.67	

FURNACE PIPING APPROPRIATION.

Balance from last year		$ 150.00
Amount unexpended	$ 150.00	

FARM HOUSE PAINTING APPROPRIATION.

Balance from last year		1.45
Amount unexpended	1.45	

BILLS RECEIVABLE.

Balance from last year	845.99	
Notes received	1,999.57	
Total notes received	2,845.56	
Notes paid		463.57
Amount of notes on hand		2,381.99
	2,845.56	2,845.56

STATE TREASURER.

Balance from last year, sales of land	65,662.87	
Amount from same source, in 1877	3,120.00	
Total in hands of State Treasurer	68,782.87	

SCHOOL BOOKS.

RECEIPTS.

Amount from School Book Department, in 1877		156.83

EXPENDITURES.

Balance from last year	298.26	
Paid sundry bills	83.98	
Total expended	382.24	
Balance due from School Book Department		225.41
	382.24	382.24

FREIGHT DRAWBACKS.

RECEIPTS.

Balance from last year		117.32

EXPENDITURES.

Amount paid out by order of Board	117.32	
	117.32—	117.32

APPROPRIATIONS OF 1868.

RECEIPTS.

Balance from last year		59.74

EXPENDITURES.

Paid College workshop, per order of Board	59.74	
	59.74—	59.74

COLLEGE EXTENSION.

RECEIPTS.

Balance from last year		63.52

EXPENDITURES.

Paid College workshop, per order of Board	63.52	
	63.52—	63.52

COLLEGE BRICK.

Balance from last year		119.38
Amount received for brick		7 60
Total receipts		126.98

EXPENDITURES.

Paid sundry bills, per order of Board	126.98	
	126.98—	126.98

FURNACE APPROPRIATION, 1874.

Balance from last year		87.64

EXPENDITURES.

Paid College workshop, per order of Board	87.64	
	87.64—	87.64

HALL MATTING APPROPRIATION.

RECEIPTS.

Balance from last year		1.22

EXPENDITURES.

Paid College workshop, per order of Board	1.22	
	1.22—	1.22

DIPLOMAS.

RECEIPTS.

Balance from last year		227.90
Amount received for diplomas		25.00
Total receipts		252.90

EXPENDITURES.

Paid sundry bills	227.90	
Balance unexpended	25.00	
	252.90—	252.90

PERSONAL ACCOUNTS.

Amount due from sundry persons	622.69

APPROPRIATIONS OF SIXTEENTH GENERAL ASSEMBLY.

RECEIPTS.

Balance from last year		$ 1,968.27
Amount received from State Treasurer		3,825.00
Total received		5,793.27

EXPENDITURES.

Amount expended as per vouchers	5,793.27	
	5,793.27	5,793.27

CASH.

RECEIPTS.

Balance from last year	3,969.94	
Amount from all sources	62,847.28	
Total receipts	66,817.22	

EXPENDITURES.

Amount paid out as per vouchers		66,632.57
Balance cash on hand		184.65
	66,817.22	66,817.22

SUMMARY.

Bills receivable	$ 2,381.99	Board	$ 1,355.63
State Treasurer	68,782.87	Interest on notes	29.10
School books	225.41	Contigent fund	1,340.50
Cash on hand	184.65	Diplomas	25.00
Personal accounts	622.69	Donations	155.00
		Seed appropriation	141.67
		Permanent endowment fund	68,782.87
		Furnace piping appropriation	150.00
		Farm House painting appropriation	1.45
		Interest fund	216.39
Total	$72,197.61	Total	$72,197.61

Respectfully submitted,

J. L. GEDDES,

Deputy Treasurer Iowa Agricultural College

REPORT OF THE SECRETARY OF THE BOARD OF TRUSTEES.

[FOR THE FISCAL YEAR ENDING NOVEMBER 14, 1877.]

IOWA STATE AGRICULTURAL COLLEGE,
NOVEMBER 27, 1877.

To the Honorable Board of Trustees:

The statute provides that the Secretary of the Board of Trustees shall keep an account with the Treasurer of the College, debiting him with moneys received from whatever source, and crediting him with all moneys paid out upon the order of the Board of Audit.

In accordance with this law I have, as in previous years, opened and kept an account with the Treasurer, Wm. D. Lucas. At the beginning of the fiscal year ending November 14, 1877, there was in the hands of the Treasurer a balance from the previous year of $3,969.94. During the year I have charged the Treasurer with money received from various sources, as follows: from agent Bassett, as rental on Endowment Fund land, the sum of $30,914.35; from agent Bassett, as rental on Contingent Fund land, the sum of $1,934.07; from agent Stone, for sale of Interest Fund land, $360.00; from the State Treasurer, as interest on Endowment Fund invested by him, $4,575.91; from the State Treasurer, as the balance due on account of the appropriations made to the Agricultural College by the Sixteenth General Assembly, the sum of $3,825.00; from the farm, horticultural, boarding and other departments of the College, and from all other sources not hitherto mentioned, except from the sale of Endowment Fund land, the sum of $21,237.95, making, with the balance on hand at the commencement of the fiscal year, a total charge against the Treasurer of $66,817.22. I have credited the Treasurer with bills paid by him, on the order of the Board of Audit, to the amount of $66,632.57, leaving as the cash balance in his hands at the close of the fiscal year, $184.65.

During the year the College Treasurer received from agent Bassett, as the proceeds of the sales of Endowment Fund land, the sum of $3,120.00, which sum he has, in accordance with the law, transmitted to the Treasurer of State. This amount added to the balance of $562.87 to the credit of the Endowment Fund at the beginning of

the year, together with a $100.00 bond redeemed by the Independent School District of Greenbush, makes the sum of $3,782.87 subject to investment by the State Treasurer. Of this sum $3,060.00 has been invested, leaving as the cash balance in the hands of the State Treasurer $722.87.

The total amount thus far realized from the sales of Endowment Fund land is $68,782.87, of which amount $68,060.00 is invested in State, city and independent school district bonds. During the past year the interest on these investments has been paid quite promptly.

In addition to keeping an account with the Treasurer of the College, I have, in connection with the President, examined all bills presented against the College, auditing such as were properly payable from the funds of the institution, and for the payment of which the Board of Trustees had made the requisite appropriations.

In compliance with my duty as a member of the Board of Audit, I have made a monthly examination of the books of the Treasurer of the College. I have examined minutely into all the sources of income of the institution, and have carefully compared the receipts given for money received, duplicates of which are by law filed in my office, with the cash account of the Treasurer in order to satisfy myself that he had debited himself with all moneys received. I have inspected each voucher as to the points of its being audited, receipted, and in itself a proper voucher to be paid from the College funds. I have examined each original entry in the day-book of the Treasurer, comparing it with the corresponding receipt or voucher. I have added both debit and credit sides of the cash account. I have taken note that the different accounts were closed into their proper funds.

By comparing balances, and by the various means known in bookkeeping, I have tested the books and accounts of the Treasurer, and, as a result of my investigations, I am prepared to certify that the accounts of said Treasurer are correct, and that the report of the Deputy Treasurer is a true and accurate summary of the financial transactions of the fiscal year ending November 14, 1877.

Respectfully submitted,

E W. STANTON, *Secretary.*

REPORT OF LAND AGENT BASSETT.

To the Board of Trustees of the Iowa State Agricultural College:

The following report of the Land Department of the College from October 31, 1875, to October 31, 1877, is hereby submitted for your consideration.

GEORGE W. BASSETT, *Agent.*

The following is a Statement of Interest Collected from November 1, 1875, to October 31, 1876, inclusive:

Interest collected months November and December, 1875	$ 5,399.64
Interest collected months January, February and March, 1876	4,177.49
Interest collected months April, May and June	7,318.30
Interest collected month July	3,801.60
Interest collected month August	4,050.89
Interest collected month September	2,284.48
Interest collected month October	2,203.58
Total	$29,235.98

Amount remitted November 30, 1875, voucher number 67	$ 2,631.04
Amount remitted December 30, 1875, voucher number 68	2,765.60
Exchange for the quarter	3.00
Amount remitted January 1, 1876, voucher number 69	2,329.59
Amount remitted February 29, 1876, voucher number 70	786.72
Amount remitted March 31, 1876, voucher number 71	1,960.32
Errors corrected	.86
Amount remitted May 4, 1876, voucher number 72	2,143.13
Amount remitted June 1, 1876, voucher number 73	2,081.96
Amount remitted June 28, 1876, voucher number 74	3,093.21
Amount remitted July 31, 1875, voucher number 75	3,801.60
Amount remitted August 31, 1876, voucher number 76	4,035.74
Exchange July and August	4.75
Amount errors corrected	10.40
Amount remitted September 30, 1876, voucher number 77	2,282.48
Amount exchange August remittance	2.00
Amount remitted October 30, 1876, voucher number 78	2,202.08
For exchange	1.50
Total	$29,235.98

From November 1, 1876 to October 30, 1877, inclusive, interest has been collected and paid over as follows:

Interest collected November, 1876	$ 1,788.43
Interest collected December, 1876	4,473.53
Interest collected January, 1877	2,778.20
Interest collected February, 1877	1,112.93
Interest collected March, 1877	1,155.94
Interest collected April, 1877	1,360.04
Interest collected May, 1877	2,022.68
Interest collected June, 1877	1,654.83
Interest collected July, 1877	4,604.82
Interest collected August, 1877	4,115.
Interest collected September, 1877	1,414.61
Interest collected October, 1877	3,453.10
Total	$29,934.35

1876.			
Nov.	1.	Amount remitted, voucher No. 79	$ 1,786.93
		Exchange on same	1.50
Dec.	31.	Amount remitted, voucher No. 80	4,472.53
		Error corrected	1.00
1877.			
Jan.	31.	Amount remitted, voucher No. 81	2,778.20
Feb.	28.	Amount remitted, voucher No. 82	1,109.43
		Exchange on December remittance	3.50
March	31.	Amount remitted, voucher No. 83	1,155.94
April	30.	Amount remitted, voucher No. 84	1,360.04
May	31.	Amount remitted, voucher No. 85	2,022.68
June	30.	Amount remitted, voucher No. 86	1,651.33
		Exchange on April and May remittance	3.50
July	30.	Amount remitted, voucher No. 87	4,604.82
Aug.	31.	Amount remitted, voucher No. 88	4,109.24
		Error corrected	.50
		Exchange on June and July remittance	5.50
Sept.	30.	Amount remitted, voucher No. 89	1,411.36
		Exchange on August remittance	3.25
Oct.	30.	Amount remitted, voucher No. 90	3,451.85
		Exchange on September remittance	1.25
		Total	$29,934.35

During the time included in this report Endowment Fund has been collected and paid over to the Treasurer as follows:

Collected during November	1875	$ 4,740.37
Collected during December	1875	4,171.00
Collected during January	1876	377.26
Collected during March	1876	392.00
Collected during July	1876	2,467.85
Collected during August	1876	560.00
Collected during September	1876	400.00
Collected during January	1877	560.00
Collected during March	1877	1,280.00
Collected during May	1877	360.00
Collected during July	1877	120.00
Collected during October	1877	800.00
Total		$ 16,228.48

November	1875.	Paid on voucher number 28	$ 4,740.37	
December	1875.	Paid on voucher number 29	4,171.00	
January	1876.	Paid on voucher number 30	377.26	
March	1876.	Paid on voucher number 31	392.00	
July	1876.	Paid on voucher number 32	2,467.85	
August	1876.	Paid on voucher number 33	560.00	
September	1876.	Paid on voucher number 34	400.00	
January	1877.	Paid on voucher number 35	560.00	
March	1877.	Paid on voucher number 36	1,280.00	
May	1877.	Paid on voucher number 37	360.00	
July	1877.	Paid on voucher number 38	120.00	
October	1877.	Paid on voucher number 39	800.00	
Total			$ 16,228.48	$ 16,228.48

I have collected and paid over to Treasurer, Contingent Fund as follows:

Collected during June	1876		$ 422 40
Collected during July	1876		76.80
Collected during August	1876		572.80
Collected during December	1876		148.74
Collected during February	1877		288.00
Collected during March	1877		166.40
Collected during April	1877		403.20
Collected during May	1877		108.80
Collected during June	1877		169.60
Collected during July	1877		204.80
Collected during August	1877		316.80
Collected during September	1877		64.00
Collected during October	1877		64.00
Total			$ 3,006.07

June	1876.	Paid on voucher number 1	$ 422.40	
July	1876.	Paid on voucher number 2	76.80	
August	1876.	Paid on voucher number 3	72.80	
December	1876.	Paid on voucher number 4	148.47	
February	1877.	Paid on voucher number 5	288 00	
March	1877.	Paid on voucher number 6	166.40	
April	1877.	Paid on voucher number 7	403.20	
May	1877.	Paid on voucher number 8	108.80	
June	1877.	Paid on voucher number 9	169.60	
July	1877.	Paid on voucher number 10	204.80	
August	1877.	Paid on voucher number 11	316.80	
September	1877.	Paid on voucher number 12	64.00	
October	1877.	Paid on voucher number 13	64.00	
Total			$ 3,006.07	$ 3,006.07

There were at date of last Biennial Report.

Forfeited lands undisposed of	31,321.34 acres.
There have been transferred from the agency of T. J. Stone, forfeited lands	2,000.00 acres.
Forfeited since last report	14,082.19 acres.
Total	47,403.53 acres.
Number acres leased since last report	19,995.38
Number acres undisposed of	27,408.15
There have been patented since date of said report	6,836.03 acres.

LIST OF IOWA AGRICULTURAL COLLEGE LANDS LEASED FROM NOVEMBER 1, 1875, TO OCTOBER 31, 1877.

No. of lease.	Part of section.	Section.	Township.	Range.	Acres	Price.	Total value.	NAME OF LESSEE.	DATE.	First payment of interest.	Office fee.
									1875.		
1580	sw qr	24	96	28	160	$5.00	$800.00	F. Little	Nov. 24	$64.00	$14.00
1581	ne qr	28	93	36	160	5.00	800.00	E. W. Comstock	Nov. 30	64.00	14.00
1582	sw qr	34	95	27	160	4.00	640.00	J. Little	Dec. 18	51.20	14.00
1583	ne qr	33	95	27	160	4.00	640.00	John Little	Dec. 18	51.20	14.00
1584	ne qr	26	97	27	160	3.00	480.00	S. J. Plumley	Dec. 29	38.40	14.00
1585	ne qr	36	97	27	160	3.00	480.00	E. A. Plumley	Dec. 29	38.40	14.00
									1876.		
1586	nw qr	12	100	36	112.39	3.00	337.17	C. A. Yarns	Jan. 1	27.97	14.00
1587	ne qr	15	96	31	160	4.00	640.00	Levi Dodson	Jan. 1	51.20	14.00
1588	nw qr	15	96	31	160	4.00	640.00	Geo. I. Hodges	Jan. 1	51.20	14.00
1589	sw qr	15	96	31	160	4.00	640.00	Geo. I. Hodges and Levi Dodson	Jan. 1	51.20	14.00
1590	se qr	15	96	31	160	4.00	640.00	Geo. J. Hodges	Jan. 1	51.20	14.00
1591	sw qr	28	96	31	160	4.00	640.00	J. B. Green	Jan. 1	51.20	14.00
1592	se qr	28	96	31	160	4.00	640.00	H. Trevett	Jan. 1	5 .20	14.00
1593	sw qr	24	97	34	160	3.00	480.00	L. Bridges	Jan. 1	38.40	14.00
1594	sw qr	3	97	32	160	3.00	400.00	N. Bean	Jan. 1	38.40	14.00
1595	s hf of nw	18	97	32	79.25	4.00	317.00	I. L. Whitehill	Jan. 1	25.36	14.00
1596	se qr	24	97	34	160	3.00	480.00	W. H. Bean	Jan. 1	38.40	14.00
1597	se qr	23	96	27	160	5.00	800.00	David Mann	Jan. 3	61.00	14.00
1598	nw qr	28	95	27	160	3.50	560.00	J. C. Thompson	Jan. 3	44.80	14.00
1599	se qr	28	95	27	160	3.50	560.00	C. Mann	Jan. 3	44.80	14.00
1600	ne qr	29	95	27	160	3.50	560.00	M. E. Thompson	Jan. 3	44.80	14.00
1601	ne qr	10	94	28	160	4.00	640.00	J. T. Campbell	Jan. 3	51.20	14.00
1602	sw qr	23	94	28	160	4.00	640.00	H. Dovenbarger	Jan. 3	51.20	14.00
1603	se qr	2	94	28	160	4.00	640.00	J. A. Smith	Jan. 3	51.20	14.00
1604	sw qr	2	94	28	160	4.00	640.00	A. B. Savage	Jan. 3	51.20	14.00
1605	e hf of se qr	23	97	27	80	3.00	240.00	D. W. Miles	Jan. 6	19.20	14.00
1606	w hf of se qr	23	97	27	80	3.00	240.00	E. Hawkins	Jan. 6	19.20	14.00
1607	se qr	25	97	27	160	3.00	480.00	F. W. Waterhouse	Jan. 6	38.40	14.00
1608	ne qr	25	97	27	160	3.00	480.00	A. L. White	Jan. 6	38.40	14.00
1609	sw qr	25	97	27	160	3.00	480.00	A. P. White	Jan. 6	38.40	14.00
1610	nw qr	25	97	27	160	3.00	480.00	A. I. White	Jan. 6	38.40	14.00
1611	nw qr	36	97	27	160	3.00	480.00	M. E. Walston	Jan. 6	38.40	14.00
1612	se qr	36	97	27	160	3.00	480.00	R. Walston	Jan. 6	38.40	14.00
1613	se qr	24	97	27	160	3.00	480.00	J. H. Hawkins	Jan. 6	38.40	14.00
1614	se qr	28	99	33	148.33	3.50	519.15	J. T. Maynard	Jan. 6	41.53	14.00
1615	nw qr	26	95	31	160	5.00	800.00	R. D. McClure	Jan. 7	64.00	14.00
1616	nw qr	24	94	32	160	3.50	560.00	P. H. Hough	Jan. 7	44.80	14.00
1617	sw qr	21	94	32	160	3.50	560.00	B. R. Wagner	Jan. 7	44.80	14.00
1618	nw qr	36	95	28	160	4.00	640.00	H. W. McClure	Jan. 7	51.20	14.00
1619	nw qr	33	98	28	160	3.00	480.00	S. B. Prindle	Jan. 7	38.40	14.00
1620	se qr	30	95	27	160	3.50	560.00	George Rambow	Jan. 18	44.80	14.00
1621	nw qr	26	99	33	160	5.00	800.00	J. N. Karodle	Jan. 21	64.00	14.00
1622	sw qr	26	99	33	160	5.00	800.00	C. A. Geeting	Jan. 21	64.00	14.00
1623	nw qr	26	94	28	160	4.00	640.00	S. E. Campbell	Jan. 21	51.20	14.00
1624	ne qr	29	94	33	160	3.50	560.00	M. J. Lindly	Feb. 5	44.80	14.00
1625	se qr	9	95	30	160	6.00	960.00	A. Omelia	Feb. 15	76.80	14.00
1626	se qr	27	94	36	160	4.00	640.00	B. Darnell	Feb. 16	51.20	14.00
1627	ne qr	34	94	36	160	5.00	800.00	V. M. Potter	Feb. 16	64.00	14.00
1628	sw qr	30	94	32	159.69	3.50	558.91	Emma Lindly	Feb. 23	44.71	14.00
1629	w hf of se qr	32	94	33	80	3.50	280.00	L. Teatherton	Feb. 23	22.40	14.00
1630	se qr	35	95	27	160	4.00	640.00	H. Little	March 16	51.20	14.00
1631	se qr	12	100	35	160	3.00	480.00	A. Evernu	April 19	38.40	14.00
1632	nw qr	8	100	34	118.09	3.50	413.32	G. H. Anderson	April 16	33.06	14.00
1633	sw qr	32	99	30	160	3.50	560.00	E. N. Coats	April 19	44.80	14.00
1634	sw qr	30	99	33	166.13	5.00	830.65	W. Dyer	May 3	66.45	14.00
1635	ne qr	24	94	33	160	3.50	560.00	James Johnson	May 22	44.80	14.00

LIST OF COLLEGE LANDS—CONTINUED.

No. of lease.	Part of section.	Section.	Township.	Range.	Acres.	Price.	Total value.	NAME OF LESSEE.	DATE.	First payment of interest.	Office fee.
									1876.		
1636	nw qr	24	94	33	160	3.50	560.00	M. A. Prichard	May 22	44.80	14.00
1637	se qr	24	94	33	160	3.50	560.00	T. Ausherman	May 22	44.80	14.00
1638	sw qr	24	94	33	160	3.50	560.00	J. M. Myers	May 22	44.80	14.00
1639	sw qr	28	99	33	160	3.50	560.00	J. R. Shelly	May 29	44.80	14.00
1640	nw qr	10	97	29	160	4.00	640.00	F. N. Tice	June 2	51.20	14.00
1641	ne qr	10	97	29	160	4.00	640.00	M. V. Saltzman	June 2	51.20	14.00
1642	nw qr	12	99	46	160	5.00	800.00	A. H. Kuklemire	June 2	64.00	14.00
1643	nw qr	32	88	41	160	4.00	640.00	Wm. Ragan	June 2	51.20	14.00
1644	n hf se qr	18	87	40	80	3.75	300.00	J. Ferguson	June 13	24.00	14.00
1645	ne qr	36	90	45	160	5.00	800.00	G. Frenier	June 13	64.00	14.00
1646	ne qr	18	87	40	160	3.75	600.00	R. A. Flourny	June 16	48.00	14.00
1647	se qr	36	87	42	160	4.00	640.00	T. J. Flourny	June 16	51.20	14.00
1648	ne qr	24	98	34	160	2.50	400.00	John Shout	June 24	32.00	14.00
1649	nw qr	24	98	34	160	2.50	400.00	E. W. Johnson	June 24	32.00	14.00
1650	ne qr	26	98	34	160	3.00	480.00	M. H. Eaker	June 24	38.40	14.00
1651	se qr	26	98	34	160	3.00	480.00	W. H. Knodle	June 24	38.40	14.00
1652	ne qr	12	97	34	160	3.00	480.00	F. D. Levett	June 24	38.40	14.00
1653	n hf se qr	22	90	47	80	4.00	320.00	N. L. Greer	June 24	25.60	14.00
1654	ne qr	22	99	33	160	3.50	560.00	T. T. Newcomer	June 27	44.80	14.00
1655	nw qr	22	99	33	160	3.50	560.00	W. H. Fouke	June 27	44.80	14.00
1656	se qr	22	99	33	160	3.50	560.00	F. Shelley	June 27	44.80	14.00
1657	sw qr	22	99	33	160	3.50	560.00	R. M. Cook	June 27	44.80	14.00
1658	nw qr	10	86	42	160	3.75	600.00	J. J. Flourny	June 27	48.00	14.00
1659	sw qr	10	86	42	160	3.75	600.00	T. J. Flourny	June 27	48.00	14.00
1660	ne qr	36	87	42	160	4.00	640.00	W. O. Curtis	June 27	51.20	14.00
1661	ne qr	8	96	31	160	5.00	800.00	C. F. Tice	July 19	64.00	14.00
1662	nw qr	8	96	31	160	5.00	800.00	Thos. Winston	July 19	64.00	14.00
1663	se qr	5	96	31	160	5.00	800.00	H. Zaller	July 19	64.00	14.00
1664	se qr	2	89	44	160	4.00	640.00	A. French	July 19	51.20	14.00
1665	ne qr	6	89	44	151.88	4.00	607.52	F. Gund	July 19	48.60	14.00
1666	se qr	6	89	44	160	4.00	640.00	Jos. M. Gund	July 19	51.20	14.00
1667	se qr	12	89	44	160	4.00	640.00	L. O. Kuklemire	July 19	51.20	14.00
1668	se qr	10	95	28	160	6.00	960.00	J. J. Mann	July 19	76.80	14.00
1669	nw qr	2	86	41	161.23	5.00	821.15	Freeman & Deland	Aug. 11	65.69	14.00
1670	sw qr	29	97	30	160	4.00	640.00	Jane Simmons	Aug. 11	51.20	14.00
1671	se qr	18	97	29	160	4.00	640.00	S. B. Stenson	Aug. 11	51.20	14.00
1672	sw qr	18	98	29	147.60	3.50	516.65	J. H. Alexander	Aug. 15	41.33	14.00
1673	nw qr	3	98	30	165.59	3.50	579.57	W. J. Maxwell	Aug. 15	46.36	14.00
1674	ne qr	4	98	30	165.12	3.50	577.92	W. S. Maxwell	Aug. 15	46.23	14.00
1675	se qr	20	98	30	160	3.50	560.00	Mrs. J. H. Alexander	Aug. 15	44.80	14.00
1676	ne qr	32	99	30	160	3.50	560.00	J. Berry, Jr.	Aug. 15	44.80	14.00
1677	se qr	32	99	30	160	3.50	560.00	E. E. Snow	Aug. 15	44.80	14.00
1678	ne qr	34	99	30	160	3.50	560.00	M. N. Philbrick	Aug. 19	44.80	14.00
1679	se qr	34	99	30	160	3.50	560.00	S. Philbrick	Aug. 19	44.80	14.00
1680	sw qr	34	97	28	160	4.00	640.00	D. R. Bowers	Sept. 1	51.20	14.00
1681	ne qr	18	97	29	160	4.00	640.00	J. P. Adams	Sept. 23	51.20	14.00
1682	n hf sw qr	32	86	44	80	3.00	240.00	W. R. Irish	Oct. 10	19.20	14.00
1683	sw qr	30	95	27	163.43	3.00	490.29	C. L. Robertson	Dec. 4	39.22	14.00
									1877.		
1684	nw qr	9	98	29	160	3.00	480.00	S. M. McLain	Feb. 1	38.40	14.00
1685	ne qr	9	98	29	160	3.00	480.00	J. McLain	Feb. 28	38.40	14.00
1686	nw qr	9	93	37	160	4.00	640.00	E. S. Churchill	March 15	51.20	14.00
1687	sw qr	15	93	37	160	4.00	640.00	H. E. Churchill	March 15	51.20	14.00
1688	sw qr	36	95	27	160	4.00	640.00	G. W. Finkboner	May 1	51.20	14.00
1689	s hf se qr, & ne se qr, & se qr ne qr,	36	87	45	160	3.75	600.00	O. E. Smith	May 12	48.00	14.00
1690	ne qr	2	86	41	164.03	5.00	820.15	M. M. Gray	May 23	65.61	14.00
1691	nw qr	3	99	30	160	3.00	480.00	P. H. Dennis	July 11	38.40	14.00
1692	ne qr	2	98	30	167.27	3.00	501.81	E. C. Quinn	July 11	40.14	14.00
1693	se qr	4	98	29	160	3.00	480.00	C. Schroeder	July 11	38.40	14.00
1694	sw qr	4	98	29	160	3.00	480.00	J. A. Boehm	July 11	38.40	14.00
1695	sw qr	3	98	29	160	3.00	480.00	C. G. Miller	July 11	38.40	14.00

LIST OF COLLEGE LANDS—CONTINUED.

No. of lease.	Part of section.	Section.	Township.	Range.	Acres.	Price.	Total value.	NAME OF LESSEE.	DATE.	First payment of interest.	Office fee.
									1877.		
1696	se qr	32	98	27	160	$3.50	$560.00	A. Lindquist	July 14	$44.80	$14.00
1697	sw qr	32	98	27	160	3.50	560.00	C. & R. Bourdette	July 14	44.80	14.00
1698	ne qr	27	98	28	160	3.50	560.00	H. Virgil	July 14	44.80	14.00
1699	se qr	27	98	28	160	3.50	560.00	T. Chantland	July 14	44.80	14.00
1700	e hf of nw qr	28	99	33	80	3.50	280.00	J. Markley	Aug. 10	22.40	14.00
1701	w hf of nw qr	28	99	33	80	3.50	280.00	C. F. Shuey	Aug. 10	22.40	14.00
1702	nw qr	4	98	33	162.35	3.50	568.22	M. Fuller	Aug. 13	45.45	14.00
1703	sw qr	4	98	33	160	3.50	560.00	J. Eling	Aug. 13	44.80	14.00
1704	ne qr	34	98	28	160	3.50	560.00	C. F. Meeker	Aug. 13	44.80	14.00
1705	nw qr	34	98	28	160	3.50	560.00	G. V. Patterson	Aug. 13	44.80	14.00
1706	nw qr	14	94	28	160	5.00	800.00	C. M. Haller	Oct. 19	64.00	14.00
1707	ne qr	13	94	28	160	5.00	800.00	E. Haller	Oct. 19	64.00	14.00
1708	nw qr	26	98	28	160	3.50	560.00	F. Backell	Oct. 19	44.80	14.00
1709	sw qr	26	98	28	160	3.50	560.00	L. E. Hulbert	Oct. 19	44.80	14.00

Total number of acres leased since date of last Biennial Report, October 31, 1875, 19,995.38.

SETTLEMENT WITH LAND AGENT BASSETT.

REPORT OF THE SECRETARY.

[SETTLEMENT EXTENDING FROM AUGUST 1, 1865, TO APRIL 1, 1876.]

IOWA AGRICULTURAL COLLEGE,
April 1, 1876.

To the Honorable Board of Trustees:

GENTLEMEN:—At the meeting of the Board held November 13, 1875, it was ordered, "that E. W. Stanton, Secretary of the Board of Trustees, be authorized, at the expiration of the contract with G. W. Bassett, on the 1st of January, 1876, to examine the books and papers connected with the agency of said Bassett during his contract to lease lands for the Iowa Agricultural College, and report to the Board at their next meeting."

In compliance with the above order I have examined the books and vouchers of said G. W. Bassett. At the commencement of my examination into the business of the agency, I found it would be inconvenient to limit said examination by bringing it down only to the 1st of January, 1876, I therefore made my examination to cover all of the time from the establishment of the agency in August, 1865, down to April 1, 1876.

In this examination I sought to ascertain the exact amount of money received by the agent from the sale and lease of College land and whether said amount had been duly paid over to the Treasurer of the College.

AMOUNT RECEIVED FROM SALES OF COLLEGE LAND

In determining the total sum, received by said agent from the sale of College land, I have compared his books with the account kept by the Secretary of the Board with the fund arising from the sale of said lands. I find that the agent has debited himself with all moneys received, and that he has, as shown by his vouchers and the books of the Secretary of the Board, paid over all of said moneys to the Treasurer of the College. The total number of acres sold to date is 27,719.62.

Amount received by agent for sale of said lands..... $61,843.00
Amount paid over by agent to College Treasurer.....$61,843.00

AMOUNT RECEIVED FROM LEASE OF COLLEGE LANDS.

In determining the amount received from the lease of College lands I obtained my results by two methods, in order that one might serve as a check upon the other. By the first method I found the amount of interest collected on each lease, and then by aggregating these amounts the sum total of interest received from the leasing of said lands. By the second method I took each item of interest in the order of its payment to the agent, and by the addition of these items I again found the total sum of interest received. The amounts ascertained by these two methods differ as to eighty-six cents, which error I have been unable to eliminate.

In determining, under the first method, the amount received on each lease, I satisfied myself in regard to the following facts: that the date of the issue of said lease, as entered upon the lease-book, was correct; that each payment given was the true interest due on said lease; and that the full number of payments had been acknowledged and entered upon the lease-book. After ascertaining that the date of the lease and the amount of the first payment of interest were correct, no question in regard to the number of payments could arise in those cases where the payments were full and interest paid to date. In all cases where the interest had not been paid in full from the date of the lease to the present time, I satisfied myself from other evidence that all the payments received had been duly acknowledged. By a careful review of all my work, I am satisfied that the total amount of interest received, as ascertained by the first method, is $289,351.44, and that said amount is substantially correct.

In determining by the second method, the amount of interest received, I compared the first payment of interest on each lease, as entered in the lease-book, with the corresponding entry in the "Record of Interest Received." I then compared the duplicate receipts retained in the office of the agent, with the entries in said record, and proved the additions. The total number of receipts issued up to April 1, 1876, was 4,815, and the total amount of interest collected, as determined by this second method, was $289,350.58; amount collected as determined by the first method, $289,351.44; amount paid over by agent, to the College Treasurer, as shown by agent's vouchers, plus exchange, $289,350.58.

It will be noticed that the amount of interest as ascertained by the second method, corresponds exactly with the amount paid by the agent to the Treasurer of the College, while the amount as determined by the first method differs only as to eighty-six cents.

I have endeavored to make the examination thorough and complete. I am satisfied that the accounts of Mr. Bassett, as they now stand, are correct, and that he has accounted for and paid over to the College authorities all moneys which have come into his hands, either from the lease or sale of College lands. I find that the books of the agency have been well kept, and that they show in detail, all the transactions of the office.

In accordance with the desire of the Board, I have entered into a lease-book, procured for that purpose, a complete history of every piece of land in the department over which Mr. Bassett has charge.

SETTLEMENT EXTENDING FROM APRIL 1, 1876, TO DEC. 1, 1876.

REPORTED TO THE BOARD OF TRUSTEES, DECEMBER 12, 1876.

To the Honorable Board of Trustees:

In accordance with a clause in the contract with agent Bassett, which specifies that the Board of Trustees shall, through its Secretary or other authorized person, make yearly settlements with said agent, I have made a full and complete examination of the books and vouchers of said agency. My examination, previous to this one, covered the time from the establishment of the agency, up to April 1, 1876. This examination, as far as it relates to the Endowment Fund and the Interest Fund, covers the time from that date up to and including November 30th, 1876. Mr. Bassett, by contract became agent for the sale and lease of the Sioux City lands on May 13, 1876, and this examination as far as it relates to the Contingent Fund, covers the time from that date up to and including November 30th, 1876. The results of the examination, which I herewith respectfully submit, are grouped under the following heads, viz: Endowment Fund, Interest Fund, and Contingent Fund.

ENDOWMENT FUND.

In determining the sum received by the agent from the sale of land, I have compared his receipt book with his cash book, and also with my record of land sold as taken from the certificates of purchase.

I find that during the time covered by this report, the total number of acres sold was 1,242.38.

Amount received by agent from said sales	$ 3,819.87
Amount transmitted by agent to College Treasurer, as per vouchers by me examined.....	$3,819.87

The total number of acres sold to date, is 28,962; and the total amount received by the agent from said sales, and by him transmitted through the College Treasurer to the State Treasurer, is $65,662.87.

INTEREST FUND.

In my examination made in order to determine the amount received by the agent from the lease of the lands known as the Agricultural College Grant, and the sum by said agent paid over to the College Treasurer, I find: *first*, by comparing the receipt book of the agent with my cash book, that said agent had acknowledged the receipt of all items contained in his receipt book; *second*, by posting these different items from my cash book into my lease book, that the sums thus acknowledged as received, were the true amounts due; *third*, by adding the columns of my cash book, that said agent had received from April 1, 1876, to November 30, 1876, inclusive, as shown by receipts from No. 4816 to No. 5138, the sum of $21,446.28; *fourth*, that said agent had paid over to the College Treasurer, as per vouchers from No. 73 to No. 79 inclusive, the sum of $21,427.13, exchange on the same $10.15, making the total amount to the credit of the agent, $21,437.28, or $9.00 less than the amount received; *fifth*, by comparing my "Register of Lands" with the "Register of Lands" of the agent, my "Register of Sales" with his "Register of Sales," my "Register of Leases" with his "Register of Leases," my "Register of Forfeited Lands" with his printed list of lands in the market for lease, I found that said agent had accounted for all the land in the agency as either sold, leased, or in the market for lease.

The difference of $9.00 noted above, between the receipts of the agency and the sum with which the agent is credited, is due to the following errors, viz: error in payment for August by which the amount remitted to Treasurer was $10.00 less than the amount received; error in lease 505 by which the agent had overcharged himself with $1.00, leaving a balance against the agent of $9.00. This amount the agent has since charged himself with, and will include in his December remittance. With these exceptions the accounts in relation to

the Interest Fund were correct. Owing to the hard times in the north-western counties, the amount of delinquent interest is quite large.

The agent is of the opinion that a considerable portion of that which has been delinquent for several months will not be paid.

CONTINGENT FUND.

By processes exactly similar to those followed in the case of the Interest Fund, I find that the amount received by the agent from the sale of Sioux City lands from May 13, 1876, the time when said agent took charge of the agency, down to and including Nov. 30, 1876, as shown by receipts from No. 1 to No. 25 inclusive, was $1,072.00, and that said amount was duly paid over to the College Treasurer as shown by vouchers from No. 1 to No. 3 inclusive.

My examination covered all the transactions connected with the entire agency, and with the exception heretofore noted, the accounts were found correct.

SETTLEMENT EXTENDING FROM DEC. 1, 1876, TO NOV. 1, 1877.

REPORTED TO THE BOARD OF TRUSTEES NOVEMBER 30, 1877.

To the Honorable Board of Trustees:

For the purpose of making the yearly settlements required by the contracts of agent Bassett, I visited Fort Dodge shortly after the close of the fiscal year and made a thorough and complete examination of the books and accounts of the agency. This examination covered the time from December 1, 1876, the date of the last settlement, up to and including October 31, 1877, the results of which examination I herewith submit to the Board.

ENDOWMENT FUND.

Of the land derived from the Congressional grant, 880 acres have been patented during the past year. The receipts from the sale of said land, amounting to $3,120, were promptly remitted by the agent to the Treasurer of the College.

INTEREST FUND.

The rental received from the lease of the lands included in the Congressional grant constitutes what is known upon the books of the College as Interest Fund. At the time of the settlement made December 1, 1876, there was due from the agent to this fund, because of errors in the accounts of the previous year, the sum of $9.00; from December 1, 1876, to October 31, 1877, inclusive, the agent received from the rent of these lands, as shown by receipts from No. 5,139 to No. 5,631 inclusive, the sum of $28,134.92, making a total debit against the agent of $28,143.92. During the same time the agent paid over to the College Treasurer, as shown by vouchers from No. 79 to 90 inclusive, the sum of $28,127.42; he also paid for exchange on said remittance the sum of $17.00, making as the total amount credited to the agent the sum of $28,144.42, showing a balance due from the College to the agent of 50 cents. This failure of the accounts to exactly balance is due to an error in one of the remittances, and will be corrected in the accounts of the present year.

CONTINGENT FUND.

The rental received from the lease of the lands purchased with accumulated interest money, is known upon the College books as Contingent Fund. During the time covered by this report, the agent received from the lease of these lands, as shown by his receipts, from No. 26 to No. 68 inclusive, the sum of $1,934.07. This amount he has paid over to the Treasurer of the College, as shown by his vouchers, from No. 4 to No. 13 inclusive.

It will be remembered, that as Secretary of the Board, I keep in my office, a set of books, the exact duplicate of those kept by agent Bassett. In them can be found a complete history of each piece of land belonging to the College. As one of the means of testing the accuracy of the books of the agent, I carefully compared them with those kept in my office. In addition, I took careful note that the amounts upon his receipt book agreed with the debit items in his cash account, compared the vouchers received from the College Treasurer with the amounts which the agent claimed to have paid him, and added the debit and credit sides of his cash accounts.

As a result of this careful and minute examination, I am able to certify: *first*, that the agent has honestly debited himself with all the moneys received; *second*, that he has paid over all moneys thus received to the Treasurer of the College; *third*, that the books and accounts of the agent are correct.

Respectfully submitted,

E. W. STANTON, *Secretary.*

SUMMARY.

Accompanying the report of the Secretary to the Board of Trustees, on his settlement with land agent Bassett, covering the time from August, 1865, down to April 1, 1876, is an itemized statement of all moneys received by said agent from the sale and lease of College land and by him paid over to the Treasurer of the College. Owing to its great length this detailed statement is not published. The following, however, is a summary of all the transactions of the agency compiled from the foregoing reports of the Secretary of the Board of Trustees:

No. of acres of original College grant placed under the charge of agent Bassett	204,206.36
No. of acres of Contingent Fund land transferred in 1875 from Sioux City Department	320.00
	204,526.36
No. of acres patented prior to April 1, 1876	27,719.62
No. of acres patented from April 1, 1876, to Dec. 1, 1876	1,242.38
No. of acres patented from Dec. 1, 1876, to Nov. 1, 1877	880.00
Total No. of acres Endowment Fund land patented	29,842.00
No. of acres under lease	149,536.21
No. of acres in market for lease	25,148.15
	204,526.36
Amount received from sales of Endowment Fund land prior to April 1, 1876	$61,843.00
Amount received from sales from April 1, 1876 to Dec. 1, 1876,	3,819.87
Amount received from sales from Dec. 1, 1876, to Nov. 1, 1877,	3,120.00
Total amount received from sales of Endowment Fund land and transmitted through the College Treasurer to the State Treasurer for investment	$68,782.87

Amount of interest on Endowment Fund lands collected from the establishment of the agency in August, 1865, to April 1, 1876		$289,350.58
Amount of interest collected from April 1, 1876, to Dec. 1, 1876		21,446.28
Amount of interest collected from Dec. 1, 1876, to Nov. 1, 1877,		28,134.92
Total amount of interest collected prior to Nov. 1, 1877		338,931.78
Amount paid over to College Treasurer by agent prior to April 1, 1876,	$289,329.08	
Exchange charged on same	21.50	
Amount paid College Treasurer from April 1, 1876, to Dec. 1, 1876	21,427.13	
Exchange on same	10.15	
Amount paid College Treasurer from Dec. 1, 1876, to Nov. 1, 1877	28,127.42	
Exchange on same	17.00	
Total amount paid College Treasurer prior to November 1, 1877, plus exchange	$338,932.28	338,931.78
Balance due agent		.50
	$338,932.28	338,932.28

On May 13, 1876, the agency for the sale and lease of the lands purchased in 1868, with surplus Interest Fund, and known upon the College books as Contingent Fund lands, was transferred from Sioux City to Fort Dodge, and placed under the charge of G. W. Bassett. The following is a summary of the transactions of the agency under the management of Mr. Bassett, as compiled from the reports of the Secretary of the Board:

Amount of interest collected from May 13, 1876, to December 1, 1876		$1,072.00
Amount of interest collected from December 1, 1876, to November 1, 1877		1,934.07
Total amount of interest collected by agent Bassett		3,006.07
Amount paid over by agent to College Treasurer, from May 13, 1876, to December 1, 1876	$1,072.00	
Amount paid over by agent to College Treasurer, from December 1, 1876, to November 1, 1877	1,934 07	
Total paid over to Treasurer by agent Bassett	3,006.07	

For a complete history of these Contingent Fund lands, see statement attached to report of Secretary upon his settlement with land agent Stone, of Sioux City.

Of the sum of $68,782.87 arising from the sale of Endowment Fund land, and forwarded to the State Treasurer, there has been invested by him $68,060.00, leaving a cash balance in his hands of $722.87. The investments are as follows:

Iowa State bonds, drawing seven per cent. interest	$12,200.00
School bonds of the Independent District of Hamburg, dated May 1, 1876, running ten years, at ten per cent. interest	13,500.00
School bonds of the Independent District of Creston, dated July 1, 1876, running ten years, at eight per cent. interest	20,000.00
School bonds of the Independent District of Milford, dated August 20, 1876, running ten years, at ten per cent. interest	2,500.00
School bonds of the Independent District of Greenbush, dated August 29, 1876, running ten years, at ten per cent. interest	900.00
School bonds of the Independent District of Mt. Hope, dated September 1, 1876, running ten years, at ten per cent. interest	900.00
School bonds of the Independent District of Woodlawn, dated October 1, 1876, running ten years, at ten per cent. interest	1,000.00
School bonds of the Independent District of Lucas, dated September 1, 1876, running six years, at ten per cent. interest	1,500.00
Bonds of the city of Davenport, dated December 13, 1876, running twenty years, at six per cent. interest	10,000.00
School orders on Contingent Fund Independent School District of Des Moines, East Side, payable on demand, at ten per cent. interest	2,500.00
School orders on Contingent Fund Independent School District of Des Moines, East Side, payable on demand, at ten per cent. interest	560.00
Iowa State bonds, drawing seven per cent. interest	500.00
School bonds of the Independent District of Des Moines, East Side, dated June 1, 1877, running ten years, at eight per cent. interest	2,000.00
Total investment	$68,060.00

SETTLEMENT WITH LAND AGENT STONE.

REPORT OF THE SECRETARY.

[SETTLEMENT EXTENDING FROM JANUARY 7, 1869, TO JANUARY 1, 1876.]

IOWA AGRICULTURAL COLLEGE,
April 1, 1876.

To the Honorable Board of Trustees :

GENTLEMEN :—In obedience to your order, passed November 13, 1875, I have examined the books and papers connected with the agency of T. J. Stone, from the time of the establishment of his agency January 7, 1869, down to January 1, 1876.

In ascertaining the total amount of interest received by said Stone, I found the amount received on each lease, and thence by addition the sum total.

The full amount received up to January 1, 1876, as shown by statement attached to this report, was.....$14,124.75
The amount paid over by said Stone to the College Treasurer, during the same time, as shown by his vouchers, was..... 11,850.68

Leaving in the agent's hands a balance of.....$ 2,270.07

This balance was paid over to the College Treasurer, February 1, 1876. The following pieces of land had been sold by the agent, and the amounts received therefor duly paid over to the Treasurer of the College:

DATE.	TO WHOM SOLD.	Part of Sec.	Sec.	Tp.	Range.	Acres.	Price.	Total.
Nov. 14, 1870	To Elizabeth T. Brownlie,	n. e. qr....	30	98	47	160	$ 2.00	$ 320
Nov. 14, 1870	To Wm. T. Brownlie.....	s. e. qr....	30	98	47	160	2.00	320
								$ 640

No errors were discovered in the accounts of the agent. I found, however, that he has been very dilatory in forwarding to the College Treasurer, the interest collected by him, and that he had failed to report from time to time to the Board, the condition of the land in his department.

Upon certain tracts, eleven in number, I found that no interest

had been paid during the past year. I instructed agent Stone to declare these lands forfeited, for non-payment of interest. They were re-appraised by Trustee Whiting, as follows:

PART OF SECTION.	Section.	Township.	Range.	Price per Acre.
s. w. qr.....	20	90	40	$ 5.00
s. w. qr.....	36	93	36	4.00
n. w. qr.....	36	93	36	4.00
w. hf. of n. w. qr.....	34	93	36	4.00
n. e. qr	32	93	36	4.00
s. w. qr.....	29	98	47	5.00
n. e. qr.....	19	100	48	3.50
s. e. qr.....	19	100	48	3.50
n. w. qr.....	17	99	47	4.50
s. w. qr.....	17	99	47	4.50
n. e. qr.....	18	99	47	4.50
n. w. qr.....	21	100	48	3.50

I forwarded a certified copy of the above appraisement to agent Stone, with instructions to offer said land in the market for lease.

After the same manner as in my settlement with agent Bassett, I copied into my lease book a complete history of each tract of land included in the Sioux City agency. This lease book is now full; I have, however, purchased a new one, and with the data now in hand I shall be able to open it in good shape. I shall hereafter keep in my office a complete record of all the transactions of both the Fort Dodge and Sioux City agencies. Your attention is called to the itemized statement of Mr. Stone's account attached to this report.

Respectfully submitted.

E. W. STANTON, *Secretary.*

T. J. STONE, *in account with Iowa Agricultural College.*

To amount received from lease No. 1.....$ 224.00
To amount received from lease No. 2..... 224.00
To amount received from lease No. 3..... 224.00
To amount received from lease No. 4..... 224.00
To amount received from lease No. 5..... 112.00
To amount received from lease No. 6..... 224.00
To amount received from lease No. 7..... 224.00
To amount received from lease No. 8..... 224.00
To amount received from lease No. 9..... 224.00
To amount received from lease No. 10..... 57.60
To amount received from lease No. 11..... 201.60
To amount received from lease No. 12..... 201.60

T. J. Stone, *in account with Iowa Agricultural College—Continued.*

To amount received from lease No. 13	$ 201.60
To amount received from lease No. 14	201.60
To amount received from lease No. 15	201.60
To amount received from lease No. 16	201.60
To amount received from lease No. 17	179.20
To amount received from lease No. 18	179.20
To amount received from lease No. 19	201.60
To amount received from lease No. 20	201.60
To amount received from lease No. 21	179.20
To amount received from lease No. 22	179.20
To amount received from lease No. 23	179.20
To amount received from lease No. 24	192.00
To amount received from lease No. 25	192.00
To amount received from lease No. 26	192.00
To amount received from lease No. 27	192.00
To amount received from lease No. 28	96.00
To amount received from lease No. 29	128.00
To amount received from lease No. 30	48.00
To amount received from lease No. 31	179.20
To amount received from lease No. 32	192.00
To amount received from lease No. 33	32.00
To amount received from lease No. 34	192.00
To amount received from lease No. 35	137.65
To amount received from lease No. 36	149.50
To amount received from lease No. 37	167.20
To amount received from lease No. 38	153.60
To amount received from lease No. 39	153.60
To amount received from lease No. 40	153.60
To amount received from lease No. 41	153.60
To amount received from lease No. 42	153.60
To amount received from lease No. 43	153.60
To amount received from lease No. 44	153.60
To amount received from lease No. 45	153.60
To amount received from lease No. 46	153.60
To amount received from lease No. 47	153.60
To amount received from lease No. 48	153.60
To amount received from lease No. 49	153.60
To amount received from lease No. 50	153.60
To amount received from lease No. 51	153.60
To amount received from lease No. 52	153.60
To amount received from lease No. 53	153.60
To amount received from lease No. 54	153.60
To amount received from lease No. 55	153.60
To amount received from lease No. 56	153.60

T. J. Stone, *in account with Iowa Agricultural College—Continued.*

To amount received from lease No. 57	$ 153.60
To amount received from lease No. 58	153.60
To amount received from lease No. 59	153.60
To amount received from lease No. 60	153.60
To amount received from lease No. 61	153.60
To amount received from lease No. 62	153.60
To amount received from lease No. 63	76.80
To amount received from lease No. 64	51.20
To amount received from lease No. 65	51.20
To amount received from lease No. 66	128.00
To amount received from lease No. 67	128.00
To amount received from lease No. 68	128.00
To amount received from lease No. 69	128.00
To amount received from lease No. 70	153.60
To amount received from lease No. 71	153.60
To amount received from lease No. 72	153.60
To amount received from lease No. 73	153.60
To amount received from lease No. 74	128.00
To amount received from lease No. 75	102.40
To amount received from lease No. 76	128.00
To amount received from lease No. 77	153.60
To amount received from lease No. 78	153.60
To amount received from lease No. 79	153.60
To amount received from lease No. 80	153.60
To amount received from lease No. 81	153.60
To amount received from lease No. 82	153.60
To amount received from lease No. 83	153.60
To amount received from lease No. 84	153.60
To amount received from lease No. 85	153.60
To amount received from lease No. 86	153.60
To amount received from lease No. 87	172.80
To amount received from lease No. 88	172.80
To amount received from lease No. 89	172.80
To error charged to himself by Stone	6.40
Total interest collected prior to January 1, 1876	$14,124.75

T. J. STONE, *in account with Iowa Agricultural College—Continued.*

CONTRA.

	Cr.
By amount paid College Treasurer, July 12, 1869	$ 553.60
By amount paid College Treasurer, Jan. 8, 1870	160.00
By amount paid College Treasurer, Dec. 3, 1870	2,048.00
By amount paid College Treasurer, Sept. 13, 1871	1,857.27
By amount paid College Treasurer, Sept. 11, 1872	2,567.67
By amount paid College Treasurer, Feb. 5, 1873	467.20
By amount paid College Treasurer, Aug. 25, 1873	1,466.87
By amount paid College Treasurer, July 27, 1874	2,028.80
By amount paid College Treasurer, Feb. 8, 1875	705.27
By amount paid College Treasurer, Feb. 1, 1876	2,270.07
Total paid College Treasurer	$14,124.75

SETTLEMENT EXTENDING FROM JAN. 1, 1876, TO MAY 13, 1876.

REPORTED TO THE BOARD OF TRUSTEES AUGUST 16, 1876.

To the Honorable Board of Trustees:

At the meeting of the Board of Trustees held May 4, 1876, it was "ordered, That E W. Stanton, Secretary of the Board, be authorized to go to Sioux City, settle with T. J. Stone as agent of the Sioux City lands, and transfer said agency to G. W. Bassett, of Fort Dodge, Iowa."

In accordance with the above order, having made arrangements with Mr. Bassett to take charge of the agency, I proceeded on May 13, 1876, to Sioux City, for the purpose of making a final settlement with Mr. Stone.

In my settlement with him last winter I arrived at the total amount of interest received by him from the lease of lands by one method, while he arrived at the same result by another method. I ascertained the full amount received on each lease, and then by aggregating these amounts, found the total sum received. He took account of each item of interest as paid by the lessees, and by adding all these items, obtained the total amount received. The results obtained by these two methods differed as to $6.40. I thoroughly reviewed my work, and, at the time was satisfied that it was correct; afterwards, however, in indexing my land books, I found that in the settlement with Mr. Stone I had omitted one tract of land, viz: The s e ¼ section 34, township 90, range 41. This tract was leased June

15, 1869. The interest on it had amounted to $201.60, for which Mr. Stone should have been debited. On the other hand he claimed that I had overcharged him $16.00 on lease No. 30, the w ½ of n w ¼ section 34, township 93, range 36, and presented the affidavit of Mr. Buckwalter, the lessee of the land, who testified that he had made to Mr. Stone only two payments of interest instead of three, the number with which I had charged him. I allowed Mr. Stone this $16.00 together with the $6.40 overcharged on settlement, which reduced the amount due from him on account of errors in January settlement down to $179.20. Having discovered these errors in my account, I knew there must be corresponding ones in his. I therefore carefully examined every transaction connected with his agency. I found the errors in his books to be as follows: In the years 1870 and 1871 he had received and, through mistake, failed to pay over to the College Treasurer the following amounts due at the times specified:

	SEC.	TP.	RNG.		
On s w ¼	22,	93,	36,	due June 12, 1870	$32.00
On n e ¼	18,	90,	40,	due June 5, 1870	28.80
On s e ¼	18,	90,	40,	due June 5, 1870	28.80
On s e ¼	30,	91,	43,	due May 31, 1870	25.60
On n w ¼	24,	93,	36,	due June 24, 1871	32.00
On n e ¼	24,	93,	36,	due June 24, 1871	32.00
Total					$179.20

This amount Mr. Stone acknowledged as due the College, and paid over to the Treasurer, June 23, 1876. I also charged him with interest on the above amount, from the time it should have been paid to the time when it actually was paid to the College. This sum, about $60.00, Mr. Stone declined to pay, leaving the question an open one to be settled by himself and the Board.

From Jan. 1, 1876, to May 13, 1876, the time of final settlement, Mr. Stone collected interest amounting to $889.60 as per itemized statement attached to this report. This sum, together with the $179.20 above mentioned, making in all $1,068.80, was paid to the College Treasurer, June 23, 1876. Having settled with Mr. Stone I proceeded to transfer the agency to G. W. Bassett, of Fort Dodge. Of the land reported by Mr. Stone at the January settlement as

neither sold nor under lease was the n e ¼ section 32, township 93, range 36. This piece was, therefore, re-appraised and placed on the list to be transferred to Mr. Bassett. I afterwards found, by examining the records of the Register of the State Land Office, that said tract of land was patented March 11, 1871, to Alex. W. Brownlie. The patent was issued on the following authority, viz: the original lease with the following endorsement on the back :

"Received, Mar. 10, 1871, of Alex. W. Brownlie, four hundred dollars in full payment of principal and interest of this lease.

SAM'L E. RANKIN,
Treas. Agri. College.

Mr. Stone had never been notified of this sale and had therefore taken no account of it in his books. As there seemed, however, to be no question but that the patent issued Mr. Brownlie was complete and perfect, I withdrew the land from market, and entered upon my land books the tract as sold, giving a brief history of the circumstances of the sale.

The remainder of the land was transferred to Mr. Bassett, who agreed to take charge of the agency and conduct it upon the following conditions : that for copying into his books the previous history of each tract of land as furnished him by the Secretary, for notifying lessees and for incidental expenses connected with the transfer of the agency, he should receive the sum of $30.00; that for the leasing of forfeited lands he should receive the same compensation as under his other contract; that for all other work connected with the agency he should receive $75.00 per annum, payable quarterly; that he should give bonds in the sum of $2,000.00, as required by the Board; and that all other items of the agreement should be the same as in his contract as agent for the Endowment Fund lands.

Attached to this report is an itemized statement of agent Stone's account with the College from January 1, 1876, to May 13, 1876, the date of final settlement.

Respectfully submitted,

E. W. STANTON, *Secretary.*

T. J. STONE, *in account with the Iowa Agricultural College.*

To amount received on se qr, 34, 90, 41, previous to January 1, 1876	$201.60		
Less overcharge on w hf of nw qr, 34, 93, 36	$16.00		
Less overcharge on January settlement	6.40	$ 22.40	$ 179.20
To amount received on lease No. 24			32.00
To amount received on lease No. 25			32.00
To amount received on lease No. 26			32.00
To amount received on lease No. 27			32.00
To amount received on lease No. 32			32.00
To amount received on lease No. 38			25.60
To amount received on lease No. 39			25.60
To amount received on lease No. 40			25.60
To amount received on lease No. 41			25.60
To amount received on lease No. 42			25.60
To amount received on lease No. 43			25.60
To amount received on lease No. 44			25.60
To amount received on lease No. 45			25.60
To amount received on lease No. 46			25.60
To amount received on lease No. 47			25.60
To amount received on lease No. 48			25.60
To amount received on lease No. 49			25.60
To amount received on lease No. 50			25.60
To amount received on lease No. 51			25.60
To amount received on lease No. 52			25.60
To amount received on lease No. 53			25.60
To amount received on lease No. 54			25.60
To amount received on lease No. 55			25.60
To amount received on lease No. 58			25.60
To amount received from lease No. 59			25.60
To amount received from lease No. 60			25.60
To amount received from lease No. 61			25.60
To amount received from lease No. 81			25.60
To amount received from lease No. 82			25.60
To amount received from lease No. 83			25.60
To amount received from lease No. 84			25.60
To amount received from lease No. 90			64.00
Total amount received			$1,068.80

CONTRA.

By amount paid Treasurer, June 23	$1,068.80	
	$1,068.80	$1,068.80

CONDENSED HISTORY OF CONTINGENT FUND LANDS.

These lands were purchased by the Board of Trustees with accumulated interest money in the year 1868. They cost, including expense of locating, etc., the sum of $15,926.55. Mr. T. J. Stone, of Sioux City, was appointed agent for the sale and lease of these lands, January 7, 1869. At a meeting of the Board of Trustees, held in May, 1876, he tendered his resignation as such agent, which was accepted, and the agency transferred to G. W. Bassett, of Fort Dodge. The following is a summary of the transactions of the agency:

Total number of acres purchased with accumulated interest money		15,013.17
Number of acres transferred in 1875 to Fort Dodge agency	320.	
Number of acres patented	640.	
Number of acres under lease	12,053.17	
Number of acres in market for lease	2,000.	
	15,013.17	
Amount of interest collected by agent Stone prior to January 1, 1876		$14,124.75
Amount of interest collected by agent Stone from January 1, 1876 to May 13, 1876		1,068.80
Amount of interest collected by agent Bassett from May 13, 1876, to December 1, 1876		1,072.00
Amount of interest collected by agent Bassett from December 1, 1876, to November 1, 1877		1,934.07
Total interest collected		$18,199.62
Amount paid by agent Stone to College Treasurer		15,193.55
Amount paid by agent Bassett to College Treasurer from May 13, 1876, to December 1, 1876		1,072.00
Amount paid by agent Bassett to College Treasurer from December 1, 1876, to November 1, 1877		1,934.07
Total paid Treasurer		$ 18,199.62
Amount received from sale of six hundred and forty acres, and paid over to College Treasurer		$ 1,400.00

ABSTRACT OF THE PROCEEDINGS OF THE BOARD OF TRUSTEES

FOR THE YEARS 1876 AND 1877.

JANUARY MEETING, 1876.

The Board met January 19th at the Aborn House, Des Moines, and continued in session until the 21st inst.

Present: Messrs. Kirkwood, Summers, Tracy, Warden and Whiting.

The following business was transacted:

APPROPRIATIONS.

For the purposes specified below the following sums, or so much thereof as might be necessary, were appropriated.

FROM INTEREST FUND:	
For building sidewalk from the main College building to the laboratory	$ 250.00
For purchasing desk and stove for President's office	65.00
For purchasing from John Wentworth the buck "Young Audley"	50.00
For the purpose of preparing for exhibition at the Centennial a sample collection of the woods of the State of Iowa	50.00
For purchasing three new pianos for the musical department of the College	1,300.00
FROM CONTINGENT FUND:	
For repairing boiler at workshop	130.00
For digging trench around laboratory	10.00

BILLS ALLOWED.

FROM INTEREST FUND:	
Bill, favor A. Thomson, expenses on trip to Des Moines in regard to repairing boiler	2.00
Bill, favor M. Stalker, expenses purchasing sheep of John Collard for College farm	5.50
Bill, favor A. Tracy, expenses looking after stock for College farm	15.00
Bill, favor President Welch, expenses attending Board meeting	4.50

SALARIES.

The following salaries were increased, said increase to commence March 1, 1876:

Salary of the Pro essor of Mechanical Engineering to $1,800 per annum.
Salary of the Preceptress of the College to..... 1,100 per annum.

MISCELLANEOUS BUSINESS.

President Welch reported that he had made settlement with the C. & N. W. R. R. upon the following basis: The College to release the company from all claims against it on account of the removal of gravel from the College farm upon the payment of the sum of one thousand dollars ($1,000.00); also to accept in full payment of all claims against the company for water furnished said company, and for the use of ground in connection with the supplying of water, the sum of two hundred and fifty dollars ($250.00), said sums to be paid May 1, 1876. Settlement approved.

Miss Sallie Stalker tendered to the Board her resignation as Matron of the College farm house, said resignation to take effect March 1, 1876. Resignation accepted.

On motion, President Welch, and Trustees Warden and Whiting, were empowered to fill the vacancies in the chairs of Agriculture, Chemistry, and Civil Engineering, provided suitable persons could be found for said positions previous to the next meeting of the Board; also to secure a Matron for the College farm house.

MILEAGE AND PER DIEM.

Mr. Summers, committee on mileage and per diem, reported that the members of the Board were entitled to mileage and per diem as follows:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
S. J. Kirkwood	.....	.....	3	$15.00	$15.00
L. Summers	380	$19.00	5	25.00	44.00
A. Tracy	520	26.00	7	35.00	61.00
C. C. Warden	172	8.60	4	20.00	28.60
C. E. Whiting	452	22.60	5	25.00	47.60

Report adopted.

FEBRUARY MEETING, 1876.

The Board met February 24th, at the Aborn House, Des Moines. Present: Messrs. Kirkwood, Warden, and Whiting.

REPORT OF SPECIAL COMMITTEE ON FACULTY.

The special committee, consisting of President Welch, and Trustees Warden and Whiting, appointed at the January meeting of the Board, to secure suitable persons to fill the vacant chairs in the Faculty of the College, reported the following nominations: For Professor of Chemistry, Thomas E. Pope, of the Boston Institute of Technology; for Professor of Civil Engineering, F. E. L. Beal, late of the Naval Academy at Annapolis, Maryland; for Professor of Agriculture, George E. Morrow, of Chicago, Ill. The committee also reported in favor of employing Mrs. Ella Milligan as Matron of the College farm house.

Report adopted.

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the following members of the Board were entitled to mileage and per diem for the amounts set opposite their names, which report was adopted:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
Samuel J. Kirkwood	.....	.....	2	$10.00	$10.00
C. C. Warden	172	$ 8.60	3	15.00	23.60
C. E. Whiting	436	21.80	4	20.00	41.80

MARCH MEETING, 1876.

Board met at the College, March 30, and continued in session two days.

Present: Messrs. Summers, Warden and Whiting.

On motion, Dr. Warden was chosen chairman.

REPORT OF THE COMMITTEE ON PURCHASING STOCK.

To the Board of Trustees:

As committee on the purchase of stock, we beg leave to report that we examined a number of cattle in the vicinity of Galesburg, Ill., and not being able to make purchases that we deemed would be satisfactory to the College, we went directly to the stock-breeding region of Kentucky.

We examined a number of herds in the neighborhood of Paris, Lexington and Winchester, and after very careful inspection of several hundred animals, selected the following as combining more good qualities, both in pedigree and individual merit, than any others within the limit of the means at our disposal.

Bought of Leslie Combs, Jr., Lexington, Ky.:

1 Short-horn heifer, Carrie Trimble 2d, age 2 years	$ 700.00
1 Short-horn heifer, Rose Bud 4th, age 1 year	400.00

Bought of Wm. Warfield, Lexington, Ky.:

1 Short-horn cow, Hope 6th, age 6 years	600.00
1 Short-horn heifer, Nanny Combs, age 2 years	700.00
1 Short-horn heifer, Lilly Napier, age 1 year	500.00
Total expended	$2,900.00

C. E. WHITING, M. STALKER, } *Committee.*

Report adopted and ordered spread upon the minutes.

LAND DEPARTMENT.

The Secretary of the Board submitted a detailed report of his examination of the books and accounts of the agencies at Fort Dodge and Sioux City, together with an itemized statement of the financial transactions of those agencies. (For reports see pages 275 and 284.) It was ordered by the Board that the report of the Secretary be spread upon the minutes and accepted as a full and correct examination of all business connected with the agencies of Messrs. Bassett and Stone for the times specified in said report.

At the request of the Board, Mr. Bassett submitted a draft of a contract, under the provisions of which he was willing to continue to act as agent for the sale and lease of the Endowment Fund lands

of the College. The contract as submitted was approved by the Board and ordered spread upon the minutes. The Chairman and Secretary were directed to sign this contract on behalf of the Board of Trustees and to see that Mr. Bassett gave a good and sufficient bond for the faithful performance of his contract. The following is the contract as signed by Mr. Bassett and by the Chairman and the Secretary of the Board:

CONTRACT OF G. W. BASSETT.

This agreement, made the 31st day of March, 1876, between the Iowa State Agricultural College and Farm, represented by the Board of Trustees, and Geo. W. Bassett, of Fort Dodge, State of Iowa, witnesseth: That said Bassett has been and is hereby appointed the agent of the said Agricultural College for a period of five years from the date hereof, to take charge of the lands granted to the State of Iowa by act of Congress approved July 2, 1862, entitled, "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and mechanic arts," to receive and receipt for all sums paid as principal and interest upon leases of lands heretofore made, or that may hereafter be made through the said agency, and to transmit the same to the Treasurer of said College.

Also, for the purpose of leasing any and all the said lands yet undisposed of, any that may hereafter be forfeited to the said College, and in general to do all acts for and on behalf of said College that may be necessary to carry out the purposes of said agency. It is further agreed that the said Bassett shall pay over to the Treasurer of said Agricultural College, monthly, all money in his hands, keeping separate accounts of principal and interest, and shall file with the Secretary of the Board of Trustees a detailed statement of his accounts in the form heretofore observed. Also said agent shall receive and deliver to purchasers patents of the said lands which may come to his hands in the course of his agency.

The said Bassett shall also annually report to the said Board of Trustees the transactions of the said agency, and shall make with the said Board annual settlements.

He shall also report to the Board of Trustees, for re-appraisement, such lands as may be hereafter forfeited. And in consideration of said services to be rendered, and expenses to be incurred, the said

agency shall (subject to the limitation hereinafter stated) be continued for the said term of five years, and the said agent shall be entitled to charge and collect the following fees: For leasing a quarter section or less sub-division, fourteen dollars to be paid to the agent by the lessee. Also the sum of one dollar per annum on each lease as a collection fee, and the sum of two dollars for obtaining a patent, to be also paid by the lessee as provided in the leases heretofore issued.

The said Iowa State Agricultural College and Farm shall also at its own expense, provide for the use of the said agency the following books, to-wit: One Register of Lands, one Register of Leases, one Register of Interest Payment, and such blank receipt books as may from time to time be required, and shall also provide for the use of said agency blank leases and certificates of purchase, and in case said Bassett shall be unable to obtain exchange for the transmission of said funds to the Treasurer of said College without the payment of premium, the sum so paid shall be allowed to said Bassett, not exceeding seventy-five cents per thousand.

The said Board of Trustees shall, by its Secretary, or other duly authorized officer, examine annually the accounts of said agency at Fort Dodge, to the end that full and complete settlements may be made annually of the said accounts.

The said agency shall be continued and conducted at Fort Dodge, State of Iowa, substantially as heretofore, and without other expense to the said Iowa State Agricultural College and Farm, other than as herein provided. It is further agreed that either party may terminate this contract after two years by giving four months notice of such intended termination.

In witness whereof, the said Board of Trustees have caused the said contract to be entered of record, and these presents to be executed by their Chairman and Secretary, with the seal of the said Iowa State Agricultural College and Farm hereto affixed, at the date above written, and the said Geo. W. Bassett hereunto affixes his signature.

C. C. WARDEN, *Chairman.*

[SEAL.] E. W. STANTON, *Secretary.*

GEO. W. BASSETT.

APPROPRIATIONS.

The following sums or so much thereof as necessary for the purposes specified, were appropriated by the Board:

FROM INTEREST FUND:

For transcribing the books of the agency of G. W. Bassett	$ 30.00
For purchasing record books for land agent Bassett	45.00
For purchasing ladder, hooks, buckets, ropes, axes, and trumpet, for the fire department	135.00
For payment of freight on cattle, purchased by Messrs. Whiting and Stalker, for College farm	15.00
For purchasing chairs for dining hall at College	50.00

FROM CONTINGENT FUND:

For building partition in music room	20.00
For building and painting College ice house	235.00

BILLS ALLOWED.

FROM INTEREST FUND:

Bill, favor C. E. Whiting, expenses incurred purchasing cattle for College farm	$192.73
Bill, favor M. Stalker, expenses incurred purchasing cattle for College farm	112.79
Bill, favor A. S. Welch, expenses at Des Moines, on College business	41.35
Bill, favor E. W. Stanton, expenses and allowance for seven weeks' extra work, making settlement with land agents Bassett and Stone	150.00
Bill, favor M. Stalker, expenses at Des Moines, purchasing window blinds	2.50

MISCELLANEOUS BUSINESS.

The Secretary of the Board was ordered to advertise for sealed proposals for putting in steam heating apparatus in the College building, said proposals to be opened in the presence of the Board, at its May meeting.

The Board directed that a fire company be organized, under the direction of Gen. Geddes, from among the students of the College, said company to drill not less than one hour per week, and for the time spent in said drill to receive a compensation to be fixed by the authorities of the College not, however, to exceed the rate per hour paid for uninstructive labor.

The salary of Mrs. Welch, Instructor in Domestic Economy,

English Composition and Elocution, was increased to $750.00 per annum, said increase to commence March 1, 1876.

It was ordered that the salaries of the new Professors of Agriculture, Chemistry and Civil Engineering, and of the Matron of the College farm house commence March 1, 1876.

MILEAGE AND PER DIEM.

The committee on mileage and per diem reported the members of the Board entitled to mileage and per diem as follows:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
L. Summers	420	$21.00	4	$20.00	$41.00
C. C. Warden	260	13.00	4	20.00	33.00
C. E. Whiting	372	18.60	2	10.00	28.60

Report adopted.

MAY MEETING, 1876.

Board met at the College, May 2d, and continued in session two days.

Mr. Buel Sherman presented his credentials as a member of the Board.

Present during the meeting: Messrs. Sherman, Summers and Warden.

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

The following business in connection with the appropriations made to the Agricultural College by the Sixteenth General Assembly, was transacted:

The sealed proposals for putting in steam heating apparatus in the College building, were opened by the Secretary in the presence of the Board, and found to be as follows:

Samuel I. Pope, Chicago, Ill.	$ 7,980.00
Haxtun Steam Heater Co., Kewanee, Ill.	10,677.00
A. Y. McDonald, Dubuque, Iowa	11,975.00
Woodman & Warner, Chicago, Ill.	9,500.00
Hiram Robinson, Des Moines, Iowa	12,000 00
John Davis & Co., Chicago, Ill.	7,350.00
A. L. Winne & Co., Chicago, Ill.	7,740.00
McDonald & Meara, Des Moines, [boiler only]	1,700.00

These proposals were based upon plans and specifications furnished by the respective bidders, without a thorough examination of which no just comparison could be made between the different bids.

The Board found, upon inquiry, that the number of running feet of pipe figured upon by the respective bidders was as follows:

Samuel I. Pope & Co.	21,000
Haxtun Steam Heater Co.	25,515
A. Y. McDonald	26,400
Woodman & Warner	17,000
Hiram Robinson	25,000
John Davis & Co	13,000
A. L. Winne & Co.	15,000

After a thorough and careful examination of each bid, in connection with the plans and specifications furnished by the bidders, the contract for heating the building was awarded to the Haxtun Steam Heater Co., of Kewanee, Illinois, upon the following conditions:

1. The company shall perform the work in accordance with the plans and specifications submitted with their bid.

2. Said company shall, within thirty days, execute and file with the Secretary of the Board a bond in the sum of $21,000, approved by the President of the College, as security for the faithful performance of the contract and for the completion of the work by September 15, 1876.

3. Payments shall be made as the work progresses on monthly estimates of labor performed and material furnished, twenty per cent. of the same being retained until the apparatus is completed and tested.

4. No payment of money shall be made until the required bond is filed and approved.

Trustee Warden was appointed to superintend, in the absence of the Executive Committee, all repairs made and work done under the appropriations of the State to the College, and to perform all acts and duties required of the Board of Trustees by the act making said appropriations. For such service he was allowed compensation at the rate of $5.00 per day.

From these appropriations there was appropriated by the Board, for the purpose of making payments to contractors and to others who might perform work or furnish material, the sum of $20,000

to be expended under the direction of Superintendent Warden—all bills to be audited by the Board of Audit.

The Secretary was instructed to advertise for sealed proposals, for building boiler house, for painting exterior of College building, and for putting up valleys and conductors to the College building.

SIOUX CITY LAND AGENCY.

A communication was received from T. J. Stone, of Sioux City, tendering to the Board his resignation as agent for the sale and lease of the lands belonging to the College, known as Contingent Fund lands.

The resignation of agent Stone was accepted and the Secretary of the Board directed to visit Sioux City, make full settlement with agent Stone and transfer the agency to G. W. Bassett, of Fort Dodge, Iowa, provided—

1. That said Bassett execute an additional bond in the sum of two thousand dollars, ($2,000.00) for the faithful performance of his duties as agent for said Contingent Fund lands.

2. That he agree to remit monthly to the Treasurer of the College, all sums which may come into his hands by virtue of his office, as said agent.

3. That he re-lease all forfeited land upon the same terms as under his present contract for the lease of Endowment Fund land.

4. That he perform all other duties connected with the agency for a compensation to be agreed upon by himself and the Secretary of the Board, said compensation, however, not to exceed $100.00 per annum.

COLLEGE DEPARTMENTS.

A department of journalism was established for the purpose of giving instruction in the art of printing, doing the necessary printing of the College, and such outside work as would assist in making the department self-sustaining. It was, however, provided that in no case should work be done for outside parties for less than the ordinary rates charged at other offices in the vicinity of the College.

The College farm house and the boarding department connected therewith were constituted a separate department, under the charge of the Matron. She was directed to collect all moneys from boarders, to pay the same to the College Treasurer, at the end of each

month, taking a receipt therefor, and to purchase all necessary supplies for the department, submitting the bills for the same, monthly, to the Board of Audit, for their approval.

It was ordered, that students, who from previous experience, were able to perform skilled labor in any of the departments, should, at the discretion of the proper authorities, receive pay for their services at a rate not exceeding fifteen cents an hour, or twenty cents per hour for entire days.

Mr. Sherman was appointed a member of the Committee on Farm and Horticulture.

APPROPRIATIONS.

In addition to the appropriations made at the meeting of the Board, held Nov. 1875, the following sums or so much thereof as might be necessary, were appropriated to the various departments:

FROM INTEREST FUND.	
For Physical Laboratory	$ 200.00
For Experiments in Agriculture	300.00
For College Workshop	300.00
For College Museum	300.00
For Chemical Laboratory	400.00
For Ornamental Grounds	200.00
For Botany and Entomology	200.00
For Horticulture and Forestry	300.00
For Farm Department	300.00
For fitting up Printing Office	750.00
FROM CONTINGENT FUND:	
For changing farm wood-house into dining-room and office for laborers	100.00
For papering the farm house sitting-room	10.00
FROM FREIGHT DRAWBACKS:	
For fitting up College printing office	1,250.00

BILLS ALLOWED.

FROM INTEREST FUND:	
Bill in favor C. E. Bessey, apparatus for department	23.40
FROM CONTINGENT FUND:	
Bill, favor Mrs. Milligan, paid for kalsomining room at farm house	5.00

FROM STEAM HEATING APPROPRIATION:

Bill, favor Chicago Tribune Company, advertising	$ 6.72
Bill, favor Iowa State Register, advertising	6.60
Bill, favor Davenport Gazette Company, advertising	3.00

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the members of the Board were entitled to mileage and per diem as follows, which report was adopted:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
Buel Sherman	376	$18.80	6	$30.00	$48.80
L. Summers	420	21.00	6	30.00	51.00
C. C. Warden	260	13.00	5	25.00	38.00

AUGUST MEETING, 1876.

Board met at the College, August 16th, and continued in session four days.

Mr. Tredway, of Sioux City, presented his credentials as a member of the Board.

Present: Messrs. Kirkwood, Sherman, Summers, Tredway and Warden.

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

In connection with these appropriations the following business was transacted:

Superintendent Warden reported that, under the authority of the Board, he had awarded contracts to various parties as follows:

TO RAFF & SON, OF AMES:

The contract for building boiler house and cistern for	$ 2,600.00
The contract for cleaning brick taken from air ducts, filling air ducts and excavations in front of basement windows, repointing building, and removing bell tower and rebuilding walls of same, for	360.00

TO R. A. WILSON, OF OTTUMWA:

The contract for painting the exterior of the College building, for	2,213.00

TO THE MECHANICAL DEPARTMENT OF THE COLLEGE:

The contract for building walls over Chapel, for	$ 350.00
The contract for changing and repairing water closets, &c., for	725.00
The contract for making certain repairs to interior woodwork, as per memorandum, for	2,151.00

TO WRIGHT & LITTLE, OF AMES:

The contract for putting up valleys and conductors, upon the following conditions: 1. That they should put in gutters and valleys of best IX charcoal tin plate 40x80 in., making one seam every seven feet and extending ten inches under slate roof, at twenty cents per square foot. 2. That they should put up four inch conductors, made of No. 26 galvanized iron, with staples and soldering, at twenty-seven cents per foot. 3. That they should roof towers, using best IX charcoal tin, at $13.00 per square.

These contracts, together with the bonds of the contractors, were submitted to the Board, and, on motion, approved.

Superintendent Warden also reported that he had received the following proposals for plastering:

Proposal of Peter Raff & Son, of Ames: To furnish material, do the plastering, and clean the building, furnishing lath and re-lathing all places where necessary, for forty-five cents per yard.

Proposal of T. R. Bickley, of Ottumwa: To do all necessary plastering on first, third, fourth and fifth stories, for thirty cents per yard; to do all plastering on second story, re-lathing places where necessary, for forty cents per yard.

The proposal of T. R. Bickley was accepted, and Superintendent Warden authorized to enter into contract with him upon the basis of said proposal.

Superintendent Warden was authorized, with the surplus of the other appropriations, to make such repairs to interior wood work as he might deem necessary. He was also empowered to make final settlement with all parties entering into contract with the College to perform labor or furnish material, and to settle in full, and make payment to said contractors for all extra work performed by them on account of these appropriations; upon all of which he was directed to report to the Board at its next meeting. The bond of the Haxtun Steam Heater Company, in the sum of $21,000, given as security for the faithful performance of their contract for putting in steam heating apparatus in the College building, was submitted and approved.

LAND DEPARTMENT.

The Secretary of the Board reported that on May 13, 1876, he made a final settlement with T. J. Stone as agent for the Contingent Fund lands, and in accordance with the instructions of the Board, transferred the agency to G. W. Bassett, of Fort Dodge, Iowa.* The contract entered into by the Secretary with Mr. Bassett in regard to the conduct of said agency, together with the bond of $2,000.00, given by Mr. Bassett as security for the faithful performance of the duties of the agency, were examined and approved.

The Board also approved the new bond of $10,000.00 given by Mr. Bassett as agent for the sale and lease of the Endowment Fund lands; and ordered that the liability of the sureties, on his bond given in December, 1875, to cover the time while he acted as temporary agent for the College in connection with these lands, should extend up to, and not later than the time when this new bond, given under the contract of March 31, 1876, should become operative.

APPROPRIATIONS.

The Board of Audit submitted a statement of the amounts expended under the appropriations made by the Board of Trustees, to the different departments, showing that additional appropriations would have to be made to cover the expenses of certain departments. The subject was referred to a committee, upon whose recommendation, orders were passed appropriating the following sums, or so much thereof as might be necessary for the purpose specified:

FROM INTEREST FUND:	
For department of Horticulture and Forestry	$ 300.00
For College workshop	450.00
For purchasing of the workshop a small engine for printing department	150.00
For completing walk between College building and laboratory	150.00
For paying balance of expenses incurred in preparing samples of wood for the Centennial	8.41
For water supply	49.12
For laundry department	100.00
For purchasing furniture for College	50.00
For College printing department	400.00

*The full report of the Secretary containing an itemized statement of the financial transactions of the agency while under the charge of Mr. Stone, together with a description of the new contract entered into with Mr. Bassett can be found on page 288 of this Biennial Report.

FROM CONTINGENT FUND:	
For completing College ice house	$ 29.05
For College repairs	125.00
For repairing music room	2.50
For plastering and kalsomining dining room	20.00
For repairing College farm house	50.00

BILLS ALLOWED.

FROM INTEREST FUND:	
Bill, favor H. H. McAfee, freight advanced	3.30
Bill, favor Mrs. Welch, expenses incurred on behalf of College.	16.25
Bill, favor M. Stalker, expenses purchasing bull for farm	11.66
Bill, favor A. S. Welch, expenses incurred purchasing printing press	12.50
FROM CONTINGENT FUND:	
Bill, favor G. W. Bassett, work as per contract	50.95
Bill, favor E. W. Stanton, expenses incurred making settlement with land agent Stone	28.60
FROM REPAIRS TO INTERIOR WOOD-WORK APPROPRIATION:	
Bill, favor A. Thomson, expenses purchasing material	28.60

MISCELLANEOUS BUSINESS.

Prof. H. H. McAfee tendered to the Board his resignation as Professor of Horticulture and Forestry, said resignation to take effect March 1, 1877. Resignation accepted.

The Professor of Civil Engineering was directed to make such surveys and estimates as might be necessary to ascertain the cost of constructing a pond upon the College farm, suitable for the propagation of fish, and of a size sufficient to furnish the College with ice.

The Board ordered that a plat of land containing five acres, to be selected by the President of the College, and surveyed under his direction, be set aside for the purposes of a College cemetery, the same to be under the charge of the department of ornamental grounds.

MILEAGE AND PER DIEM.

Mr. Summers, committee on mileage and per diem, reported the following members entitled to the amounts set opposite their names:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
S. J. Kirkwood	80	$ 4.00	3	$15.00	$19.00
Buel Sherman	394	19.70	7	35.00	54.70
Laurel Summers	420	21.00	6	30.00	51.00
Wm. B. Tredway	450	22.50	5	25.00	47.50
C. C. Warden	260	13.00	8	40.00	53.00

Report adopted.

NOVEMBER MEETING, 1876.

Board met Nov. 8th, and continued in session until the 17th inst. Present: Messrs. Sherman, Summers, Tredway, and Warden.

GRADUATION.

A communication was received from the Faculty recommending for graduation the following students:

In the Course in Agriculture—Lewis W. Beard, George A. Garard, James F. Hardin, Abner E. Hitchcock, William M. James, Louis E. Spencer, Henry N. Scott, Walter M. Woodward and John J. Fegtly.

In the Course in Civil Engineering—Martin I. Aitken, Albert M. Blodgett, Winfield S. Collins, William T. Gilmore and Arvin B. Shaw.

In the Course in General Science for Ladies—Julia C. Blodgett, Winifred M. Dudley, Ellen W. Harlow and Ella E. Mead.

In General Science—Joseph E. Cobbey and Arthur P. Barker.

The recommendation of the Faculty was approved, and it was ordered that diplomas be issued to persons named therein.

FACULTY.

The committee appointed for that purpose reported that they had made a full and complete settlement with Prof. McAfee.

Professor Morrow tendered to the Board his resignation as Professor of Agriculture, said resignation to take effect December 31, 1876. The resignation of Professor Morrow was accepted, and the Treasurer was directed to settle with him in full, paying him salary due up to December 31st.

M. Stalker was elected Professor of Agriculture and Veterinary Science, with a salary of $1,800.00 per annum, said salary to commence March 1, 1877.

J. S. Lee was elected Assistant Professor of Chemistry and officer in charge of the College building, with a salary of $1,500.00 per annum, said salary to commence March 1, 1877.

COLLEGE DEPARTMENTS.

The heads of the different departments were directed to make to the Board of Audit at the end of each month, an itemized report of all sales made during the month, and at the same time to pay over to the Treasurer of the College all moneys collected on account of said sales.

The President of the College was authorized to employ a foreman for the College printing office, at a rate of compensation not to exceed $18.00 per week, to be paid from the receipts of the printing office.

The price of board at the College farm house was fixed at $5.00 per week for the months of November, December, January, February and March, and for the remainder of the year at $4.50 per week. It was, however, directed that farm hands should be charged at the rate of $3.50 per week for the entire year, and that day boarders should pay at the same rate.

The plat of land—about three acres in extent—known as the farm house garden, was transferred from the farm to the farm house boarding department.

LAND DEPARTMENT.

Mr. Bassett submitted a detailed report of the transactions of his agency for the year ending November 1, 1876, which was ordered spread upon the minutes. The principal points of this report are contained in the biennial report of agent Bassett found on page 269.

The committee on the re-appraisement of forfeited lands reported that they had re-appraised the following tracts:

PART OF SECTION.	Section.	Township.	Range.	New valuation.
sw qr	20	95	33	$4.00
sw qr	30	95	27	3 00
ne qr	34	94	37	4.00
nw qr	32	100	34	4.00
sw qr	22	93	37	4.00

Report adopted.

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

Superintendent Warden submitted an itemized statement of the amounts drawn and expended on account of these appropriations. He also stated that he had made full settlement with the following contractors:

WITH PETER RAFF & SON:

For building boiler-house and cistern, paying them the amount of their contract $2,600.00

For work done and material furnished outside of contract, paying 330.54

For cleaning brick, filling up air-ducts, pointing building, moving bell tower, &c., paying, as per contract 360.00

WITH MECHANICAL DEPARTMENT OF COLLEGE:

For changes and repairs to water-closets, paying the amount agreed upon in memorandum 725.00

For re-building brick wall over chapel, paying as per agreement 350.00

WITH R. A. WILSON:

For painting exterior of College building, paying amount of contract 2,213.00

WITH WRIGHT & LITTLE:

For putting up gutters and conductors, paying as per contract 831.24

The Superintendent reported that on the contract of the Haxtun Steam Heater Company, to put in steam heating apparatus in the College building, he had paid the sum of $8,541.60, leaving the balance due them under their contract $2,135.40. He also submitted to the Board, for approval, the following contracts together with bonds in double the amounts involved in said contracts:

CONTRACT WITH T. R. BICKLEY:

To re-plaster chapel, museum and library, and do such other plastering in the College building as the Superintendent in charge might designate, to the amount of 3,760 yards for 1,220.00

For all plastering in excess of the above number of yards, the contractor to receive compensation at the same rate.

CONTRACT WITH R. A. WILSON:

To paint the interior wood-work in the College building and grain in oak all work, hitherto grained, for 1,211.80

And to furnish material and do all necessary kalsomining, at the rate of thirty-nine cents per square.

These contracts, with the accompanying bonds, were approved by the Board.

At the request of Superintendent Warden, Professor Thomson submitted to the Board a written report in regard to the new steam heating apparatus. The report stated, that in the main the apparatus worked successfully; that the few defects discovered by the test of heating the building during the fall term could be easily remedied; and that the contractors were making such changes in the apparatus as would insure its giving entire satisfaction in the future.

From these appropriations of the State to the College, the Board appropriated for the payment of contractors or others who might perform work or furnish material on account of said appropriations, the sum of $4,820, the same to be expended under the direction of Superintendent Warden—all bills to be audited by the Board of Audit.

COLLEGE APPROPRIATIONS.

A committee on appropriations was appointed, upon whose recommendation the following sums, or so much thereof as might be necessary, were appropriated for various purposes to cover the expenses of the fiscal year ending November 14, 1877:

FROM INTEREST FUND:

For Salaries	$25,000.00
For Botany and Entomology	300.00
For Department of Military Tactics	100 00
For Department of Physics	500.00
For Department of Horticulture and Forestry	1,000.00
For Department of Civil Engineering	350.00
For Ornamental Grounds	500.00

FROM INTEREST FUND—*Continued*—	
For College Workshop	$ 500.00
For Chemical Laboratory	600.00
For Farm Department	1,000.00
For Farm Garden	100.00
For Museum	400.00
For Library	2,000.00
For Fires and Lights	1,500.00
For Contingent Expenses	2,000.00
For College Furniture	200.00
For Printing College Statement and Library Catalogue	250.00
For Slates for Recitation Rooms	200 00
For Cleaning College Building	120.00
FROM CONTINGENT FUND:	
For Agent Bassett's salary	75.00
For College repairs	200.00

In addition to the above there was appropriated to each department the proceeds of all sales made by said department.

It was ordered that the President of the College should direct the expenditure of all appropriations to the different departments, and that in so doing he should exercise strict economy and caution in order that under no circumstances should the College suffer from even temporary financial embarrassment.

In relation to certain old balances, which had been carried upon the books of the College since the defalcation of Treasurer Rankin, the following action was taken:

WHEREAS, In the year 1872 certain appropriations were made by the Fourteenth General Assembly for the use of the Agricultural College, of which the following were a part, viz: for main laboratory building, $25,000.00; for farm improvements, $7,000.00; and

WHEREAS, The authorities at the College proceeded to lay the foundation of said laboratory, and make said farm improvements, previous to drawing from the College Treasurer the amounts of said appropriations, using for said purposes money from Contingent Fund to the amount of: For main laboratory building, $1,725.84; for farm improvements, $1,963 86; and

WHEREAS, Through the defalcation of Treasurer Rankin, the aforesaid sums thus used from Contingent Fund could not be replaced from the appropriations made by the State for said purposes; and

WHEREAS, It is desirable that these old balances be adjusted on the books of the College, and charged to the funds from which the money was really taken. It is hereby

Ordered, That said balances be charged over to Contingent Fund.

BILLS ALLOWED.

FROM INTERIST FUND:	
Bill, favor *Aurora*, advertising	$ 10.00
Bill, favor J. M. B. Sill, balance of expenses lecturing before College Societies	2.50
Bill, favor Farm Household, board of Farm Superintendent	300.00
Bill, favor Gen. Geddes, material furnished Physical Laboratory	4.00
Bill, favor C. F. Clarkson, expenses incurred through lecturing before Board of Trustees	25.00
FROM CONTINGENT FUND:	
Bill, favor Gen. Geddes, damages by burning of barn, caused by fire set on College farm	31.75
FROM BOARDING DEPARTMENT:	
Bill, favor Gen. Geddes, expenses purchasing supplies	34.45

MISCELLANEOUS BUSINESS.

Wm. D. Lucas was re-elected Treasurer of the College, with a salary of $500.00 per annum, said salary to commence November 9, 1876.

Miss Alice Neal was elected Librarian, and Miss Alfaretta Campbell assistant.

The rate of compensation of the Librarian and Assistant Librarian, was increased from seven to nine cents per hour, and it was ordered that said Librarians while on duty in the library, should be required to give their whole attention to the duties of their office.

Prof. Beal, who was directed to make surveys and estimates necessary to ascertain the cost of constructing a fish pond upon the College farm, reported that a pond one hundred and twenty-five feet in length, by seventy-five feet in breadth, and of an average depth of about three feet, could be constructed at an estimated cost of $100.00; while one thirty feet square and of the same depth as the first, could be built for about $50.00.

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the members of the Board were entitled to mileage and per diem, as follows:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
Buel Sherman	394	$19.70	8	$40 00	$59.70
L. Summers	420	21.00	9	45.00	66.00
Wm. B. Tredway	450	22.50	6	30.00	52.50
C. C. Warden	260	13.00	12	60.00	73.00

Report adopted.

DECEMBER MEETING, 1876.

Board met December 12th, and continued in session until the 18th, inst.

Present: Messrs. Sherman, Summers, Tredway and Warden.

The President's report, and the report of the Secretary on settlement with land agent were read and ordered spread upon the minutes. (See reports of officers.)

FARM AND HORTICULTURAL DEPARTMENTS.

Superintendent Stalker presented his report of the operations upon the farm during the year, which was read and referred to the Committee on Farm and Horticulture.

This committee submitted a report containing the following recommendations:

1. That the farm proper be put under the management and control of an experienced farmer, and that he be relieved of all duties not pertaining strictly to the cultivation of the farm and the care of the stock, farm implements, and machinery thereon.

2. That a public sale of all extra or surplus stock on the farm be held under the direction of the President of the College, and Wm. B. Tredway of the Committee on Farm and Horticulture.

3. That the Farm Superintendent be instructed to furnish such apparatus from his department as may be required for experimental and lecture purposes in the department of Veterinary Science.

4. That the President of the College be authorized to employ and have under his sole control a suitable person of some skill to look after and take care of the ornamental grounds, at a salary not to exceed $40.00 per month for six or eight months.

The report was adopted and the Committee, with the President of the College, was authorized to secure the services of a Farm Superintendent at a salary not to exceed $1,200.00 per year; and if not able to obtain a suitable person for the position in time for the spring operations upon the farm, then to employ such assistance for carrying on the farm as might be deemed necessary, and for the best interests of the College.

The same committee was authorized to secure the services of a qualified horticulturist to fill the chair of Horticulture and Forestry, at a salary not to exceed $1,600.00 per annum, and, if not able to find such person in time for the commencement of the spring term of the College, then to employ some practical gardener to cultivate the garden and small fruits at a salary not to exceed $50.00 per month for the term of six or eight months; and a suitable person to cultivate the forestry and orcharding at a salary not to exceed $40.00 per month.

The Superintendent in charge of the farm was directed to furnish a team of horses, and harness and wagon for the sole use of the horticultural department at the stipulated price of fifteen cents per hour for the time actually employed, whenever the department should want the same.

The President of the College and the Farm Superintendent were instructed to purchase a thoroughbred bull for the College farm, and charge the same to the farm stock account.

The President was authorized to purchase volumes 12, 13, 14, 15 and 16 of the American Herd Book, and charge the same to farm stock.

SETTLEMENT WITH THE COLLEGE TREASURER.

The report of the Deputy Treasurer for the year ending Nov. 15, 1876, was read and referred to the Executive Committee. [For report in full see page 255.]

The report of the Secretary of the Board of Trustees upon the proceedings of the Board of Audit and the monthly examinations made of the Treasurer's books and accounts was read and ordered spread upon the minutes. [For report in full see page 260.]

The Board of Trustees spent several days in examining the books and vouchers of the Treasurer, the results of which examination are embodied in the following report of the Executive Committee:

To the Board of Trustees:

The Executive Committee to whom was referred the report of the Deputy Treasurer, beg leave to report that they have examined the books and vouchers of the Treasurer to such an extent as to satisfy themselves that said Treasurer has rendered a true account of all moneys received and paid out by him during the last fiscal year. We find, that at the beginning of the year there was in the hands of the Treasurer a cash balance of $8,067.18; that during the year he received from all sources, except from the sale of land, $79,784.40; that during the same time he paid out as per his vouchers by us examined and found correct, the sum of $83,881.64, leaving as the balance in the hands of the Treasurer $3,969.94. We further find that this sum, viz., $3,969.94, was the true balance in the hands of the Treasurer at the close of the year, Nov. 15, 1876. We also find that during the year the Treasurer has received from agent Bassett and transmitted to the State Treasurer, the sum of $21,357.45.

C. C. WARDEN,
L. SUMMERS, } *Committee.*

IRON TANKS.

It was ordered by the Board that two iron tanks, each seven feet six inches square by seven feet six inches high, be constructed, under the direction of Superintendent Warden, one in the north and the other in the south wing of the College building. For constructing these iron tanks the following proposals were received:

McDonald and Meara, Des Moines	$400.00
Haxtun Steam Heater Co., Kewanee, Ill	380.00

McDonald & Meara changed their bid to $375.00, but the contract, on motion, was awarded to the Haxtun Steam Heater Co.

COLLEGE APPROPRIATIONS.

In addition to the appropriations made at the November meeting for the fiscal year ending November 14, 1877, the following sums were appropriated for the purposes specified below:

FROM INTEREST FUND:	
For department of journalism	$150.00
For farm house department	167.32
For fires and lights	600.00
For cleaning College building	50.00
FROM CONTINGENT FUND:	
For addresses of National Agricultural Congress	15.00
For fitting up and furnishing an experimental kitchen	100.00
For paying claim of Mrs. Kimberly	50.00
For paying claim of Mr. Milnes	15.00

The following sums or so much thereof as might be necessary were appropriated for the payment of any balances which might, after the appropriations from the State had been expended, remain due to any parties for work done on the College building:

From freight drawbacks	$117.82
From interest on notes	297.27
From diploma account	187.00
From donations	243.00

BILLS ALLOWED.

FROM CONTINGENT FUND:	
Bill, favor G. W. Bassett, blank leases as per contract	8.00
Bill, favor McCarthy & Stevens, legal services	26.00
Bill, favor E. W. Stanton, expenses incurred in making settlement with land agent	13.70
FROM IRON TANKS APPROPRIATION:	
Bill, favor A. Thomson, expenses to Des Moines in regard to tanks.	2.50
FROM FARM APPROPRIATION:	
Bill, favor H. H. McAfee, lumber furnished	7.87

COURSES OF STUDY.

The recommendation of the President of the College in regard to the establishment of special courses for post-graduates, and the conferring of second degrees upon those who should pass said courses was approved.

The President of the College was authorized to establish a Sub-Freshman course of one year, and to employ students as teachers in said course, paying them from the appropriation for contingent expenses. It was directed that applicants for admission to this course should be furnished with rooms in the College building not needed for students in the regular College courses.

It was ordered that Latin be introduced as an optional study in the department of English Literature during the entire Freshman, and for the first half of the Sophomore year, provided that the same could be done without additional expense to the College.

FACULTY.

It was provided that in the absence of President Welch, General Geddes should act as his substitute in performing the duties of President of the College.

The Preceptress of the College was appointed a member of the Judiciary Committee.

PRODUCER.

The rates of charge for printing the "Producer" were fixed as follows:

For composition, 40 cents per 1,000 ems.
For make up, 50 cents per page.
For press work, 50 cents per token, (per 250 impressions.)
For time work, 50 cents per hour.

It was directed that bills for advertising the College departments in the Producer, should be paid quarterly without being previously acted upon by the Board.

STUDENT'S CHARGES.

The Board ordered that rental be charged for rooms in the College building; that the President of the College and the Steward, make an inspection of said rooms and fix the rental of each room in accordance with the situation and character of the room, the average rental for the entire number of rooms to be not less than three and not more than four dollars per term for each student; and it was further ordered, that the amount received from said rentals should constitute a contingent fund, which was appropriated to refitting and keeping in order the rooms in the College building.

The janitor's fees, to be paid by students attending the Agricultural College, and boarding outside of the College building, was fixed at five dollars per term.

The Steward was directed to charge students ten cents extra for meals served in their rooms.

MISCELLANEOUS BUSINESS.

A communication was received from Treasurer Lucas in regard to furnishing exchange for payment of College bills, which communication was referred to Trustee Warden, with instructions to report upon the same at the May meeting.

A room in the College building, to be chosen by the President of the College and the Secretary of the Board, was set apart as an Auditor's office; and it was ordered that all bills against the College be handed first to the Board of Audit, and not presented to the Treasurer for payment until allowed by said Board.

The acting Chairman and the Secretary of the Board were directed to sign all leases of land belonging to the Agricultural College, and all other instruments or contracts made by the Board of Trustees.

The matter of letting the contract for carrying the mail, express and passengers to and from Ames was referred to President Welch and Gen. Geddes, who were authorized to make any arrangements they might deem just and proper to the College and all parties concerned.

The cleaning of the College building was placed under the charge of the Steward and Preceptress, who were authorized to employ outside help, the total expense of which should not exceed $700.00 per annum; and it was directed that the chapel, stairways and recitation rooms should be cleaned as often as necessary to keep the building in proper condition.

The wages of the Janitor of the College were increased to $35.00 per month, with board; said increase to commence November 15, 1876.

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the members of the Board were entitled to mileage and per diem as follows:

NAMES.	No. of miles.	Mileage.	No of days.	Per diem.	Total.
Buel Sherman	394	$19.70	9	$45.00	$64.70
L. Summers	420	21.00	9	45.00	66.00
Wm. B. Tredway	450	22.50	9	45.00	67.50
C. C. Warden	260	13.00	5	25.00	38.00

Report adopted.

MAY MEETING, 1877.

The Board met at the College May 2d. All the members present except Gov. Kirkwood.

APPROPRIATIONS OF THE SIXTEENTH GENERAL ASSEMBLY.

Trustee Warden submitted his report as superintendent of the work done under these appropriations, which report was adopted. [For report see page 251.]

The following resolution in regard to the Haxtun Steam Heater Co. was passed:

Resolved, That the Haxtun Steam Heater Co. of Kewanee, Illinois, have completed their contract with the Board of Trustees of the Iowa State Agricultural College to the entire satisfaction of all concerned; that the work done by them in putting in steam heating apparatus in the College building is complete in all its parts, and that in our opinion said Company is worthy of the confidence of the public at large.

COLLEGE APPROPRIATIONS.

For the purposes specified below, the following sums, or so much thereof as might be necessary, were appropriated.

FROM INTEREST FUND:	
For the experimental kitchen	$ 50 00
For covering any deficiency which might occur in the laundry department	100.00
FROM CONTINGENT FUND:	
For heating the building during the winter vacation, while repairs were being made under the State appropriations	1,400.00
FROM BRICK ACCOUNT:	
For the experimental kitchen	50.00

BILLS ALLOWED.

FROM INTEREST FUND:	
Bill, favor F. E. L. Beal, engineer's transit, drawing desk, and freight on rods	158.50
Bill, favor Wm. B. Tredway, expenses and per diem purchasing bull for College farm	53.25
Bill, favor M. Stalker, expenses purchasing bull for College farm	11.40
FROM CONTINGENT FUND:	
Bill, favor C. C. Warden, additional compensation allowed for superintending repairs of College building	135.00

FARM DEPARTMENT.

The committee on the sale of stock submitted the following report, which was adopted:

To the Board of Trustees:

Your committee appointed at the December meeting to order and conduct the sale of such of the surplus stock that had accumulated upon the farm as they might deem expedient, beg leave to report that in accordance with the usages and customs of stock-breeders of the State, on May 3, 1877, they exposed to public sale the following classes and kinds of stock with the following results:

Eight head of Short-horn cows with calves at their sides	$ 950.00
Ten head of Short-horn bulls	1,220.00
Three head of Jersey bulls	95.00
Three head of Ayrshire bulls	135.00
Two grade cows	100.00
Thirty head of hogs	365.50
	$2,865.50

There has been incurred in conducting this sale an aggregate expense of about $200.00, as follows:

Paid for advertising	$150.00	
Paid for printing catalogue	25.00	
Paid for services of auctioneer	25.00	$200.00

WM. B. TREDWAY, *Chairman.*

An order was passed authorizing Professor Stalker to expend in the department of Veterinary Science the sum of $50.00 and charge the same to the farm stock account.

The salary of James Gilmore, foreman of the farm, was increased to $33.33 per month, said increase to commence May 1, 1877.

REPAIRS TO COLLEGE BUILDING.

For the purpose of making repairs upon the College building, in addition to those made under the appropriations from the State, certain sums were expended under the order of the Board. Concerning these repairs, Superintendent Warden submitted the following report:

To the Board of Trustees:

The amount of $3,172.98, having been appropriated by you in

excess of the State appropriations, the same has been expended as directed by your Board, and the necessary vouchers taken, subject to your inspection and approval. The following is an itemized statement of these expenditures.

1876.			
Aug.	23.	To paid express on fixings	$ 4.35
Oct.	3.	To paid express on fixings	5 05
Oct.	4.	To paid freight on hose	.55
Oct.	9.	To paid College workshop for repairing flag-staff	12.85
Oct.	12.	To paid E. Baggott for four chandeliers and globes	106.58
Oct.	12.	To paid Crane Bros. Manufacturing Co. for hose, couplings, etc	35.38
Oct.	17.	To paid Gray for building wall	5.00
Nov.	14.	To paid freight on slate	18.31
Nov.	15.	To paid for digging ditch and making connections	31.80
Nov.	26.	To paid Andrew & Co. for slate for recitation rooms	200 25
Dec.	9.	To paid Van Dusen for hauling	.75
1877.			
Jan.	15.	To paid T. R. Bickley for filling cracks in building	25.00
Feb.	8.	To paid R. A. Wilson, balance due on interior painting	199.25
Feb.	8.	To paid C. C. Warden for services as Superintendent	125.00
March	12.	To paid freight on slate	3.40
May	2.	To paid College workshop for miscellaneous repairs	864.46
May	4.	To paid for heating building during winter vacation	1,400.00
May	4.	To paid C. C. Warden for services as Superintendent	135.00
		Total expended	$3,172.98

By the order of your Board these expenditures were charged to the following accounts:

Department of Civil Engineering	$ 200.25
Interest on notes	317.82
College brick account	294.45
Contingent fund	1,601 57
Freight drawbacks	117.32
Appropriations of 1868	59.74
College extension	63.52
Furnace piping appropriation	87.64
Hall matting appropriation	1.22
Diploma account	186.45
Donations account	243.00
Total	$3,172.98

C. C. WARDEN, *Superintendent.*

FACULTY.

A petition was received from the Faculty urging that on account of failing health, a leave of absence be granted President Welch for such time as the Board might deem necessary. Leave of absence was granted the President for the remainder of the spring term.

Professors Wynn, Bessey, and Stanton were appointed an advisory committee to assist Gen. Geddes in discharging the executive duties during the absence of President Welch; and Professor Wynn was empowered to see that the College pulpit was filled each Sabbath during said absence.

The committee—consisting of President Welch and Trustees Tredway and Sherman—which was authorized by an order of the Board passed December 15, 1876, to secure a Professor of Horticulture and a Superintendent of the Farm, reported that they had secured the services of J. L. Budd as Professor of Horticulture and Forestry, at a salary of $1,600.00 per annum, and as acting Superintendent of the Farm for the year, for the additional sum of $200.00, said salary to commence March 1, 1877.

It was ordered that a plat of land, not to exceed one acre in extent, be leased to Professor Budd for the purpose of building a residence thereon, and that the lease be drawn for ten years with the privilege of renewal; the President of the College and the Secretary of the Board were directed to select a location for said residence and have the same surveyed and platted, and the Chairman and Secretary of the Board were instructed to execute to Professor Budd a lease for the said land.

STUDENTS.

Students were prohibited from bringing into the College building or upon the farm, books, stationery or any kind of merchandise for the purpose of retailing the same for gain or profit.

It was ordered that all damages done to the College buildings, furniture or untensils, by students or others, be assessed by the Steward to the amount of actual damages done, on the parties doing the same, or, if the parties be not known, the amount shall be assessed upon the section, or school at large; and if said assessment has to be entered upon the College books, such additional charge shall be made as may be necessary to cover the expense of the entry.

MILEAGE AND PER DIEM.

Mr. Summers, committee on mileage and per diem, reported that the following members of the Board were entitled to mileage and per diem for the amounts set opposite their names:

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
Buel Sherman	394	$19.70	8	$40.00	$59.70
L. Summers	420	21.00	7	35 00	56.00
William B. Tredway	450	22.50	9	45.00	67.50
C. C. Warden	260	13.00	7	35.00	48.00

SEPTEMBER—OCTOBER MEETING, 1877.

The Board met at the College September 29th, and continued in session three days. All the members present except Gov. Kirkwood and Mr. Tredway.

FARM DEPARTMENT.

The Superintendent of the Farm was directed to make such improvements in the way of building and repairing bridges, repairing the foundation of the old barn, ditching, constructing embankment to prevent the overflow of the bottom lands, &c., as he might deem advisable and the appropriations to the farm and ornamental grounds would allow.

The committee on purchasing a bull for the use of the College farm submitted the following report:

To the Board of Trustees:

Your committee appointed to purchase a bull for the College farm beg leave to report as follows:

The health of President Welch being such that he could not attend to the business of the committee, he appointed Wm. B. Tredway to act in his place. After corresponding with a number of parties, and looking over several lots of animals, we visited West Liberty, and attended the Short-horn sales at that place. We examined some half dozen choice herds, and finally decided to purchase the Rose of Sharon bull, Remick's Geneva 20,842, owned by P. Nichols, if he could be bought at such a price as the condition of our finances

would allow. When he came to sale he was bid off by your committee for $825.00; the terms of sale being approved notes, bearing eight per cent. interest, due in eight months from date. We trust the purchase will prove satisfactory.

M. STALKER,
WM. B. TREDWAY, } *Committee.*

APPROPRIATIONS.

FROM CONTINGENT FUND:

For building a coal house for the department of fires and lights	$ 250.00
For repairing the foundation walls of the house occupied by Gen. Geddes	20.00
For repairing the College farm house	150.00

STUDENTS.

The following order was passed by the Board:

Ordered: That in the late action of certain members of the Senior class of the College, in disobeying an order of the Faculty, directing special preparation for commencement exercises, we regard said rule or order in nowise unjust or oppressive, but in accordance with the usages of our best Colleges, and it is directed that this order of the Faculty be sustained and made the final rule of action for future classes; but since said Senior class has formally submitted to the ruling of the Faculty, it is ordered by the Board, as a special favor to the class, that rule five, as printed on page 37, of the Biennial Report of 1874–1875, be adopted in selecting speakers for the class of 1877; and that those not selected as speakers be excused from the duty of writing a final oration,—the President of the College and two Professors appointed by the Faculty, to constitute a committee to select the said ten speakers.

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the members of the Board were entitled to mileage and per diem, as follows:

NAMES.	No of miles.	Mileage.	No. of days.	Per diem.	Total.
Buel Sherman	394	$19.70	8	$40.00	$59.70
L. Summers	420	21.00	5	25.00	46.00
C. C. Warden	260	13.00	5	25.00	38 00

Report adopted.

NOVEMBER MEETINGS, 1877.

The Board met at the College November 12th, and continued in session until the 17th inst; it met again on November 26th, and adjourned December 1st. At both meetings all of the members were present except Gov. Kirkwood.

GRADUATION AND DEGREES.

Upon the recommendation of the Faculty the following students were graduated, each receiving the degree of Bachelor of Science.

In the Course in Sciences related to Agriculture :—Frank W. Booth, Craton C. Colclo, Jacob W. Doxsee, Almar P. Hargrave, William A. Helsell, John B. Hungerford, Richard F. Jordan, Edwin L. King, George I Miller, Lyman B. Robinson, and Fabian L. Stratton.

In the Course in Civil Engineering :—Wilber N. Hunt.

In the Course in Mechanical Engineering :—Thomas L. Smith, and John C. Milnes.

In the Course in Science for Ladies :—Alfaretta J. Campbell, Mary C. Carpenter, Kate S. Curtis, Mary E. Farwell, Cora B. Keith, Alice Neal, and Cora M. Patty.

Mr. Joseph C. Arthur, Bachelor of Science, 1872, having pursued a course of advanced studies in Botany and Zoology, and having passed the examination required by College law, was recommended by the Faculty for the degree of Master of Science; said recommendation was approved by the Board, and the degree of Master of Science conferred upon Mr. Arthur.

The following resolution passed by the Faculty was submitted to the Board:

Whereas, Professor Isaac P. Roberts, Professor of Agriculture in the Iowa State Agricultural College, from 1872 to 1873 inclusive, and since then Professor of Agriculture, and Dean of the Agricultural Faculty in Cornell University, has, by his long and successful occupancy of these positions shown himself a man of rare merit and attainments in his chosen profession, therefore,

Resolved, That we recommend that his name be placed before the Board of Trustees, with the recommendation that they confer upon him the degree of Master of Agriculture. [M. Ag.]

The recommendation of the Faculty was approved, and the degree of Master of Agriculture conferred upon Professor Roberts.

The revised courses of study and the rules and regulations concerning preapration for graduation and the conferring of first and second degrees, adopted by the Faculty, were approved by the Board.

OFFICERS.

President Welch was elected to the Professorship of Philosophy of Science, in addition to that of Psychology; he was granted leave of absence until March 1, 1878; the amount hitherto allowed him for clerk hire was discontinued.

E. W. Stanton was elected Professor of Mathematics and Political Economy, and J. K. Macomber, Professor of Physics, each to receive a salary of $1,800 per annum, commencing with March 1, 1878.

Professor Stanton was elected Secretary of the Board of Trustees, with a salary of $200 per annum, commencing Nov. 15, 1877; also Recorder of the College, to serve without extra compensation.

The salaries of the following officers were increased: J. L. Budd, Professor of Horticulture and Forestry, from $1,600 to $1,800 per annum; Mrs. M. P. Stanton, Preceptress and Instructor in French and Mathematics, from $1,100 to $1,200 per annum; Mrs. Welch, Instructor in the English Language and Lecturer on Domestic Economy, from $750 to $1,000 per annum; Mrs. Thomson, Housekeeper, from $500 to $600 per annum; Mrs. Milligan, in charge of Farm House, from $500 to $600 per annum. In each of these cases it was provided that the advanced salary should commence March 1, 1878; in the cases of Mrs. Milligan and Mrs. Thomson, it was understood that in addition to their salaries, they should receive,—Mrs. Milligan board during the entire year, and Mrs. Thomson board during the session of school.

The following new officers were elected, their services to commence March 1, 1878: H. H. Robinson Superintendent of the Farm, with salary of $1,000 per annum; Thomas L. Smith Foreman in the Workshop and Teacher in the Preparatory Department, with salary of $400 per annum; Joseph C. Arthur Librarian, with salary of $200 per annum; Miss Florence Brown Assistant Librarian, with the same compensation as hitherto allowed students holding that position.

It was directed that Professor Lee should teach two of the classes in the Freshman or Sub-Freshman class, without extra compensation.

The sum of $200 was appropriated from Interest Fund to compensate Professor Wynn for all extra services in sustaining the Sunday exercises which he might be called upon to perform during the

coming school year. It was however provided that from this amount the Professor should pay the expenses of securing at least eight Sabbath discourses from distinguished divines from different parts of the State.

The proposition of Frank W. Booth to work during the coming school year in the College printing office at a compensation of thirty cents per hour—working at such times as the necessities of the department require and the funds to its credit will warrant—was accepted.

The title of Mr. H. D. Harlow was changed from Janitor to Proctor, and his salary, commencing with March 1, 1878, was increased to $40.00 per month, with board; provided, that in addition to the duties already performed by him, he should, under the direction of the President, and with the advice of Professor Lee, act as officer in charge of the College building.

COLLEGE TREASURER.

The Deputy Treasurer submitted to the Board his report of the financial transactions connected with the Treasurer's office for the fiscal year ending November 14, 1877. This report was read and referred to the Executive Committee. [For report, see page 262.]

The report of the Secretary in regard to the account kept by him with the Treasurer, and the monthly examinations of the Treasurer's books and vouchers, made by the Board of Audit, was read and ordered spread upon the minutes. [For report, see page 267]

The Board of Trustees spent several days in examining the books and accounts of the Treasurer, the results of which examination are contained in the following report of the Executive Committee:

To the Board of Trustees:

The Executive Committee to whom was referred the report of the Treasurer, for the fiscal year ending November 14, 1877, beg leave to report that they have examined the same in connection with the account kept by the Secretary of the Board of Trustees with said Treasurer, and find: that the cash balance in the hands of the Treasurer at the commencement of the year was $3,969.94; that during the year he was debited with cash received from all sources, except from the sales of Endowment Fund lands, $62,847.28; that he was credited with cash paid out during the year $66,632.57, leaving as a cash balance in his hands at the close of the year $184.65.

Your committee, in their examination, have compared the duplicate receipts issued by the Treasurer with the corresponding items on the debtor side of his cash account, have examined the vouchers of all moneys paid out, taking note that said vouchers have been properly credited, have tested the additions of the cash items and made such other investigations of the books and accounts of the Treasurer as to satisfy themselves, that the said Treasurer has debited himself with all cash received; that he has proper vouchers for all moneys which he claims to have paid out during the year; that the amounts before mentioned are the true amounts received and disbursed; and that the sum claimed, $184.65, was the correct balance in the hands of the Treasurer at the close of the College year.

C. C. WARDEN,
LAUREL SUMMERS, } *Committee.*

Mr. Wm. D. Lucas was re-elected Treasurer with a salary of $500.00 per annum, commencing November 15, 1877.

The sum of $100.00 was appropriated from Interest Fund, as payment to the Treasurer for exchange on College drafts furnished by him during the years 1875, 1876 and 1877. It was also ordered that hereafter there should be allowed him, annually for making collections and furnishing exchange on domestic bills, the sum of $33.33; and that for foreign exchange he should be paid the expense of the same.

An order was passed empowering Wm. D. Lucas, Treasurer of the College and an officer of the Board of Trustees, to receive from the Treasurer of State all interest collected by him on the investment of moneys received from the sale of Endowment Fund land; and authorizing said Lucas to receipt for the same as Treasurer of the College, for and on behalf of the Board of Trustees.

COLLEGE APPROPRIATIONS.

To cover the expenses of the various departments for the fiscal year, commencing November 15, 1877, and ending November 13, 1878, the following sums or so much thereof as may be necessary for the purposes specified, were appropriated from the funds mentioned below:

FROM INTEREST FUND:	
For Salaries	$28,000.00
For Fires and Lights	1,500.00

FROM INTEREST FUND—*Continued*—

For Contingent Expenses	$ 2,000.00
For Farm Department	1,000.00
For Department of Horticulture and Forestry	1,000.00
For Department of Botany and Entomology	350.00
For Department of Veterinary Science	200.00
For Department of Civil Engineering	200.00
For Department of Physics	250.00
For Department of Military Tactics	300.00
For Experimental Kitchen	200.00
For Chemical Laboratory	250.00
For Workshop	600.00
For Museum	250.00
For Library	600.00
For Ornamental Grounds	500.00
For College Printing Office	150.00
For publishing 1,500 extra copies of Seventh Biennial Report	200.00
For purchasing cows for Farm Department	600.00
For purchasing chairs for College Farm House	25.00
For purchasing book-case for Crescent Society	50.00

FROM CONTINGENT FUND:

For salary of G. W. Bassett as agent for the sale and lease of Contingent Fund land	75.00
For incidental repairs to College building	200.00
For purchasing of Gen. Geddes barn built by him on College farm	64.00

In addition to the foregoing, there was appropriated to the various departments the proceeds of all sales made by said departments.

It was directed that all appropriations for the present year should be expended under the direction of the President, and in such manner as not to cause, at any time, even temporary financial embarrassment to the College.

BILLS ALLOWED.

FROM INTEREST FUND:

Bill, favor Schuyler Colfax, expenses incurred through lecturing before the Board of Trustees on Commencement week	$75.00
Bill, favor F. E. L. Beal, material furnished	6.50
Bill, favor A. Thomson, expenses at State Fair with College exhibit	16.80
Bill, favor College Workshop, material furnished	86.37
Bill, favor J. L. Budd, expenses purchasing material, &c	20.90

FROM CONTINGENT FUND:

Bill, favor G. W. Bassett, salary and receipt book	$31.05
Bill, favor E. W. Stanton, expenses making yearly settlement with land agent	6.70

FROM SEWER FUND:

Bill, favor J. L. Budd, expenses at Des Moines purchasing tile	2.00

LAND DEPARTMENT.

G. W. Bassett submitted his report of the Land Department, covering the time from October 31, 1875, to October 31, 1877 inclusive; this report was read and ordered printed in the Biennial Report of the Board of Trustees. [For report see page 269]. The report of the Secretary upon his settlement with agent Bassett, was read and ordered spread upon the minutes. [For report see page 279].

Agent Bassett was authorized to have the lease book, containing a history of the land leased in his department, re-bound, the expense of the same to be hereafter provided for by the Board of Trustees.

In regard to the Contingent Fund land, the following action was taken:

WHEREAS. Leases heretofore made upon certain land belonging to the Iowa Agricultural College, purchased with accumulated interest and held as part of the Contingent Fund, are about to terminate by expiration of the term, and the purchase price of such land about to become due and payable, it is ordered:

1. That said leases be not extended and that payment of the purchase price be required in accordance with the terms of such leases, and that where payment is not made, the agent of the College, having charge of said lands, be and hereby is instructed to enter a forfeiture of such delinquent leases.

2. That holders of said leases who are not in default of payment of their annual interest, may, on or before the expiration of their leases, make application to the agent of the College at Fort Dodge, Iowa, for the privilege of leasing such tracts anew after such forfeiture, and upon paying the required sum within thirty days from the expiration of said leases, said applicants shall be entitled to lease said tracts anew at an advance of fifty cents per acre above the former price of such tracts, and to receive contracts in the form and upon the terms and conditions now in force in making leases on College lands.

3. That when application and payment for a second lease is not made as above provided, the said tracts shall be reported to the Board of Trustees for re-appraisement.

4. That the agent of the College be and is hereby instructed to notify holders of such leases of the foregoing order and instructions.

The committee appointed to re-appraise forfeited land reported the following tracts re-appraised during the past year:

ENDOWMENT FUND LAND FORFEITED APRIL 4, 1877.

PART OF SECTION.	Section.	Township.	Range.	Acres.	Old price.	Re-appraisement.
sw qr	10	98	27	160	$ 2,25	$3.50
ne qr	10	98	29	160	2.25	3.50
nw qr	10	98	29	160	2.25	3.50
sw qr	22	94	39	160	2.25	4.00
nw qr	22	94	39	160	2.25	4.00
nw qr	4	94	37	138.40	2.25	4.00
se qr	11	94	39	160	2.25	4.00
ne qr	2	86	41	164.03	3.75	5.00
ne qr	34	98	28	160	2.70	3 50
nw qr	34	98	28	160	2.70	3 50
nw qr	33	94	33	160	2.25	3.50
ne qr	32	97	30	160	2.25	3.50
nw qr	28	97	33	160	5.50	5.00
ne qr	14	86	42	160	3.75	5.00
nw qr	14	86	42	160	3.75	5.00
sw qr	14	86	42	160	3.75	5.00
se qr	14	86	42	160	3.75	5.00
ne qr	10	86	42	160	3.75	5.00
se qr	10	86	42	160	3.75	5.00
ne qr	32	94	32	160	3.50	3 00
nw qr	32	94	32	160	3.50	3.00
se qr	32	94	32	160	3.50	3.00
sw qr	32	94	32	160	3.50	3.00

ENDOWMENT FUND LAND FORFEITED APRIL 28, 1877.

nw qr	28	88	41	160	4.00	$3.00
nw qr	2	87	41	156.77	4.00	4.00
se qr	14	89	43	160	4.00	4.00
sw qr	14	89	43	160	4.00	4.00
sw qr	11	97	48	160	3.50	3.00
nw qr	28	93	36	160	4.50	4.00

ENDOWMENT FUND LAND FORFEITED AUGUST 13, 1877.

ne qr	22	96	31	160	2.25	5.00
se qr	22	96	31	160	2.25	5.00
ne qr	17	99	31	160	2.25	4.00
nw qr	17	99	31	160	2.25	4.00
se qr	17	99	31	160	2.25	4.00
sw qr	17	99	31	160	2.25	4.00
ne qr	2	98	34	157.77	2.25	3.50
se qr	2	98	34	160	2.25	3.50
sw qr	1	98	30	160	2.25	3.50
se qr	1	98	30	160	2.25	3.50
s hf of se qr	22	90	47	80	5.25	7.50

ENDOWMENT FUND LAND FORFEITED AUGUST 13, 1877—CONTINUED.

PART OF SECTION.	Section.	Township.	Range.	Acres.	Old price.	Re-appraisement.
ne qr	31	95	33	160	$ 3.50	$4.00
se qr	31	95	33	160	3.50	4.00
ne qr	13	94	28	160	4.00	5.00
nw qr	14	94	28	160	4.00	5.00
ne qr	23	97	30	160	4.00	4.00
nw qr	23	97	30	160	4.00	4.00
ne qr	22	93	37	160	2.25	3.50
se qr	22	93	37	160	2.25	3.50

ENDOWMENT FUND LAND FORFEITED AUGUST 18, 1877.

nw qr	28	93	48	160	3.00	5.00
ne qr	28	93	48	160	3.00	5.00
w hf of se qr	23	97	27	80	3.00	3.50
se qr	28	99	33	148.33	3.50	5.00
nw qr	26	95	31	160	5.00	5.00
nw qr	36	95	28	160	4.00	5.00
nw qr	33	98	28	160	3.00	3.50
nw qr	26	94	28	160	4.00	4.00
se qr	29	94	33	160	3.50	3.50
se qr	27	94	36	160	4.00	5.00
ne qr	34	94	36	160	5.00	5.00

ENDOWMENT FUND LAND FORFEITED NOV. 12, 1877.

se qr	32	98	29	160	1.75	5 00
ne qr	34	97	27	160	2.60	4.00
nw qr	35	97	27	160	2.60	4.00
se qr	27	97	27	160	2.60	4.00
nw qr	26	90	24	160	4.60	5.00
nw qr	24	94	39	160	2.25	4.00
se qr	22	98	33	160	2.55	4.00

ENDOWMENT FUND LAND FORFEITED NOV. 29, 1877.

ne qr	35	95	27	160	3.00	4.00
se qr	32	96	31	160	2.60	4.00
ne qr	32	96	31	160	2.60	4.00
se qr	28	96	36	160	2.60	4.00
sw qr	22	97	30	160	2.55	4.00
ne qr	12	90	41	160	10.75	10.75
se qr	12	90	41	160	5.00	5.00
ne qr	17	98	36	160	2.75	4.00
sw qr	17	98	36	160	2.75	4.00
s w qr	27	95	27	160	3.00	3.50
n e qr	28	99	33	160	4.00	5.00
n w qr	12	100	36	112.39	3.00	3.50
n e qr	11	96	30	160	1.50	5.00
s w qr	28	90	32	160	4.30	5.00
s w qr	25	94	28	160	4.00	4.50

ENDOWMENT FUND LAND FORFEITED NOV. 29, 1877—CONTINUED.

PART OF SECTION.	Section.	Township.	Range.	Acres.	Old price.	Re-appraisement.
s e qr.	2	94	28	160	$ 4.00	$4 00
s w qr	2	94	28	160	4.00	4.00
n e qr.	24	94	33	160	3.50	3.50
n w qr.	24	94	33	160	3.50	3.50
s e qr.	24	94	33	160	3.50	3.50
s w qr.	24	94	33	160	3.50	3.50

CONTINGENT FUND LAND FORFEITED APRIL 4, 1877.

ne qr.	34	90	41	160	2.25	5.00
ne qr.	20	100	48	160	2.00	3.50
sw qr.	20	100	48	160	2.00	3.50

FARM DEPARTMENT.

Professor Budd, acting Superintendent of the farm, was authorized to remove the hot-beds from the College to the farm garden; to build such air shafts in the College barns as he might deem necessary for the purpose of ventilating the same, charging the expense of their construction to the farm stock account; and to provide for the various departments a supply of wood for the coming year, cutting the down timber in the vicinity of the ditches dug for the straightening of the creek channel, and such other timber as he might deem advisable.

The President of the College was instructed to declare the road leading from the laboratory to the west extremity of the College farm abandoned; to close the gate opening into said road, and to prosecute any party who should remove said gate, or in any way trespass upon the College grounds by using this west road as a public highway.

The Committee on Farm and Horticulture submitted the following report:

To the Board of Trustees:

Your committee would recommend, that hereafter only one variety or class of neat cattle be kept upon the farm for breeding purposes, and that that be Durham or Short-horn; that this breed be kept in limited numbers but of the highest type of excellence; that of the various other distinctive breeds there be retained only such individual

animals as are needed for class exercises and lecture purposes; that all aborting and sterile cows, impotent bulls, and non-productive stock be disposed of; and that the balance of the stock to be hereafter kept on the farm be of the practical sort, combining both milk and beef producing characteristics, and that it be handled and managed with a view of obtaining the best financial results with practical treatment. To the end that these results may be definitely ascertained we would suggest, that the inventory of farm stock be revised and the stock re-appraised by a committee appointed by the Board; and in order that said results may be shown clearly and the condition of the stock be more readily ascertained than by reference to the monthly reports, we would recommend that the Superintendent of the Farm be specifically instructed to hereafter keep a day-book or journal, recording therein births, deaths, and sales of stock, when and to whom sold, and the money received from such sales.

WM. B. TREDWAY, }
BURL SHERMAN, } *Committee.*

The report was adopted, and the following committee appointed to revise the farm inventory, viz: Trustees Tredway and Sherman, and President Welch. This committee reported as follows, their report being adopted:

To the Board of Trustees:

Your committee to whom was referred the last inventory of the farm department, beg leave to report that they have reviewed the same and re-appraised the stock, tools, machinery and products of the farm, putting such valuation upon each article as, in their judgment, its merits seemed to demand. You will notice that there is quite a decrease in the aggregate of the inventory. This may be accounted for from the fact that we found many animals upon the farm that had been purchased at the former high prices asked for this class of cattle, and had been carried along in the inventories from year to year, at the price for which they were purchased, while they had been deteriorating in value because of advancing age, and the natural shrinkage consequent upon the present close times. This class of cattle we have appraised at what we believe to be their actual cash value, and we hope we have put such a value upon all the matters under revision as will, in the future, enable the farm department to make a successful showing of profitable results upon the capital stock of the farm.

WM. B. TREDWAY, *Chairman.*

The Farm Superintendent was directed to purchase as many cows as might be necessary to supply the College boarding department and the farm household with milk during the ensuing year, his bill of expenses not exceeding $20.00, to be paid from Interest Fund.

As it was deemed impracticable for the Board of Trustees to meet again at the opening of school in the spring, and as Trustee Tredway had four days yet left him of the per diem allowed by law, it was ordered that he should visit the College farm on or about March 1, 1878, for the purpose of assisting the newly elected Farm Superintendent in assuming his duties as such superintendent; and, should the Auditor of State refuse to allow his per diem and mileage, then the Board of Trustees shall, on presentation of bill, allow the same and order it paid from the appropriation to the farm.

COLLEGE WORKSHOP.

The sum of $626.28 was appropriated by the Board to the College workshop, to cover the amount expended by said department in excess of its appropriation for the year ending November 14, 1877.

In view of the onerous duties connected with the department of Mechanical Engineering and the workshop, the duty of keeping the accounts of said department was assigned to Thomas L. Smith.

LIGHTING THE COLLEGE BUILDING.

Upon the subject of procuring gas-works for the College, which should be less expensive than those now in use, Professor Thomson reported that he had corresponded with the manufacturers of various gas machines, receiving from them proposals for lighting the building.

The report of Professor Thomson was referred to the Executive Committee. This Committee, after a careful consideration of the subject, submitted the following report, which was adopted:

To the Board of Trustees:

Your Committee, to whom was referred the report of Professor Thomson in regard to the proposals of certain parties to furnish gas for the College buildings, beg leave to report that they have had the same under consideration, and are in favor of accepting the proposal of H. D. Patton to put in a system of gas-works for the sum of $650.00, provided;

1. That said Patton shall enter into a contract with Gen. J. L. Geddes and Professor A. Thomson, as agents for the College, to put in said gas-works during the present winter vacation, binding himself to furnish gas of a quality at least equal to that furnished under the present system.

2. That said Patton shall have no valid claim against the College for compensation for said work, until the amount saved to the College over the present system of supplying gas shall exceed the sum of $650.00; and in no case shall the College authorities be required to pay said sum until, by the test of one school year, they shall be satisfied that the amount above given has been, without doubt, saved to the institution by the use of said works.

Your committee would further recommend that if said Patton should fail to comply with the contract above specified, then Professors Geddes and Thompson be authorized to make similar arrangements with any other responsible party who shall agree to perform said work under like conditions.

C. C. WARDEN,
L. SUMMERS, } *Committee.*

SANITARY MATTERS.

The committee appointed at the October meeting of the Board to investigate the subject of College sewerage, submitted a report recommending the building of a new sewer. [For report see page 123.]

This report was referred to the Executive Committee, and by them reported upon as follows:

To the Board of Trustees:

Your committee to whom was referred the report of Professors Budd and Beal on the College sewerage, would recommend that the Legislature be memorialized to appropriate the sum of $1,500.00 for building a new sewer, there being no fund belonging to the College from which the Board can legally appropriate money for such purpose. It being, however, a work that must be completed during the winter vacation, and one *imperatively necessary* for the health of the students and others occupying the building, we would recommend that the College authorities borrow the money necessary to construct said sewer, and reimburse themselves when the appropriation shall be made by the Legislature to pay for said work; and that Professors Budd and Beal be authorized to make all purchases of material and superintend all work necessary to the construction of said sewer, reporting all action taken under this order to the Board at its next regular meeting.

C. C. WARDEN,
L. SUMMERS, } *Committee.*

Dr. Fairchild, of Ames, and Professors Budd and Beal were appointed a committee, whose duty it should be to make from time to time an investigation of the sanitary condition of the College buildings and grounds. The committee was empowered to elect its own chairman and to recommend for adoption by the Faculty rules and laws for the regulation of the sanitary condition of the College. It was instructed to report to the Board at the next regular meeting, and at such other times as the Board might direct.

LEASING LAND FOR RESIDENCE LOTS.

The Committee on Farm and Horticulture, to whom was referred the subject of leasing plats of lands to certain employees of the College, for the purpose of building residences thereon, submitted the following report, which was adopted:

To the Board of Trustees:

Your committee would recommend that President Welch and Professor Budd be appointed a committee to select two sites of one square acre each, suitably located on the College farm, one for a gardener's house, the other for a farm workman's house, and that the Board lease the former to J. Sexton, the latter to L. L. Eastwood, for the purpose of building thereon residences for their occupancy so long as they shall remain in the employ of the College authorities. These leases shall be given for the term of five years, with the privilege of renewal, or for such time as the parties may be employed by the College. The authorities of the College shall reserve the right to control, at all times, the occupancy of these houses, and when either of them shall cease to be occupied by the parties before mentioned, the College authorities shall especially reserve the right to control and re-lease the same, allowing to the first lease-holder a rental equal to ten per cent. on a valuation or appraisement made by the President of the College, the Chairman of the Board of Trustees, and a third party, to be selected by the lease-holder.

WM. B. TREDWAY,
BUEL SHERMAN, } *Committee.*

COLLEGE QUARTERLY.

President Welch proposed to the Board that $200.00 be deducted from his salary and applied in part payment of the expense of printing four issues annually of a publication to be called the *College Quarterly*, and to be edited by the heads of the departments. As a condition of the proposal it was stipulated by the President that this sum should be restored to his salary if not used for the purpose specified. It was further agreed upon by the Board that they would appropriate annually, from the Interest Fund, the sum of $100.00 for the support of the paper and pay annually $100.00 for the advertising in said *Quarterly* of the College departments.

The above proposal was accepted by the Board and President Welch elected managing editor.

MISCELLANEOUS BUSINESS.

The Judiciary Committee was empowered to appoint a committee of five, of which the President should be Chairman, to try all cases of disobedience of College law,—the decision of this committee to be final.

The Superintendents of the different industrial departments were ordered to keep a day-book or journal, recording therein the labor performed, the kind of labor, by whom done, the expense of the same, and the various other items of cost of each article manufactured or produced in their respective departments. They were also directed to keep a record of *all* transactions connected with their departments together with the dates of said transactions.

It was ordered, that diseased animals brought in for clinical practice in the Veterinary department should be left at a safe and proper distance from the farm barns, a cheap shed being built in a safe enclosure for their accommodation; that all food consumed by said animals and all other expenses incurred in their behalf, should be charged to the department; and that all moneys received for food or fees should be reported monthly to the Board of Audit, paid over to the Treasurer of the College, and credited to the Veterinary department,—the rate of charge for treatment to be fixed in all cases by the President of the College and the Professor in charge of the department.

On motion, the deposit required of students as security for the payment of their bills was increased from $15.00 to $20.00.

MILEAGE AND PER DIEM.

Mr. Summers, committee, reported that the members of the Board were entitled to mileage and per diem, for the two meetings held in November, as follows.

FIRST MEETING.

NAMES.	No. of miles.	Mileage.	No. of days.	Per diem.	Total.
Buel Sherman	394	$19.70	7	$35.00	$54.70
L. Summers	420	21.00	7	35.00	56.00
Wm. B. Tredway	450	22.50	5	25.00	47.50
C. C. Warden	260	13.00	7	35.00	48.00

SECOND MEETING.

Buel Sherman	394	$19.70	7	$35.00	$54.70
L. Summers	420	21.00	11	55.00	76.00
Wm. B. Tredway	450	22.50	11	55.00	77.50
C. C. Warden	260	13.00	11	55.00	68.00

Report adopted.

Board adjourned *sine die*.

E. W. STANTON, *Secretary*.

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