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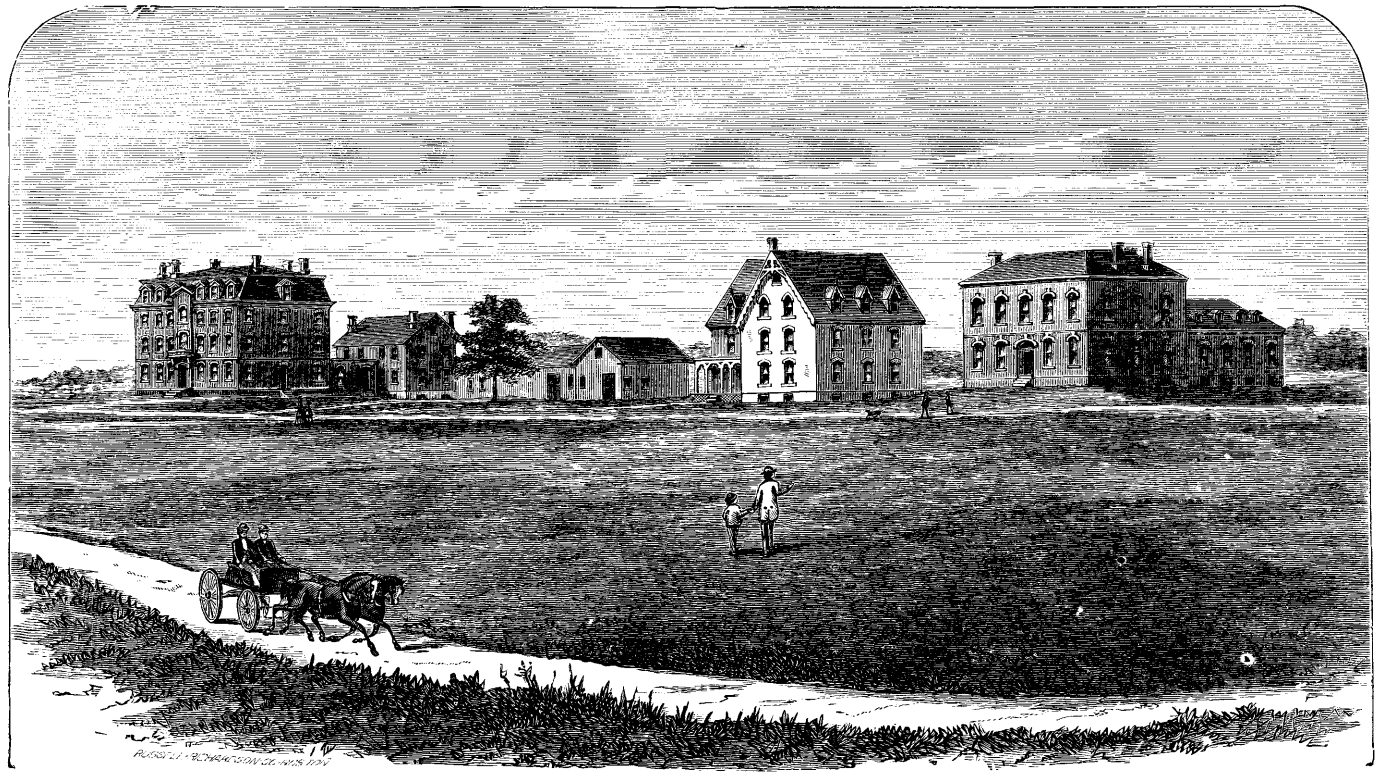
FOR THE YEAR

1885

VOLUME II.

AUGUSTA:
SPRAGUE & SON, PRINTERS TO THE STATE.
1885.



Dormitory and Boarding House. White Hall. Laboratory.

PRINCIPAL BUILDINGS OF THE STATE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS, ORONO.

ANNUAL REPORTS

OF THE

Trustees, President, Farm Superintendent and Treasurer

OF THE

STATE COLLEGE OF AGRICULTURE

AND THE

MECHANIC ARTS,

ORONO, ME., 1884.

Published Agreeably to a Resolve Approved February 25, 1871.

AUGUSTA:
SPRAGUE & SON, PRINTERS TO THE STATE.
1884.

TRUSTEES' REPORT.

To the Honorable Senate and House of Representatives in Legislature assembled:

The Trustees of the State College respectfully submit herewith their Seventeenth Annual Report; also, the reports of the President and members of the Board of Instruction, and of the Treasurer of the College.

These several reports will exhibit the work of the College during the year, its present condition, and the immediate wants of the several departments.

The personnel of the Board of Instruction remains the same as at the date of our last report.

In the Board of Trustees, Hon. E. E. Parkhurst, of Maysville, fills the vacancy occasioned by the retirement of Hon. William P. Wingate. Mr. Wingate's term of service, extending through a period of sixteen years, was characterized by rare fidelity and usefulness. Every call upon him for service in behalf of the College was promptly responded to.

Mr. Lander, after several years of faithful and successful service as Steward of the Institution, relinquished the position at the close of 1883, and was followed by Mr. J. G. Johnson. Mr. Johnson's management thus far inspires the hope that his services will prove satisfactory.

BUILDING FOR WORK-SHOPS.

The Legislature of 1882 appropriated $2,800, for the construction and partial equipment of a building for work-shops. With this, a substantial wooden structure was erected, 56x36, two stories high, with an ell 56x24, one story high, the entire building being 112 feet in length. The outside was well

finished, as was, also, a part of the inside, and such equipments as were needed for immediate use were supplied. This building has been in use one year and is represented by the instructor in shop-work, as reasonably well adapted to the purposes for which it was designed. Money will be needed to complete the interior and supply additional equipments, as will be shown by the reports of Professors Benjamin and Flint.

MILITARY DEPARTMENT.

The Trustees have been glad to notice, that in charge of Lieut. Howe, the range of instruction in this department has been extended, and that the interest in military practice has been much increased. The influence of the department has, also, been manifest in a more thorough inspection of College halls and rooms, as will be seen by reference to the report of President Fernald. The Trustees hold the services of Lieut. Howe in high estimation, and regret that a rule of the department at Washington, from which his appointment emanated, forbids an extension of his term of service at this Institution beyond the close of the next term.

The report of the Farm Superintendent indicates substantial and gratifying progress in that department. The tract of twenty acres alluded to in the report of last year, as having been redeemed from a condition of relative barrenness, and as having produced a crop of 800 bushels of oats, yielded over 2 tons of hay to the acre the present year. The cost of renovation was more than paid by the crops of 1883 and 1884. Another tract, of nearly equal size, has been cleared of stones and bushes, and has been drained, ploughed, smoothed and supplied with a heavy coat of dressing, ready for seeding next spring. While the Superintendent has thus been preparing for an increase of the hay crop, he has shown by well-conceived and carefully conducted experiments, independently of the question whether it is wise for one to impoverish his own land by selling hay to enrich the farms of others, that it

is much more profitable to feed hay to dairy-cows than to sell it for what it will bring in market.

The study of the methods of farm and dairy practice at the College cannot fail to be of great usefulness to students interested in the subject of practical agriculture.

Reports of various valuable experiments conducted at the farm have been widely read by the farmers of the State, and have excited a lively interest in many of the subjects to which they relate.

At their recent visit to the College, the Trustees found the several herds of cattle—mostly thoroughbreds, and representatives of some of the best blood in the country—in fine condition. The present stock barn has its stalls now filled with cattle, and its capacity for the storage of hay is taxed to the utmost. If the hay produced is to be consumed on the farm, which is very desirable, more room for stock must be provided. There is a heavily timbered barn belonging to the College, 100x40 feet in size, but it is so far away from the other buildings as to be nearly useless for stock raising. It may be furnished with new sills, moved to the site where it is needed, repaired and fitted for stock, at the cost of about $1,000. It would then subserve a most useful purpose. The Trustees have no hesitation in recommending the appropriation indicated for this purpose.

DEPARTMENT OF NATURAL HISTORY AND AGRICULTURE.

In carrying out the purpose for which the State College was established, viz: "the liberal education of the industrial classes," its Trustees have proceeded very cautiously, that each step forward might be taken safely, and with careful regard to the considerations of economy. The Department of Mechanical Engineering was greatly strengthened two years ago by the construction of a building in the interests of shop-instruction. The value of this building and its equipments, as aids to practical instruction in the various branches in shop-work, is not likely to be over-estimated.

The Departments of Natural History and Agriculture are closely allied, and instruction in the former lies at the basis of an intelligent comprehension of the latter. In the judgment of the Trustees, the next step forward should be in the interests of these departments, and there is pressing need that this should be taken immediately. These departments are provided with able and earnest instructors, but are shorn of half their usefulness, for the want of proper facilities of illustration.

A building of suitable size and appointments is the immediate and special need of these departments. The details of the plan of such a building, having been carefully considered by the President and instructors in these departments, it should, in their judgment, contain a conveniently arranged and well-lighted laboratory and lecture room for each department, and a Museum of Natural History and Agriculture, common to both. The size of a building for these purposes would need to be 40x55 feet, of two stories, with an extension from the rear 33x45 feet. A more definite specification of the features of the proposed building, and purposes to be accomplished by its construction, may be found in the annexed reports of President Fernald and Prof. C. H. Fernald, to which attention is respectfully called. The cost, if built with bricks, would be about $15,000.

The needs of the College for the years 1885 and 1886 will be as follows:

Amount needed to pay for instruction, in addition to revenue from Endowment Fund and tuition,	$3,300	per year,	$6,600
Travelling expenses of Trustees,	200	" "	400
Insurance,	300	" "	600
Farm experiments,	250	" "	500
Finishing shop and additional equipments therefor,			1,000
Apparatus for the several departments,			1,650
Sanitary improvements and repairs,			350
Painting farm buildings,			300
Moving barn described in Trustees' report,			1,000
			$12,400

New building for Departments of Natural History and Agriculture, $15,000.

The Maine State College is more poorly endowed than any of its class, with one or two exceptions, in the country. That it is doing very creditable work, in spite of its dearth of resources, is due to the able and excellent management of its President, seconded by the efficient services of the members of its Board of Instruction. Its graduates illustrate the valuable and thoroughly practical training they receive at its hands. Many of them step almost directly from its halls to useful and profitable employments; some of them to positions of immediate responsibility and trust. With the record it has made in the past, the Institution may, without even the implication of arrogance, ask for reasonable aid to carry out well-considered plans for the extension of its usefulness.

Respectfully submitted.

LYNDON OAK,

President of the Board of Trustees.

PRESIDENT'S REPORT.

To the Trustees of the Maine State College of Agriculture and the Mechanic Arts:

GENTLEMEN: It gives me great pleasure to state that the favorable action of the last Legislature (1883), toward the College, has extended its good influence over the two years now closing, and has contributed during this period to its substantial prosperity.

The intelligent interest in the affairs of the College, and the enlightened and kindly appreciation of its work on the part of the members of that Legislature, together with their fair provision for its immediate and pressing needs, have been sources of constant satisfaction and encouragement to all laboring in its behalf. Moreover, the essential unanimity of their action must be regarded in its relations to the future of the College as highly auspicious, indicating as it does, a more general comprehension than formerly existed, of the important service which this Institution is designed to render, and, properly fostered, cannot fail to render to the State. It should be here recorded that the plans inaugurated two years ago for the erection of a work-shop, for new gas apparatus, and for other improvements, have been strictly carried out with decided advantage to the instruction in the several departments in whose interests the changes were made.

GENERAL STATISTICS.

The more important statistics of the College having undergone sundry changes since their previous publication, I venture to give a condensed summary of them, brought down to date, for the information of the members of the Legislature,

and of others who may have an interest in the facts presented. The form adopted two years ago is essentially followed.

The Maine State College has an endowment from the National Government of $131,300,* yielding an annual revenue of about $7,600. It has received from the State $200,218. It has buildings, grounds, library, apparatus, farming tools, stock, &c., valued at $150,000. It has required from the State, in addition to the income from the national endowment, less than $3,500 a year, for purposes of instruction and for current expenses.

It has graduated 206 students, who have pursued full courses of study extending through four years, and has given instruction to 231 other students, in special or partial courses, extending through periods varying from a single term to three and a half years, and averaging one and a half years for each. These numbers do not include the 91 students now catalogued in the College, except that three names are duplicated. It thus appears that 525 different students have enjoyed, or are now enjoying, the benefits of the courses of instruction given at this Institution.

The average age of students on admission has been eighteen and one-half years, and hence the average age on graduation has been twenty-two and one-half years.

Of the living graduates whose occupations are known, eleven per cent are in so-called professional life, and eighty-nine per cent are engaged in other and varied industries; nineteen are farmers, three are teachers of agriculture in colleges, two are veterinary surgeons, and two are employed in agricultural experiment stations; six are engaged in manufactures, twenty-two in mechanics, and about twice the latter number in civil engineering. Of the living non-graduates whose occupations are known, thirteen per cent are in the so-called professions, and eighty-seven per cent are engaged in other and varied industries.

The five courses of study maintained in the College, prepare the students pursuing them for a wide range of practical pur-

* Incorrectly printed in the report for 1882, $132,500.

suits, as is clearly shown by the record of the vocations of the graduates, and of the important positions held by so large proportion of them.

COMMENCEMENT AND DEGREES.

The customary order was observed at the thirteenth annual commencement, the exercises eliciting the usual manifestations of interest.

On Saturday evening, June 21st, prize declamations were given by members of the Sophomore Class, the competition resulting in the award of the Coburn prize to Heywood Sanford French of Bangor, the committee also naming as especially meritorious the declamations of Charles Herbert Merriam of Orono, and James Frederic Lockwood of Brewer.

On Sunday evening, June 22nd, the Baccalaureate discourse was given by the President of the College, on the theme, "Liberty in Obedience to Law."

The Junior exhibition, consisting of the presentation of original essays, occurred on Monday evening, June 23rd. The first rank was accorded to the essay, "The Past and Future of Our Indian Policy," written by Frank Ellsworth Manter of Milo, who received the prize. The second rank was accorded to the essay, "Classical and Scientific Education," written by George Walter Chamberlain of West Lebanon, Maine.

On Tuesday afternoon, June 24th, the College halls were opened to visitors and the accustomed military exercises and review occurred on the College grounds. In the evening, the reception at the President's house was attended by the Alumni and other friends of the College.

On Commencement Day, Wednesday, June 25th, graduating parts were given by the Senior Class, and degrees conferred. The titles of the several parts, and the names of those receiving degrees, are herewith submitted:

Bachelor's Degree in Course.

Degree of Bachelor of Science—Course in Agriculture: George Herman Allan, Dennysville; Chemical Fertilization,

Its Growth and Results: Elmer Ellsworth Hatch, Lagrange; Education of Farmers: Edwin Fremont Ladd, Starks; Monopolies. Degree of Bachelor of Science—Course in Science and Literature: Mary Francis Conroy, Brewer; Monuments of Antiquity: Hattie Converse Fernald, Orono; Animal Intelligence. Degree of Bachelor of Science—Course in Chemistry: Fred Leroy Stevens, Temple; Bacteria and the Germ Theory of Disease. Degree of Bachelor of Civil Engineering: Will Hall Burleigh, Vassalboro'; Engineering, Past and Present: Leslie Willard Cutter, Bangor; The French Revolution: John Edward Hill, Bangor; Cremation: Joseph Grant Kelley, Orono; Political Education: Clarence Sumner Lunt, Stillwater; State Bridge Inspection. Degree of Bachelor of Mechanical Engineering: William Webber, Guilford; Prison Labor.

Master's Degree.

Civil Engineer—Robert Bruce Burns, Class of 1877; thesis, Railway Location. Charles Wingate Gibbs, Class of 1879; thesis, Railway Construction. Master of Science—Horace Melvin Estabrooke, Class of 1876; oration, The Modern Demand (in Education).

MILITARY INSTRUCTION AND INSPECTION.

In military tactics, thorough instruction is given and a high degree of efficiency has been attained. In connection with this department, a system of careful inspection of the College halls and rooms is maintained, with the best of results.

Many students have fitted up their rooms very tastefully and nearly all take a commendable pride in keeping them, at all times, neat and orderly. The improvement in this regard, has been decidedly marked within the past year.

Lieut. Howe has proved himself a worthy and efficient officer and gives evidence that at the expiration of his detail to this Institution, he will transfer the Department of Military Science and Tactics, in a thoroughly satisfactory condition, to his successor.

VARIOUS ITEMS.

Thirty-one new students have been in attendance at the College during the autumn, four in the Sophomore Class, twenty-three in the Freshman Class and four in special studies. In addition to these, one of the graduates of last June has been pursuing post-graduate studies. Four applicants for admission to the Freshman Class, not included above, have passed the entrance examinations, and with others, are expected in the spring.

Two of the recent graduates of the College, in the Course in Agriculture, are employed at experiment stations: one at the Houghton Farm, Mountainville, N. Y., and the other at the State Experiment Station, Geneva, N. Y.

In response to an invitation by President Prince of the State Agricultural Society, the Coburn Cadets and the young ladies of the College attended the State Fair at Lewiston. They acquitted themselves, in all regards, with credit, the Cadets giving evidence of the superior training they had received at the hands of their military professor. They were indebted to the favor of the Maine Central Railroad by courtesy of General Manager Payson Tucker, Esq., for free transportation to Lewiston and return.

The College has sent to the "World's Industrial and Cotton Centennial Exposition," New Orleans, an exhibit consisting of photographs of the buildings and grounds, and drawings illustrating the work done in the departments of Civil and Mechanical Engineering. Mr. Chamberlain of the Senior Class furnishes also to the Exposition an interesting and valuable exhibit of the Maine grasses.

FINANCIAL COMPARISON WITH THE AGRICULTURAL COLLEGE OF MICHIGAN.

In previous reports I have taken occasion to present the financial condition of the Maine State College, in comparison with that of a number of other State colleges, devoted to

agriculture and the mechanic arts. It thus appeared that our own Institution has in grounds, buildings and apparatus $90,000 less than the average investment for like purposes, of the sixteen similar institutions with which the comparison was made, and that its productive funds are less than the average productive funds of these institutions by $150,000, and the annual revenue from the same less by $10,000. In the present report, I make comparison with the Agricultural College of Michigan, selecting it because it is the oldest institution of its class in the United States, and also because it is, doubtless, the most distinctively agricultural in character. The facts and figures in regard to it are drawn from the report of the Michigan Board of Agriculture, 1883, quoting from the retiring message of Governor Jerome, June, 1883:

"This college was established in 1855. The means for its construction and maintenance have been derived from the following sources:

Appropriation by the Legislature of 22 sections of salt spring lands, for which the money was advanced by the State, amounting to,	$56,320.00
In 1861 a further appropriation by the Legislature of swamp lands, which have been sold for	42,396.87
Total realized for State lands sold,	98,716.87
In 1862 the United States Government donated to this, with other States, lands to be used in establishing Agricultural Colleges. Two hundred and forty thousand acres were nominally set apart to this State, but owing to the loss from fractional sections the amount received was really but 235,973.37 acres. One hundred thousand two hundred and three and fifty hundredths acres of these lands have been sold, and $224,868.15 received thereon. This has been used by the State, and on which interest has been and will continue to be paid at seven per cent. The total interest paid, beginning in 1870, up to September 30, '82, on the above, amounts to	179,626.82
	278,343.69
Appropriations in cash have been made from 1857 to 1882, both years included, amounting to	558,744.84
Making a total expenditure of	$837,088.53

This amount divided by 26, the number of years since the College was established, makes an average annual expenditure of	$32,195.71
The property of the College on December 1st, 1882, exclusive of granted lands for sale is estimated at	338,471.55
Deduct from the total expenditure, it leaves	498,616.98
Which if divided by 26, shows the average annual cost of maintaining the College, after allowing for the value of the land and the permanent improvements,	19,177.57
There remain unsold of the lands granted by the government, 135,469.87 acres, which, when sold, will increase the endowment doubtless to $900,000."	

From the foregoing, it appears that the Agricultural College of Michigan received from the State, in twenty-six years prior to 1883, appropriations in land and money amounting to $657,461.71, or on an average $25,286.99 annually. The same report shows that the Legislature appropriated to the College for 1883 and 1884, the sum of $51,089, an amount above the average for the preceding years.

From the gross amount of State appropriations for twenty-six years, $657,461.71, if we deduct the estimated value of the College property, $338,471.55, there remains $318,990.16, which, divided by twenty-six, gives $11,884.24, the average annual expense of the College to the State, not represented in buildings, apparatus and other permanent improvements, and exclusive of receipts from the national endowment, and from other sources.

Over against this average annual expense of $11,884.24, stands something less than $3,500 for the Maine State College. Over against the average annual appropriation of $25,286.99 for the Michigan College, stands $11,778 for the Maine College. A comparison of the two institutions in regard to permanent endowment, including money and lands, would disclose much wider contrasts than those already presented.

These figures and statements are submitted in no spirit of complaint, but to show in what manner a strong and progressive State institution is built up. The people of Michigan are justly proud of their State College, and of the good work it is accomplishing, but their pride in it is measured by the

substantial aid they have rendered and are still rendering to it, since it is in virtue of this aid that the results it is achieving have been and are possible.

If the Maine College is to be a credit and honor to the State, in the large measure which I believe to be generally desired, it will be in virtue of a like liberal policy toward it, to that which has rendered so successful the sister institution to which special reference has been made.

BUILDINGS.

The renovations and repairs made on the College buildings from time to time, have served to prevent serious deterioration, and the most of them are in very fair condition. When means will allow, the interior of the chemical laboratory should receive attention. It can be much improved at no very large expense.

The new shop is answering admirably the purpose for which it was erected, so far as its rooms are finished and equipped, and are thus rendered available. It is the testimony of all who have examined it and its fittings, that the College has in it much to show for the money expended. The amount assigned two years ago for its construction did not allow of the finishing of three rooms, which it is desirable to bring into service next season. The estimated expense of finishing these rooms is $250, and of stoves needed in the building, $50. Professor Benjamin, in charge of the Department of Mechanical Engineering, desires to increase the equipment of the shop by drawing tables, $100, machinery, $500, and tools, $100. The advantages of such additions will appear in his report. The whole amount needed on shop account is $1000.

In my report of 1880, attention was called to the need of two buildings, one for the Department of Mechanics, and the other, a building which should contain "an agricultural museum, natural history museum, chapel, library, physical laboratory, and working rooms for other purposes."

The former has been constructed, and with the additions indicated above, will be provided for, in the main, for a number of years.

The necessity for the latter is a *real* necessity, and one that has been increasing from year to year. The limited accommodations of several departments are large barriers to their effectiveness and hence to their usefulness.

Nothing approaching real development is possible to them in their present cramped quarters. To make adequate provision for all departments of a growing institution is a work of time, but by judicious plans and effort it is hoped the result can be finally realized in this Institution. The departments for which immediate provision should be made are those of Agriculture and Natural History. The building which would fitly accommodate these important departments would be, in dimensions and general structure, not unlike the chemical laboratory. It should contain conveniently arranged and well lighted working laboratories and lecture rooms for each department, and a museum of Natural History and Agriculture, common to the two, so closely related are these two departments in the objective material required for instruction. The cost of the building and the fitting up of its rooms would probably be not less than fifteen thousand dollars.

SPECIFIC NEEDS.

In addition to the income from the national endowment and from tuition, there will be needed for purposes of instruction, three thousand three hundred dollars each year, or six thousand six hundred dollars for the next two years; for farm experiments, two years, five hundred dollars; for travelling expenses of Trustees, four hundred dollars; for insurance, six hundred dollars; for the finishing and the further equipping of the shop, one thousand dollars. For department apparatus, the following sums: Department of Chemistry, three hundred dollars; Natural History, three hundred dollars; Civil Engineering, four hundred dollars; Mechanical

Engineering, two hundred dollars; Agriculture, two hundred and fifty dollars; Physics, two hundred dollars; making for the several departments, sixteen hundred and fifty dollars; for library periodicals, the customary assignment of fifty dollars will suffice. For a new well, to accommodate the dormitories and the boarding-house, and for certain much needed sanitary and other improvements about the buildings, three hundred dollars will be required. These several sums aggregate eleven thousand dollars.

For providing additional barn-room for stock, and for increasing the water supply for the same, the Farm Superintendent indicates that one thousand dollars will be needed.

In addition to the foregoing, and in the way of more extended permanent advancement, the building (previously referred to) for the departments of Natural History and Agriculture must be regarded as one of the pressing needs of the Institution.

CONCLUSION.

For definite information in regard to the farm, its management, the experiments carried on and their results, and for many other facts of interest and value as showing the nature of the work done by the College, reference is made to the reports of the several departments. In concluding my own report, I desire to make record of continued thoughtfulness on the part of the students and of that regard for good order which makes discipline comparatively easy, and of that earnestness in study and in work which gives promise of future success.

My acknowledgments are also especially due to those associated with me in the instruction and government of the College, for constant courtesy and consideration, and for fidelity to the important interests committed to them.

To those immediately connected with it, as well as to all other friends of the College, it will be gratifying indeed, when it shall be so amply endowed that, except for buildings, it shall have no occasion to look to the Legislature for aid.

Notwithstanding there is reason to believe that such condition is destined to exist, the time of it is not the present, but on the other hand, the amount of aid previously indicated is necessary. In this great and prosperous State, it certainly can be no error to assume that the necessary funds devoted to maintain the College in good working condition, and to render all its departments strong and progressive, cannot be regarded, by that intelligent citizenship which fosters all her interests, as money misapplied; but rather as money devoted in accordance with that system of true economy which seeks, through the building up of appropriate institutions, the development of her abundant natural resources and the constant increase of her thrift and prosperity.

Respectfully submitted.

M. C. FERNALD, *President.*

REPORT OF THE LIBRARIAN.

President Fernald:

About the middle of the present term, Prof. Hamlin resigned the position of College librarian, and the duties pertaining thereto, heretofore so acceptably performed by him, have devolved upon me.

The additions to the library during the past year have been as follows:

From J. P. Le May, 2 volumes.
Senator Hale, 5 volumes, 2 pamphlets.
United States Naval Observatory, 2 volumes.
Coburn Fund, 32 volumes magazines, 1 volume Encyclopædia Brittannica.
Department of the Interior, 2 volumes.
Department of the Treasury, 1 volume.
Bureau of Education, 1 volume, 2 pamphlets.
F. E. Emery, B. S., 4 pamphlets.
State Superintendent of Schools, 1 volume.
Department of Agriculture, Georgia, 1 volume.
C. F. Reeves, 1 volume, 2 pamphlets.
General J. M. Brown, 35 volumes.
Hon. C. A. Boutelle, 4 volumes.
Smithsonian Institution, 1 volume.
Bureau of Ordnance, 1 volume.
Patent Office, 12 pamphlets.
A. C. Stockin, 1 volume.
University of California, 1 pamphlet.
Massachusetts Experiment Station, 6 pamphlets.

Number received during the year, 91 volumes and 29 pamphlets.

The library numbers now about six thousand volumes and pamphlets, and this number is slowly increasing; for accommodations we have a room sixteen by eighteen feet, which two standing shelves, necessary for storing the books, darken and occupy to such an extent as to render the library almost useless as one of reference.

A library properly conducted is a most efficient aid in giving instruction; but to be properly conducted there must be a suitable room and accommodations, and the securing of these I respectfully urge upon your consideration.

An appropriation of fifty dollars is necessary that the periodicals for the coming year may be secured and our sets kept complete.

Very respectfully,

A. E. ROGERS.

REPORT OF MILITARY PROFESSOR.

MAINE STATE COLLEGE,
ORONO, MAINE, November 21, 1884.

President M. C. Fernald:

SIR: During the two years that have elapsed since submitting my last report, I have had the satisfaction of making considerable improvement in the Military Department. During the fall terms there have been infantry drills, comprising the school of the soldier, the school of the company, instruction in camp duties and target practice. During the spring terms there have been bayonet exercise, infantry drills in the school of the company, and target practice. The interest in these various duties has been good and is increasing. Instruction in target practice is confined to the Senior and Junior classes; in bayonet exercise to the Sophomore and Freshman classes.

Owing to the courtesy of the Hon. Rufus Prince, and the generosity of the management of the Maine Central Railroad, as expressed by Mr. Payson Tucker, the instruction in camp duties has been of a practical nature. The encampment at Lewiston last year was of four days' duration; that of the present year, five days. Guard duty, camp police and drills were successfully carried on. At the same time the students had ample opportunity to visit all points of interest.

There has been a great change in the interest taken by students in their rooms. A greater number of rooms were papered and comfortably fitted up during the past term than in any previous term since I reported for duty. The tendency of the present dormitory regulations has been to secure, in most cases, greater carefulness in the appearance

of the rooms, and has diminished the defacement of the walls.

The cadet officers of the present organization are very efficient and have shown a marked improvement over those of preceding classes. In target practice, Captain Fernald, Lieutenant Riggs, and Privates Dole and Manter of the Senior Class, and First Sergeant Sears and Sergeant Black of the Junior Class, have made very good records at 100 yards. The ammunition is furnished by the Chief of Ordnance of the Army, 1,000 rounds each year.

During the past term the greatest number enrolled was 72, the least 65; average 68. The average attendance has been 52.

Respectfully submitted.

EDGAR W. HOWE,

2D LIEUTENANT 17TH INFANTRY,

Professor of Military Science and Tactics.

DEPARTMENT OF CIVIL ENGINEERING.

President M. C. Fernald:

The following report concerning the Department of Civil Engineering is respectfully submitted:

The work of the department during the last two years has been essentially as heretofore, and according to the explanatory statement in the catalogue.

The method of instruction is by the use of text-books supplemented by lectures, notes on the black-board, and problems designed to test the student's practical knowledge of the principles taught.

The department is well supplied with transits, compasses, levels, chains and tapes, for the ordinary work of the engineer and surveyor. But as no field engineer is well qualified for the higher classes of his work without familiarity and practice with several instruments and pieces of apparatus which we do not possess, I earnestly hope, that, in the future, our field work may be rendered more efficient and complete, by the aid of some, at least, of these instruments, the need of which has long been felt in our work. Our most urgent wants in this direction are a plane-table, solar compass and base measuring apparatus. We also feel the need, very much, of some of the more modern books of reference in our library, as nearly all the books upon engineering subjects were procured some thirteen years ago, when the department was first equipped, and consequently do not meet our wants very fully at the present time. These are the actual wants of the department, and while I do not expect to see them all filled at once, it seems to me that an appropriation of four hundred dollars should be made for the use of the department during the next two years. The plane-table, with all the modern appliances, can be procured for three hundred

dollars, and one hundred dollars will enable us to procure a few of the most needed books. There are at present twenty-eight students registered in the course in civil engineering, and this number would tax the energies of one man quite severely with the best of accommodations and all needful apparatus.

At the last annual commencement five students graduated from this course, and the following is a list of their names and the subjects of their theses:

Will H. Burleigh, The Maine Central Railroad Bridge across the Kennebec River at Waterville, Maine.

Leslie W. Cutter, The Retaining Wall at the Junction of Harlow Street and Kenduskeag Avenue, Bangor, Maine.

J. E. Hill, The Sewage System of Keene, New Hampshire.

Joseph G. Kelley, The Wooden Howe Truss on the Maine Central Railroad at Oldtown, Maine.

C. L. Lunt, The Wooden Trestle on the Bangor and Piscataquis Railroad at Blanchard, Maine.

Robert B. Burns, B. C. E., of the class of 1877, presented a thesis upon The Final Location of the Mexican Central Railway, and received the degree of Civil Engineer.

Charles W. Gibbs, B. C. E., of the class of 1879, presented a thesis on Railway Construction, and received the degree of Civil Engineer.

G. H. HAMLIN,

Professor of Civil Engineering.

DEPARTMENT OF MECHANICAL ENGINEERING.

President Fernald:

During the past year I have given instruction in Kinematics, Mechanics, Machine Design, Hydraulics, Steam Engineering, Drawing, Analytic Geometry, and Calculus. The changes in this department have been slight, but have been in the direction of a system of instruction more in accordance with the demands of modern practice in this country. Rankine's text-books have been dropped with this end in view. In teaching Kinematics, or the Geometry of Mechanism, I have made use of Prof. MacCord's recently published work on that subject. This work is clear and practical, and the drawings made by its assistance show a decided improvement in accuracy over those made by former methods.

In this connection, I desire to acknowledge the receipt of a set of gearing models from the Pratt & Whitney Company, of Hartford, Conn., illustrating their system of inter-changeable cut gearing. The instruction in Mechanics and Machine Design has been principally in the form of lectures, although I am hoping to find a suitable text-book another year. In giving lectures on these subjects, I have found the use of lecture notes copied by the blue-print process a great saving of time and labor, both to the students and myself.

The study of the various valve motions used on the steam engine has been taken up by the present Senior Class, with the work by Auchincloss as a basis, especial attention having been given to designing locomotive link motions. It is my intention to have this study taken up, hereafter, in its proper place as a part of Kinematics.

To make the subject clear to a class, it is necessary to have a suitable model. Designs for a comprehensive model of this

kind are in course of preparation, and I hope it may be possible to have them executed the coming year.

Through the kindness of Instructor Flint, in relieving me of the class in Descriptive Geometry, I am now enabled to devote two hours a day to class-work with the Juniors in Mechanics, during the spring term, thus nearly doubling the amount of work done in that term.

I am endeavoring to systematize the work in drawing as rapidly as possible, by adopting methods sanctioned by good, practical engineers, and conforming to them rigidly. During the Senior year, the drawing is made subsidiary to the other work, and is confined to the making of tracings and blue prints of the various designs. There is urgent need of more models of machine construction, to guide the students in their machine design and drawing, by giving them a better idea of actual machine details. I think that these could, in many cases, be procured at a nominal cost by obtaining worn-out or defective pieces from locomotive repair shops and marine engine works. There is also need of more drawings to serve as examples of the best practice in machine design. A suitable apparatus for taking blue prints is needed, and could be made at the College shop at slight expense.

In pursuing the study of Steam Engineering, more experimental work on engines would be beneficial to the students. The apparatus needed for this purpose, consists of a dynamometer and new indicator attachments.

Hereafter, I would like to arrange for one excursion by the Senior Class during the fall term, for the purpose of inspecting different kinds of machinery in actual operation, and taking notes thereon. This is a feature of most engineering schools, and seems especially necessary here, on account of our remoteness from large machinery establishments.

The most favorable time would be during the month of October, when the mechanical fairs are open in Boston, and the necessary absence from the College would only be of a week's duration. To make this department what it should

be, more time is needed by both teacher and student, and I hope that the time may come when three years, instead of two, can be devoted to special studies in this course, and a chair of mathematics be established, relieving Instructor Flint and myself from the charge of purely mathematical branches of study.

I have asked for an appropriation of $200 for apparatus for this department, which will enable me to supply most of the wants above mentioned. The cost of the different items will be about as follows:

Model of valve and link motions	$50.00
Blue-print apparatus	30.00
Drawings and machine details	20.00
Dynamometer	100.00
Total	$200.00

For completing the equipment of the work-shop, I have asked for the sum of $1,000. It is perhaps necessary to explain that this amount is needed simply to supplement the appropriation made two years ago, by carrying out the plan then contemplated. At that time it was impossible to estimate the cost of equipping the shop with any close degree of approximation. The result was, as is usual in such cases, an underestimate. The only course possible under these circumstances, was to make the money go as far as possible, leaving many parts of the shop unfinished, and many needed tools unpurchased.

This fall I have looked the matter over carefully, and made an estimate of the cost of such improvements as will enable us to carry on successfully the instruction in Mechanics, Drawing and Shop-Work, on the present basis.

The estimate is as follows:

Finish for three rooms	$250.00
Drawing tables and cases	100.00
Two wood lathes, at $127.00	254.00
Shafting, pulleys and hangers	125.00

Circular saw and table	$60.00
Drill press and drills	35.00
Portable forge	26.00
Boiler feed-pump	55.00
Pipe, tools and vise	40.00
Stoves	50.00
Total	$995.00

For a detailed explanation of these needs, I refer to the report of the Instructor in Shop-Work, and will here mention but one item, viz: the necessity of an appropriation to defray the expense of finishing and furnishing the lecture room, drawing room and office, in the second story of the shop building. This will simply complete the original plan, and enable this department to be transferred from its present inconvenient and crowded quarters, to suitable rooms, where good work can be done.

I believe that the excellent character of the work done in the shop the past year, and the evident value of the practice thus obtained to young men engaging in industrial pursuits, warrants us in asking for an appropriation to complete the necessary equipment.

Very respectfully,

CHAS. H. BENJAMIN.

REPORT OF SHOP WORK.

President Fernald:

Owing to the bad condition of the forge shop, it was necessary to omit the work there for the spring term of '83. In the latter part of the term, work was begun on the new building, which furnishes the long needed accommodations for this department. It is admirably adapted to the work, and thus far has proved quite satisfactory.

In the fall term of '83, as the new shop was not ready for occupancy, the vise work had to be omitted, and an extra class in wood work was started, using the afternoon hours. The work was begun early in September, but as only an hour and a half each day could be devoted to it the desired amount was not done. The character of the work was necessarily of the simplest. Exercises were given in planing, squaring and sawing to dimensions; the pieces thus prepared were halved, mortised and tenoned in various ways. Practice was also given in mitring, dovetailing and dowelling. Hard and soft wood were used, so that the students became accustomed to both.

It is designed to supplement this course in wood work with lathe work as soon as the necessary machinery can be procured. The appropriation asked for two years ago was very generously given by the Legislature; but the amount thus received was just enough to provide the absolute necessities of the courses already established, and by strict economy to start the course in wood work. The building for the complete course in shop work was also obtained, but the equipments for these other courses are still wanting. It is hoped that the State will see fit to provide the funds for completing this system of practical instruction, for the courses

now started labor under a disadvantage because the others do not follow.

The year's work, ending this fall, '84, has been about the same as the year before, except that more has been done in each of the three courses. All the students who have taken this work have manifested a great deal of interest in it, and some of the work done by them in the wood shop will bear a critical examination.

Wood turning and pattern making should be taught here, and in order to do it lathes will be necessary. Turning, at least, should be established as soon as possible, for it would add greatly to the value of the course. At present, two good wood lathes, with the necessary shafting, would answer the purpose. A table saw is also needed to rip up lumber with, which can be obtained at no very great expense. A few more jointers are also needed, as there is but one to be used by several students, which makes it very inconvenient.

The shop is supplied with a fifteen horse power engine, and a small boiler, which at present is large enough, but if anything more is ever required of the engine a larger boiler will be necessary. Owing to the insufficient protection the boiler has had till within a year, it has rusted very badly, and is, in a measure, rendered unsafe. The apparatus for testing boilers ought to be furnished the College, both for safety and instruction. There are now three boilers here which have not been tested since they left the factory, and their condition is unknown. A pump is needed, in fact, is indispensable, for supplying the boiler with water. The means heretofore used have now failed entirely, so that a new apparatus is a positive necessity if the engine is to be run longer. A portable forge is also needed in the forge shop, as it is very often that a job of forging has to be done when the engine is not running; such as sharpening cold chisels, etc., in the vise shop.

For the vise shop and various work connected with the building, a hand drill would supply a want long felt. Some

arrangement for washing should be made, for iron work is very dirty, and students need some chance to clean up before leaving the building. A set of taps and dies for pipe fitting is very much needed, together with a vise suitable for such work. The cost of the tools would be saved every year by avoiding to hire men from Bangor to do the work.

The apparatus above mentioned is very earnestly asked for. While all of it would be a great convenience, most of it is an absolute necessity, as any one who will take the trouble to examine will be convinced. In Prof. Benjamin's report will be found a careful estimate of the cost, which has been reduced to the very lowest figure.

In addition to the care of the shop, I have had several classes in Mathematics and Drawing to teach. On account of the dirty kind of work done in the shop, it is very inconvenient to dress in a manner suitable to both class-room and workshop in the same day. Besides this, the shop furnishes all the work I can attend to properly. It is my earnest wish that I may be relieved of class-room work.

Respectfully submitted.

WALTER FLINT.

DEPARTMENT OF CHEMISTRY.

President Fernald:

The course of study in this department for the past two years has undergone but few changes. During the spring term of each year I had the Junior Class in Advanced Chemistry and the Sophomore and Senior classes in the laboratory in the forenoon. The Senior Class, as well as the Junior, in both Chemistry and Agriculture, worked in the laboratory in the afternoon.

My forenoon work during the fall term consisted of recitations by the Sophomore Class in General Chemistry and the Junior and Senior classes in Advanced Chemistry. In the afternoon, quantitative determinations were performed in the laboratory by the Junior and Senior students. During this term I also make a series of experiments before the Sophomore Class, illustrating the main points taken up in General Chemistry. The text-books used by the department, are: Roscoe's Lessons in Elementary Chemistry, Naquet's Principes de Chimie, two volumes. For laboratory practice are used: Craft's Qualitative Chemical Analysis, Caldwell's Agricultural Chemical Analysis, Fresenius' Quantitative Chemical Analysis, Wanklyn's Milk Analysis, Rickett's Notes on Assaying, besides which, notes on special determinations are given by myself, and the College library may be referred to.

At the commencement, in June, 1883, four students graduated, each presenting a thesis, namely:

Mr. J. H. Cain, thesis on Tanning.

Mr. B. P. Kelleher, thesis on The Chemistry of the Blood.

Mr. L. H. Merrill, thesis on Methods of Precipitating Caseine.

Mr. H. W. Powers, thesis on a Volumetric Method of Butter Analysis.

Messrs. Merrill and Powers did some original work in connection with their theses which will be found in the appendix to the report.

In June, 1884, Mr. F. L. Stevens graduated, presenting a thesis on Spruce Gum. An abstract of the work done by him will also be found in the appendix to the report.

The quantity of the original work done by the students is necessarily small, as the time at their disposal for such investigations is very short.

It is a pleasure for me to add that the students generally have done their work faithfully and conducted themselves with propriety.

For some years past all the departments of the College have suffered from lack of apparatus, the sums appropriated having been too small. The Department of Chemistry is no exception to the others in this respect, for though fairly equipped as regards the common glass-ware, we have hardly a single piece of apparatus for special analysis. If we intend to develop in the right direction, it is imperatively necessary that some such pieces be procured. A short-armed balance for chemical weighings is very much needed, to accommodate the students in quantitative analysis. Our larger Becker balance is in such a condition that it must be sent to the manufacturer to be put in proper order. It is not the kind of balance to put into the hands of students, and should be reserved for the finest work only. Nothing better could be procured than a Bunge balance, or one made on that principle; they are sensitive, strong and not easily put out of order.

A good polariscope for sugar and other determinations, is a pressing need. With such an instrument an accurate analysis can be performed in a very short time, which by any other method would take hours, if not days. As to its *practical* value I need only add, that the instrument is in constant use in the sugar refineries, etc. A well-constructed laboratory spectroscope should be obtained as soon as possible. By its

aid the metals of the alkalies and alkaline earths may be determined in a few minutes, while wet methods of analysis are less accurate, more tedious and require much more time. In fact, the spectroscope will indicate the presence of the above-mentioned metals, when the quantity present is so small as to be unweighable and undeterminable by any other means of analysis.

I have thus far had to omit all determinations involving the measurement of gases and eudiometric experiments. A beginning should be made in this direction, and a little apparatus obtained. Some of the methods of gas analysis are daily becoming more and more important, such as the examination of illuminating gas, the gases escaping from blast furnaces, the gases given off by mineral waters, etc. There is at present no microscope in the laboratory building; one should be provided, as it would very often be most useful. In fact, in urinary analysis and the examination of sediments and calculi, it is absolutely necessary. I would also draw your attention to the desirability of having a Gooch crucible for rapid determinations with vacuum filter pump, and a J. Lawrence Smith crucible for the determination of alkalies in minerals. Besides the apparatus mentioned, there are many minor pieces that we daily feel the need of.

In order to make this department comparable with those in other technical colleges, a sum of at least $300, for the purchase of new pieces of apparatus, should be appropriated to it.

Respectfully submitted.

ALFRED B. AUBERT,

Professor of Chemistry.

DEPARTMENT OF NATURAL HISTORY.

President M. C. Fernald:

The instruction in the Department of Natural History has not been as efficient as could be desired, nor indeed can it be much improved till some adequate provisions are made for it. There is imperative need of suitably equipped laboratories for both the animal and vegetable lines of study, and also a cabinet, which will serve the purposes of both the Departments of Natural History and Agriculture.

The laboratories referred to, should be so arranged that lectures can be given and demonstrations made before the entire class, and then each student have an opportunity of working out his own studies on each object, in a manner similar to that done in the chemical laboratory.

The specimens which have been accumulating during the existence of the College, are, for the most part, packed away for want of a suitable place for their exhibition, and, of course, are not at present available for class-room use. I would suggest that it may be more economical to follow the course of many of the large museums, and adopt a plan which allows a section to be built at a time, and additions to be made when needed. This, however, does not apply to the laboratories, for they are needed entire.

The studies which are expected to be taught in this department form, in a great measure, the foundation of the agricultural course, for it has truly been said that "Agriculture is Natural History applied." The farmer needs to know as much as possible of the plants and animals he has to deal with, and where can he look for this knowledge but to the natural and physical sciences.

The methods of study in Natural History in this country, have been completely revolutionized during the last twenty-five years. Before that time, simple recitations from text-books were in vogue, and as a result, no permanent knowledge of the subject was obtained; nor was there any application made of it to the every-day pursuits of life. It is not at all surprising that scientific studies should have been so much neglected, when, as a means of culture, or for practical application, they proved of so little value, as then taught. By the new methods, not only the most permanent impressions are made, but a training and development of the perceptive faculties are acquired which can in no other way be obtained—a training of the highest importance to the farmer or business man.

This revolution in the methods of study is due, in a great measure, to the teachings of the late Prof. Louis Agassiz, whose influence extended in a greater or less degree to all the scientific circles in the land, and at once affected both the methods and quality of scientific instruction in our higher institutions of learning.

When the industrial colleges were established, a large majority of them at the first gave facilities for the development of Natural History as the best means of developing Agriculture, as well as kindred pursuits. This College has, however, up to the present time, made no provisions for the departments of Natural History and Agriculture, at all commensurate with the importance of the subjects to be taught.

The census for 1880 reports over 64,000 farms in the State of Maine, of which over 25,000 comprise more than 100 acres of land each. These farms, in the next generation will pass into other hands, mostly to the sons of those now holding them, and this is the large class for which the agricultural course is especially designed. The facilities for instruction in Agriculture should be so complete, especially in those lines which this class of our citizens have no possible opportunities for studying or learning at home, that they may be more largely attracted to the College than at present.

It is not enough to employ teachers for the several departments, however competent and enthusiastic they may be. They must have the proper materials to work with, and it is most sincerely hoped that the means may be provided to equip this department as indicated above.

Respectfully submitted.

C. H. FERNALD.

DEPARTMENT OF AGRICULTURE.

President Fernald:

Though no changes of importance have been made in the course of theoretical instruction in this department, the year has not passed without our being able to record substantial progress.

The farm, under its present management, has offered greater facilities for illustration and practical instruction than ever before in the history of the College. Works of improvement have been going on in the way of drainage and reclaiming land, new and improved machinery has been introduced, careful and systematic breeding of animals has been pursued, experiments in fertilization of the soil and feeding of animals have been carried out, and last, but not least, the farm has been run on business principles.

In giving instruction to the students of Agriculture it has been made a point to utilize, so far as practicable, the work on the farm, thus bringing the farm into greater prominence as one of the educational features of the agricultural course, and making it subserve the purpose for which it was originally designed.

For the fuller development of the agricultural course, there is much to be urged upon the Trustees. In regard to what falls directly in this department, provisions should be made for a better reference library. During the last five years only one book bearing on scientific agriculture has been added to the College library, while the other books on this subject are from ten to twenty or more years old. In view of the great advance that has been made within that time, our library is of but little value to the agricultural student of

to-day. Additions should also be made to the apparatus of the department, both for class-room use and for investigation. For department library and apparatus I would recommend that $250 be asked. This sum, though not sufficient to put us in the condition we desire, would make a great improvement in the department.

While there are other pressing wants felt by the department, such as better accommodations in the way of lecture room, laboratory and museum, I am of the opinion that the Department of Natural History should first be placed in a position to give more efficient instruction, as it forms, to a large extent, the foundation of the agricultural course.

Respectfully submitted.

WALTER BALENTINE.

FARM SUPERINTENDENT'S REPORT.

To the Trustees of the Maine College of Agriculture and Mechanic Arts:

GENTLEMEN: I herewith present an account of farm transactions for the year ending November 30, 1884.

FARM STATEMENTS.

APPRAISAL OF PROPERTY BY TRUSTEES, NOVEMBER 30, 1883.

Live stock	$3,600 00	
Crops	2,956 00	
		$6,556 00

APPRAISAL OF PROPERTY BY TRUSTEES, NOVEMBER 30, 1884.

Live stock	$3,924 00	
Crops	2,789 00	
		$6,713 00
Cash receipts for the year ending November 30, 1884		$4,676 28
Cash expenditures for the year ending November 30, 1884		4,577 54
Liabilities November 30, 1883		3,478 62
Liabilities November 30, 1884		4,825 73

FARM CREDITS.

By excess of appraisal of November, 1884, above appraisal of November, 1883	$157 00
By excess of receipts above expenditures	98 74
By amount due for experiments	230 00

By machinery and implements purchased during the year, less 20 per cent	$116 76	
By clearing and ditching new land	298 40	
By new buildings and fence erected	173 33	
		$1,074 23

FARM DEBITS.

To excess of liabilities of November, 1884, above liabilities of November, 1883	$1,347 11

The work of this year, as in the previous two, has been largely in the direction of permanent improvements of land, herds and buildings.

The areas of crops and their yields were as follows:

Grass	82 acres	155 tons.
Mensury Barley	6¼ "	220 bushels.
Hulless Barley	3¼ "	115 "
Experimental Barley Field	5½ "	154 "
Barley on new land	6 "	148 "
Oats on new land	8 "	208 "
Beans	3¾ "	50 "
Potatoes	7 "	545 "

The grass fields were affected by the conditions that proved so unfavorable to the crop in most sections of the State, and here, as elsewhere, the yield upon all except upon newly seeded land was very much reduced.

The amount of hay harvested was precisely the same as last year, but was grown upon eighty-two instead of seventy acres, as then. The twenty-five acres that were stocked to grass last year, gave this season an average a little above two tons per acre.

The barley upon old land yielded satisfactorily, while upon the new raw land, both barley and oats suffered much from the great amount of rain during the spring months.

The beans were grown upon sod land, fertilized with superphosphate. The crop promised well, but was cut short by early frosts.

Potatoes were put upon land in fine mechanical condition; that was well manured the fall before, and fertilized with superphosphate at planting time. All conditions seemed favorable for a heavy crop, but the sharp drouth at the time when the tubers were setting, nearly ruined them.

As will be seen, the five and one-half acre experimental field yielded a small crop per acre; certain plats giving good and others very light crops. It was the intention to fertilize the whole of the field with superphosphate, or such purchased commercial fertilizer as seemed best adapted to its needs, using no cattle manure, and subject it to a course of crop rotation, with the hope of learning something of profitable crop growing without the aid of cattle manure. But for the purpose of giving wider range to the work, and testing the value of different fertilizing materials and their effects upon the soil when used alone upon the same areas for a series of years, the field was divided into nine plats, each one of which was fertilized differently from the others, some having all, and others single, or no elements of plant nutrition supplied. This work is reported among the experiments, No. 13, and is referred to here only in explanation of the change in its plan, and its small yield as a whole field.

I desire to call your attention to the account with the "brick-yard field." Two years ago the renovation of this twenty-acre tract was undertaken. Much of it was very wet and bushy, and the whole in an unproductive condition. It was plowed, ditched, thoroughly worked, fertilized with ashes and superphosphate, sown to oats and seeded to grass last season. A good catch of grass was secured, and forty bushels of oats per acre harvested. This season its crop of hay averaged a little more than two tons per acre. Total expenditures for fertilizers and labor upon the field and its crops for the two years, amount to $863.32. The crops during the same time, put at selling prices, are worth $904.70.

The two crops have paid for all outlays upon the field, and it is now in condition to furnish fair crops for a series of years.

The eighteen acres of new valley land which were grubbed and broken last fall, are now well drained, smooth, and in fine condition to be cropped with grain and seeded to grass next season, one hundred cords of cattle manure having been applied to them this fall.

The transfer of nearly forty acres of land from an unproductive, waste condition, of bush and swamp, to a state of active fertility sufficient to produce average crops of two tons of hay per acre, is a matter which I trust will not be over-looked.

ANIMALS.

The herd of cattle consists of forty-two animals, thirty-seven of which are thoroughbred. Of these, five are Shorthorns, nineteen are "Maine Jerseys," and thirteen are "Cattle Club" Jerseys. Among the Jerseys are some large producers, of good breeding, partaking largely of the blood of the great butter families of the world. Most of the cows are young, many not having matured yet. The young animals have mostly been bred upon the Farm and are vigorous, well-developed specimens of their respective breeds.

Sales of young bulls to farmers, for breeding, have been frequent, but the heifers have mostly been retained, as the Farm is yet under-stocked.

In the dairy, there has been an average of twenty-two and two-thirds cows and heifers. Several of these have been in process of fattening, or unfortunate in breeding, but they are counted in the dairy as long as they were upon the Farm.

The amount of milk produced was 110,005 pounds. Of this, 100,270 pounds were manufactured into butter, producing 5,609 pounds; thus requiring 17.87 pounds of milk for one pound of butter.

Butter sold for	$1,876 75	
Milk and cream sold for	203 90	
Value of calves at birth	150 00	
		$2,230 65

The provender fed to the cows was as follows:

14,509 pounds of corn meal, costing.....	$196 32
14,509 pounds of cotton-seed meal, costing.....	218 36
14,549 pounds of wheat bran, costing.....	163 67
	587 35
Cost of salt, etc., used in dairy and for stock	33 05
	$611 40

The amount taken from receipts leaves $1,619.25, to pay for seventy-four tons of hay used, or $21.88 per ton. This agrees very nearly with the results of last year, the amount then received for each ton being $20.95. I have placed the value of calves at $150. This by no means represents their true worth, as they are nearly all thoroughbred, but is such a sum as they could readily have been sold for to neighboring farmers. I leave out of account entirely the credit for skimmed milk and manure, and the charges for labor with herd and at dairy-room. Individuals perusing the report can make estimates of these values and costs suited to their own markets. I give only the produce of the foods employed and their values.

The flock of Shropshire sheep now numbers thirty good animals. Sales of bucks and ewes to go into different sections of the State for breeding have been made.

In the swine herd there are nine breeders and twelve shoats—all pure Chesters. From these, also, sales have been made, largely for breeding. Some eighty young animals have been sent out.

SEED TRIALS.

Of the many varieties of seed grains that have been tested during the past two or three years, there are two that have strong claims for recognition. "Mensury" barley is a new grain, having been grown but a few years. It is a large, stiff-strawed, six-rowed variety, having longer, heavier heads than any other barley I have ever seen. The kernel

is light-colored and very firm, weighing well. Its yield here last year was slightly above forty bushels per acre. This season six and one-fourth acres yielded two hundred and twenty bushels.

"Purple Hulless" barley has a dark-colored berry, without husk or hull, weighing sixty to sixty-two pounds per bushel. It is broad-leaved, vigorous, and stools freely when not sown thickly. In 1882, a few quarts were received from the Department of Agriculture, and sown, giving evidence of its worth. In 1883, in field culture, on heavy clay soil, its yield was forty-two bushels per acre. This year three and one-fourth acres gave one hundred and fifteen bushels.

We have not tested its feeding value in comparison with other grain, but shall do so this winter. These two barleys and the Hogan oats, described in previous reports, have been sent to farmers in many sections, and reports from them fully sustain the opinions I had formed of their values.

IMPLEMENTS.

Among the many implements sent here for trial, I desire to speak of the "Strowbridge Broadcast Seed Sower," from the Racine Seeder Company. We attached it to a single horse wagon, and used it for sowing barley, oats, Timothy and clover, with much satisfaction. It is decidedly the best power sower for these seeds we have ever used.

By aid of the hay tedder, we were enabled to cure heavy grass sufficiently during the dark weather of the past haying season. Where grass is heavy, I regard it as an indispensable machine.

NEEDS.

Regarding the welfare of the Farm and the management of its departments, I desire to call your attention to an important matter, viz: the necessity for the provision of additional barn room for cattle.

The present stock barn accommodates, or can, with slight change, forty animals, and has storage room for sufficient hay

to feed them throughout the year. The balance of the hay and the grain crops have been stored in the "White" and "Goddard" barns, some one hundred rods from the farm buildings, in different directions.

The condition of the Farm is now such that it has a capacity for feeding from sixty to seventy-five animals, according to their ages. This number will very soon be made up from the young animals now being bred.

With the present distant location of the other barns, it is impossible to keep animals at them with any degree of satisfaction.

The Goddard barn has a good strong frame, well preserved, with the exception of the sills. It is forty feet in width, and one hundred feet in length.

I will suggest its removal to the vicinity of the farm buildings, locating it so that it may very nearly corner with the stock barn on the south-east, and covering it, and fitting it up for the accommodation of all the cattle, excepting the cows: these, to the number of forty, being kept in the present stock barn.

This arrangement would transfer a building now rapidly going to ruin, to a valuable purpose, and furnish good quarters to the stock, without which we cannot carry out the leading plan of the Farm—stock-breeding—successfully.

I earnestly hope that, through your efforts, this necessity may be provided for.

Respectfully,

G. M. GOWELL.

FARM EXPERIMENTS,

CONDUCTED AT MAINE STATE COLLEGE, BY SUPERINTENDENT G. M. GOWELL AND PROFESSOR WALTER BALENTINE.

EXPERIMENT NO. 8.

Comparison of Feeding Values of Early and Late Cut Hay

This feeding test is a continuation of the same line of work reported in Experiment No. 4, College Report, 1883.

In Experiment No. 4 a field of grass consisting mostly of clean Timothy was divided, and the crop upon one-half of it was harvested when in full bloom, July 11, 1882, and the balance allowed to stand twenty days longer before cutting, when it had ripened, but not so much as to cause loss of seed in curing. These lots of hay were fed under precisely the same conditions, alternately, to two cows in milk, seventy-two days, with results which showed their comparative values for milk production to be as 100 for the early, to 93.34 for the late hay; while the amount of butter produced from each was almost exactly alike. Desiring to examine the subject further, last July another field of Timothy was divided, and one-half cut when in full bloom, July 13, and the other half twenty days later, when it had become quite ripe and considerably bleached.

Chemical analysis of the hay showed the following composition:

EARLY HAY.

Moisture	12.2	per cent.
Protein	6.25	"
Fat	2.80	"
Nitrogen-free extract	46.99	"
Crude Fibre	26.81	"
Ash	4 95	"

LATE HAY.

Moisture	12.40 per cent.
Protein	5.00 "
Fat	2.50 "
Nitrogen-free extract	49.25 "
Crude Fibre	26.83 "
Ash	4.02 "

During the past winter this hay was fed alternately, as before, to two cows, for eighty-four days. The daily ration of each cow was 20 pounds of early or late hay, 2 pounds of corn meal, 2 pounds of cotton seed meal, and 1½ pounds of wheat bran. The grain used was the same throughout, the only change being in the quality of hay. The early hay ration contained

	Total Nutrients.	Digestible Nutrients.
Protein	2.44 lbs.	1.73 lbs.
Fat	.96 "	.61 "
Carbohydrates	17.89 "	12.12 "

Nutritive ratio, 1 : 7.9.

LATE HAY RATION.

	Total Nutrients.	Digestible Nutrients.
Protein	2.19 lbs.	1.56 lbs.
Fat	.90 "	.59 "
Carbohydrates	18.31 "	12.29 "

Nutritive ratio, 1 : 8.8.

The thoroughbred Jersey cow, Pansy, had been in milk five months at the commencement of this feeding test. For twenty-eight days she received the early hay ration, and during the twenty-eight days following she had the late hay ration. The first seven days of each period was used in accustoming the animal to the changed feed, and in overcoming the influence of the previous feeding. The produce of the last twenty-one days of each period was taken as the result of that period's ration. Princess Alice, a pure cross-bred Jersey-Ayrshire cow, had been in milk seven months when her feeding commenced. With her the periods were transposed so that she received the late hay ration while Pansy received the

early, and early hay while Pansy had late, designing by this alternation to overcome the variation in milk yield which might arise from changes of temperature, and the gradual decline which accompanies the advance of the milking season in all animals. The following table shows the results of the feeding in each period:

PANSY.

Period of 21 days each.	Feed.	Pounds of Milk for Period.	Per cent of Cream.	Pounds of Milk required for 1 lb. of Butter.	Pounds of Butter for Period.	Pounds Gain or Loss in Weight of Cows.
First	Early hay ration	407.8	21.5	19.8	20.6	20 g.
Second	Late "	366.4	20	18.6	19.68	18 l.

PRINCESS ALICE.

First	Late hay ration	326.4	25	19.4	16.8	8 g.
Second	Early "	322.2	22	17.64	18.3	8 l.

It was found that 231 pounds of mixed grain and 840 pounds of early hay produced 731 pounds of milk and 38.9 pounds of butter, and the gain in weight of cows was 12 pounds.

The same quantity and quality of grain fed in connection with 840 pounds of late hay gave 702.8 pounds of milk, 36.5 pounds of butter, and the loss in weight of cows was 10 pounds.

There is such a constant variation in the weight of cows from day to day, even when receiving the same quantity of food, that it is difficult to determine just how much of their increase or decrease in weight is fictitious or actual. Not taking into consideration this phase of the question, the comparative values of these qualities of hay for milk production was as 100 for the early to 96.14 for the late, and for butter as 100 for the early to 93.8 for the late, or, the daily feeding ration of 20 pounds of early hay produced the same quantity of milk that was obtained from 20.8 pounds of late hay. These results are somewhat surprising as the early hay was harvested when in full bloom, at just that time when it has generally been supposed to contain the most nutriment and to have its greatest feeding value, while the late hay was left until it had attained a very unattractive appearance; yet it produced quantities of both milk and butter nearly equal to those furnished by the hay from grass in blossom. The length of time elapsing between the early and late

harvest was sufficient to seriously affect the feeding value of the late hay had it been severely injured by ripeness. Had the hay been fed alone, without the addition of grain, the results might have been different.

These tests upon the hay of two different seasons' growth and harvest correspond in results very closely to those obtained by Prof. Sanborn at the New Hampshire State College when feeding growing steers.

While it may be desirable that grass be harvested as soon as possible after blossoming, yet it is evident that the haying season can be considerably extended without serious injury to the feeding value of the crop.

Experiment No. 9.

Practical Comparison of the Feeding Values of Corn Meal, Cotton Seed Meal and Wheat Bran.

This test is substantially a repetition of Experiment No. 6, Report of 1883.

In Experiment No. 6 two cows in milk were employed eighty-four days upon a uniform hay ration, but with changes in provender which consisted of either corn meal, cotton seed meal, or wheat bran, in equal quantities. The results showed their relative values for milk production to be represented by 100 for cotton seed meal, 98.4 for corn meal, 86.7 for wheat bran; and as butter producers by 100 for cotton seed meal, 97.5 for corn meal, and 97.4 for wheat bran.

In the test just completed the hay used was a mixture principally of Timothy and Redtop, and very uniform in quality. The corn meal and cotton seed meal were good samples of these materials as usually found in the markets, and the wheat bran was what is known as coarse St. Louis bran.

Two thoroughbred Jersey cows, Tinnie in milk three months, and Betsy in milk six months, were employed. During the first twenty-eight days of the experiment Tinnie received 20 pounds of hay and 5 pounds of wheat bran per day.

This ration contained

	Total Nutrients.	Digestible Nutrients.
Protein	2.05 lbs.	1.49 lbs.
Fat	.67 "	.37 "
Carbohydrates	15.82 "	10.63 "

Nutritive ratio, 1 : 7.8.

During the second period she received 20 lbs. of hay and 5 lbs. of cotton seed meal daily, which ration furnished

	Total Nutrients.	Digestible Nutrients.
Protein	3.27 lbs.	2.28 lbs.
Fat	1.22 "	.82 "
Carbohydrates	14.84 "	8.98 "

Nutritive ratio, 1 : 4.8.

In the third period she had 20 lbs. of hay and 5 lbs. of corn meal daily. This ration had

	Total Nutrients.	Digestible Nutrients.
Protein	1.68 lbs.	1.13 lbs.
Fat	.73 "	.43 "
Carbohydrates	16.23 "	11.61 "

Nutritive ratio, 1 : 11.12.

With Betsy the same process of feeding was repeated with changed periods.

The produce of the last twenty-one days of each period was taken as the result of the food used during that time and is shown as follows.

TINNIE.

Periods of 21 days each.	Feed.	Pounds of Milk for Period.	Per cent of Cream.	Pounds of Milk required for 1 lb. of Butter.	Pounds of Butter for Period.	Pounds Gain or Loss in Weight of Cows.
First	Bran ration	316.	34.5	11.12	28.41	15 l.
Second	Cotton seed meal ration	332.1	25.	10.75	30.9	35 l.
Third	Corn meal ration	292.6	24.	14.5	20.18	18 l.

BETSY.

First	Cotton seed meal ration	320.	30.	17.7	18.08	3 g.
Second	Corn meal ration	242.5	28.	16.	15.34	21 l.
Third	Bran ration	265.6	28.	20.8	12.76	48 l.

It is noticeable that there was a constant loss in weight of the cows throughout, with the exception of one period when there was a slight gain. When they came into milk several months previously they were well coated with flesh which they gradually transferred into milk. That there was a general shrinkage in the weight of animal upon all rations is evident; just how much of it to attribute to each ration is not so plain. Leaving this feature out of consideration, we find that 840 lbs. of hay and 210 lbs. of cotton seed meal produced 652 lbs. of milk, 48.98 lbs. of butter; and the cows shrunk in weight 31 lbs.—That 840 lbs. of hay and 210 lbs. of corn meal produced 535.1 lbs. of milk, 35.52 lbs. of butter; and loss in weight of cows was 39 lbs.—That 840 lbs. of hay and 210 lbs. of bran produced 581.5 lbs. of milk, 41.17 lbs. of butter; and the cows lost in weight 63 lbs. The relative values of these foods as milk producers are represented as follows: Cotton seed meal, 100; corn meal, 82; bran 89.1. As butter producers: Cotton seed meal, 100; corn meal, 72.5; bran, 84.

The average prices paid for cattle foods in our market during the test—March, April and May, 1884—were, cotton seed meal, per 100 lbs., $1.50; corn meal, per 100 lbs., $1.34; bran, per 100 lbs., $1.15. Putting the hay at $10 per ton, its market value at the time, and the food costs of butter and milk from the different rations were as follows:

RATION.	Cost per 100 lbs. Milk.	Cost per lb. of Butter.
Hay and cotton seed meal.....	$1.12	15 cents.
Hay and corn meal.....	1.31	19.7 "
Hay and wheat bran.....	1.13	16 "

The quality of the butter from the corn meal ration was higher in color and somewhat firmer in texture than that from either of the other rations. No difference could be detected in the flavor of the different samples.

Experiment No. 10.

On Feeding Full Rations and Reduced Rations.

There has been adopted at the College Farm, for mature dairy animals of 800 to 1,000 pounds weight, a daily ration consisting of 20 lbs. of hay of mixed grasses, 3 lbs. of cotton seed meal, 3 lbs. corn meal and 2 lbs. of wheat bran. This ration has given good

satisfaction and proved profitable financially. While there has been a decided loss of flesh during the flush of the flow of milk, the animals have returned to their original weight later in the season.

Farmers visiting the farm to examine into the management of the herd of dairy cows have often asked if better results could not be obtained from a financial standpoint by feeding smaller rations. With a view of throwing some light on this question the following experiments were undertaken. In one experiment there was fed the full ration of 20 lbs. of hay, 3 lbs. of cotton seed meal, 3 lbs. corn meal, and 2 lbs. of wheat bran, against a ration in which the quantity of hay and bye fodders was reduced one-fourth, or a ration consisting of 15 lbs. of hay, $2\frac{1}{4}$ lbs. of cotton seed meal, $2\frac{1}{4}$ lbs. of corn meal and $1\frac{1}{2}$ lbs. of wheat bran.

From the analyses of the different fodders used, it appears that the full ration had the following composition:

Protein	3.03 lbs.
Fat	1.13 "
Carbohydrates	17.03 "

From the table of digestibility in Armsby's Manual of Cattle Feeding, it was calculated the ration contained of digestible

Protein	2.16 lbs.
Fat	.76 "
Carbohydrates	11.50 "

With a Nutritive ratio, 1 : 6.2.

In the three-fourths ration was contained of

Protein	2.28 lbs.
Fat	.84 "
Carbohydrates	12.75 "

Of digestible nutrients calculated as above, there were

Protein	1.62 lbs.
Fats	.60 "
Carbohydrates	8.64 "

Nutritive ratio, 1 : 6.2.

These rations were fed alternately to two cows through two periods of 28 days each. The first seven days of each period which were allowed for the animals to become accustomed to their feed and to overcome the effects of previous feeding have not been taken into

account. The cows selected for the experiment were Clover, three-fourths Jersey, one-fourth Devon, weighing 760 lbs., had been four months in milk; and Juno, a Maine registered Jersey, weighing 875 lbs., had been four months in milk.

For the first period Clover was fed the full ration, and Juno the three-fourths ration. For the second period Clover received the three-fourths ration, and Juno the full ration, with the results given in the following table:

CLOVER.

Periods of 21 days each.	Feed.	Pounds of Milk for Period.	Per cent of Cream.	Pounds of Milk required for 1 lb. Butter.	Pounds of Butter for Period.	Gain or Loss in Weight of Cows.
First	Full ration.	389.56	20.0	34.24	11.37	22
Second	Three-fourths ration.	330.44	16.0	20.66	16.00	—42

JUNO.

First	Three-fourths ration.	491.44	21.5	19.70	24.9	—27
Second	Full ration	534.06	21.0	19.75	27.04	25

An examination of the table shows that Clover produced 59.16 lbs. more of milk on the full ration than on the three-fourths ration, while on the full ration there was also a gain of 22 lbs. in the weight against a loss of 42 lbs. when on the three-fourths ration. For some reason which we are unable to explain, the yield of butter was less from the larger quantity of milk produced from the full ration than from the smaller quantity produced by the three-fourths ration.

Juno produced 42.62 lbs. more milk on the full ration and 2.1 lbs. more of butter, and made a gain of 25 lbs. in weight against a loss of 27 lbs. on the three-fourths ration.

The two cows together while on the full ration produced 923.62 pounds of milk against 821.88 pounds of milk on the three-fourths ration. Together the cows gained 47 lbs. in weight during the time they were fed on the full ration and lost 67 lbs. during the time they were fed on the three-fourths, making a difference of 101.74 lbs. of milk and 114 lbs. in live weight in favor of the full ration.

It is true that the live weight of animals taken with every precaution to avoid disturbing influences cannot be implicitly relied upon to determine actual gain or loss of flesh, but in this case it was noted that during the experiment the general appearance of the

animals while on the smaller ration was such as to indicate that they were losing flesh.

It appears then that the full ration was sufficient to keep up a good flow of milk and to cause a considerable gain in flesh, that a slight reduction of this ration might be advisable, but that any radical reduction would not be desirable.

Experiment No. 11.

On Feeding Full Rations and Reduced Rations.

A second experiment on feeding a reduced ration to dairy stock was undertaken in which the bye fodders of the full ration of the preceding experiment were reduced by one-half, so that the reduced ration consisted of 20 lbs. of hay of mixed grasses, 1½ lbs. of cotton seed meal, 1½ lbs. of corn meal and 1 lb. of wheat bran. This ration was fed in connection with the full ration of 20 lbs. of hay, 3 lbs. of cotton seed meal, 3 lbs. corn meal and 2 lbs. of wheat bran.

The chemical composition of the full ration was the same as that of the full ration of the preceding experiment, while that of the reduced ration was as follows:

Protein	2.16 lbs.
Fat	.83 "
Carbohydrates	14.70 "

Furnishing, according to the tables of digestibility, the following quantities of digestible nutrients:

Protein	1.49 lbs.
Fat	.53 "
Carbohydrates	9.92 "

With a Nutritive ratio of 1 : 7.5.

This ration and the full ration were fed alternately to two cows through two periods of 28 days each. The results of the first seven days in each period were rejected as liable to be influenced by previous feeding.

The animals selected for the trial were Maggie, a three-fourths Jersey and one-fourth Short-horn, and Tulip, a full-blooded Short-horn. Maggie had been in milk 12½ months and weighed at the

commencement of the trial 1015 lbs. Tulip had been in milk 9½ months and weighed 1085 lbs.

During the first period of the feeding trial Maggie received the full ration, and Tulip the full ration of hay and one-half ration of the bye fodder. During the second period this order was reversed, Tulip receiving the full ration and Maggie the reduced ration.

In the table below are given the results of the last twenty-one days of each period.

MAGGIE.

Periods of 21 days each.	Feed.	Pounds of Milk for Period.	Per cent of Cream.	Pounds of Milk required for 1 lb. Butter.	Pounds of Butter for Period.	Gain or Loss in Weight of Cows.
First	Full ration	271.25	25.0	20.9	12.98	35
Second	Reduced ration	191.63	31.0	17.12	11.18	—55

TULIP.

First	Reduced ration	350.50	17.5	24.1	14.54	12
Second	Full ration	341.75	19.0	25.0	13.67	18

It appears that Maggie produced 80 lbs. more milk on full ration and gained 35 lbs. in weight against a loss of 55 lbs. of weight on the reduced ration, while Tulip produced 8¾ lbs. more of milk on the reduced ration than on the full ration, while the gain in weight in each period was about the same.

The two cows together produced 613 lbs. of milk and made a gain of 53 lbs. while on the full ration, and 542 lbs. of milk and suffered a loss in weight of 43 lbs. while on the reduced ration, making a difference of 71 lbs. of milk and 96 lbs. in live weight in favor of the full ration in 21 days.

EXPERIMENT NO. 12.

Cream Tests.

An examination of different samples of cream has given results which are of value to creamery managers, and especially to their patrons. It has been the custom at creameries, as at cheese factories, with respect to milk, to consider all cream as of equal value.

Twenty samples of cream, from different cows in the College

Farm herd, obtained by deep setting in ice-water, having been subjected to precisely similar conditions in ripening and churning, gave results, varying widely, or extremes requiring from seventy-four to one hundred and thirty-six cubic inches of cream for the pound of butter. The following table shows the number of cubic inches of cream and pounds of milk required for a pound of butter, also the amount of milk and butter yielded by each cow upon the day of the test, and per cent of cream shown by the milk:

	Pounds of Milk per day.	Per cent of Cream.	Pounds Butter per day.	Pounds Milk for 1 lb. Butter.	Cubic inches of Cream for 1 lb. Butter.
Cow No. 1	37.43	25	2.125	17.61	124
" 2	30.25	21	1 625	19.23	113
" 3	20.06	21	1.5	13.4	79
" 4	16.93	21	.75	22.58	133
" 5	12	18	.75	16.	84
" 6	16.31	28	1.	16.30	128
" 7	20 56	27	1.5	13.7	104
" 8	14.93	18	1.	14.93	74
" 9	15.62	22	.875	17.74	108
" 10	17.56	30	1.375	12.77	108
" 11	11.43	37	.875	13.7	136
" 12	22.	21	1 25	17.6	104
" 13	13.87	27	1.	13.14	99
" 14	21.75	16	.75	29.	130
" 15	18.93	19	.875	21 64	116
" 16	30.75	32	2.312	13.29	120
" 17	23.5	20	1.437	16.35	92
" 18	14 75	25	1.	14.75	104
" 19	20.62	20	1.	20.62	116
" 20	32.68	18	1.562	17.65	89

These samples of cream prove to be but little more uniform in their butter capacity than was the milk from which they were produced.

Experiment No. 13.

The question;—Can profitable crops be grown continuously by use of commercial fertilizers, but without aid from animal manure, —presses itself forward for examination.

A field of five and one-half acres of uniform clay loam soil, underlaid by compact clay subsoil, offered opportunities for this experiment upon plots sufficiently large to show their products and costs, in actual field culture.

Previous to 1882, this field had been in grass many years, and was much reduced in fertility. It was used in 1882 and 1883 as a

fertilizer test field, with the plots running in an opposite direction to those of the present plan, and cropped with beans each year.

This season it was divided into nine plots, each one of which contained one-half acre or more, and received the kind and quantity of fertilizing material as indicated in the accompanying plan. The field was sown to barley, using two and one-half bushels of seed per acre, and seeded to Timothy and Red Clover.

Plot.	Fertilizer Per Acre.	Cost of Fertilizer per Acre.	Yield of Barley per Acre.
No. 1.	Bradley's X. L. Superphosphate, 500 lbs.	$10.00	37. bushels.
No. 2.	Unleached Ashes from mixed wood, 75 bushels.	$15.00	38.8 "
No. 3.	Rockland Lime, 12 casks.	$12.50	22.5 "
No. 4.	Raw Bone, 500 lbs.	$9 50	27.8 "
No. 5.	Dissolved Bone, 500 lbs.	$10.00	25.2 "
No. 6.	Nothing.	-	22.5 "
No. 7.	Muriate of Potash, 200 lbs.	$5.00	31.5 "
No. 8.	Sulphate of Ammonia, 200 lbs.	$9.00	18. "
No. 9.	Bradley's X. L. Superphosphate, 500 lbs.	$10.00	38.2 "

It is proposed to apply, each season, to each plot, the same kind of fertilizing material that it has received this year, and pursue a course of crop rotation in which Red Clover shall have a place. Other questions, aside from the leading one, are to be studied.

First: The comparison of raw bone with dissolved bone.

Second: Are the results of ashes upon this soil to be attributed to the lime, or potash which they contain? The products from the lime plot and the potash plot must settle this point.

Third: What will be the plant-producing capacity of the unmanured plot; after a series of years? or, will a clay soil become entirely exhausted of its fertility when subjected to thorough mechanical working, and crop rotation?

The experiment offers opportunities for study in other directions.

TREASURER'S REPORT.

To the Trustees of the State College of Agriculture and the Mechanic Arts:

GENTLEMEN: Your Treasurer herewith submits his annual report of the receipts and disbursements for the College the past year.

GENERAL ACCOUNT.

RECEIPTS.	
On the State appropriation	$6,500 00
Tuition of students	1,929 50
Interest, Augusta Savings Bank	302 83
" Hallowell Savings Bank	162 37
Balance on hand Dec. 18, 1883	477 78
ENDOWMENT.	
Interest on State bonds	7,098 00
" Bangor city bonds	180 00
" Hallowell Academy bonds	240 00
Total	$16,890 48
DISBURSEMENTS.	
GENERAL.	
W. P. Wingate, insurance	$40 00
J. S. Kimball, "	20 00
Loan of Sept. 6, 1883	1,500 00
Interest, on same	31 00
M. C. Fernald, apparatus	200 00
Interest on temporary loan	3 63
Expense, collecting coupons	46
M. C. Fernald, repairs and general expenses	58 94
W. P. Wingate, Trustee expenses	16 00
D. H. Thing, " "	42 35
L. S. Moore, " "	18 50
E. Parkhurst, " "	17 50
Z. A. Gilbert, " "	36 15
W. T. Haines, " "	17 90
G. M. Gowell, farm experimental appropriation	200 00
ENDOWMENT.	
G. M. Gowell, Farm Superintendent, salary	1,000 00
The Faculty, salaries	11,661 10
Total	$14,863 53
Balance on hand Dec. 4, 1884	2,026 95
	$16,890 48

GENERAL ACCOUNT—*Concluded.*

SUMMARY.	
Balance on hand last report	$477 78
Total receipts for the year	16,412 70
Total payments for the year	14,863 53
Balance on hand Dec. 4, 1884	2,026 95
RESOURCES.	
6 per cent State of Maine bonds	$118,300 00
6 per cent City of Bangor bonds	3,000 00
6 per cent Hallowell C. and S. Academy bonds	4,000 00
Deposit in Augusta Savings Bank	2,000 00
Deposit in Hallowell Savings Bank	1,000 00
Loaned to College Farm	1,000 00
Cash on hand	2,026 95
	$131,326 95

The items under the head of "Resources," except $26.95 in the item of cash on hand, make up the Endowment Fund, of which the interest only is available to pay the expenses of the College. Two thousand dollars of this fund are at present uninvested; therefore $26.95 is the only available cash on hand to meet expenses.

ORONO, MAINE, December 4, 1884.

J. FRED WEBSTER, *Treasurer.*

ORONO, December 12, 1884.

Having examined the foregoing account of the Treasurer, I find the same properly vouched and correctly cast.

By direction of the Trustees.

A. M. ROBINSON.

CATALOGUE

OF THE

Maine State College of Agriculture and Mechanic Arts.

ORONO, MAINE, 1884–85.

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Secretary of Maine Board of Agriculture, *ex-officio.*

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J. FRED WEBSTER, ORONO.

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Professor of Military Science and Tactics.

WALTER FLINT, B. M. E.,
Instructor in Vise Work and Forge Work.

GILBERT M. GOWELL,
Farm Superintendent.

JESSE G. JOHNSON,
Steward.

STUDENTS.

POST GRADUATE.

Fernald, Hattie Converse,	Orono.

SENIOR CLASS.

Chamberlain, George Walter,	W. Lebanon.
Dole, Ashar,	Brewer.
Dunton, Frank Orion Jessie Smith,	Orono.
Fernald, Henry T. L.,	Orono.
Goodridge, Elmer Orlando,	Milo.
Hanscom, George Loring,	Orono.
Hart, James Norris,	Willimantic.
Hull, Frank Eugene,	Warren.
Keyes, Austin Herbert,	Orland.
Manter, Frank Ellsworth,	Milo.
Merritt, Elmer Ellsworth,	Houlton.
Moulton, Joseph Perkins,	Sanford.
Paine, Leonard Gregory,	Bangor.
Pennell, Elmer Ellsworth,	Saccarappa.
Riggs, Louis Warner,	No. Georgetown.
Russell, Fremont Lincoln,	No. Fayette.

JUNIOR CLASS.

Allan, Bert John,	Pembroke.
Ayer, Josiah Murch,	Freedom.
Barker, George Greenleaf,	Rockland.
Black, George Fuller,	Palermo.
Blagden, John Decker,	Carmel.
French, Heywood Sanford,	Bangor.
Graves, Edwin Dwight,	Orono.
Jones, Ralph Kneeland, Jr.,	Bangor.
Leavitt, Hannah Ellis,	Norridgewock.
Lenfest, Elmer,	Bradley.
Lockwood, James Frederic,	Brewer.
Merriam, Charles Herbert,	Houlton.
Merriam, Willis Henry,	Houlton.
Page, Arthur Dean,	Orono.
Ray, Irving Burton,	Harrington.
Sears, Cassius Almon,	Fort Kent.
Twombly, Sydney Smith,	Enfield.

SOPHOMORE CLASS.

Brick, Francis Stephen,	Biddeford.
Burleigh, John Henry,	Vassalboro'.
Cilley, Luis Vernet Prince,	Rockland.
Clark, Bert Elmer,	West Tremont.
Clark, Irving Mason,	Bethel.
Colby, David Wilder,	Skowhegan.
Coffin, Edward Voranus,	Harrington.
Harris, William John,	Groton, Mass.
Hicks, Alice Albur,	Hampden.
Houghton, Austin Dinsmore,	Ft. Fairfield.
Kirkpatrick, Fred Hudson,	Bangor.
Lazell, James Draper,	Rockland.
Lincoln, Harry Foster,	Dennysville.
Mason, Charles Ayers,	Bethel.
McNally, Henry Allen,	Ft. Fairfield.
Merrill, Fenton,	Orono.
Ruth, Alfred Smith,	Linneus.
Saunders, Addison Roberts,	Hanover.
Stevens, Charles Hildreth,	Ft. Fairfield.
Trask, Frank Ellsworth,	Bethel.
Tucker, Frank Lincoln,	Norway.
Vose, Charles Thatcher,	Milltown, N. B.
Webb, Howard Scott,	Skowhegan.
Williams, John Sumner,	Guilford.
Young, Rodney Adelbert Buxton,	Greenbush.

FRESHMAN CLASS.

Bachelder, George Stetson,	Exeter Mills.
Blanchard, Charles DeWitt,	Oldtown.
Breed, Charles Wesley,	Bangor.
Buker, Albion Henry,	Rockland.
Burke, Frederick Lawrence,	Orono.
Butler, Harry,	Hampden.
Chamberlain, James Kent,	Bangor.
Drew, Fred Thayer,	Orono.
Eastman, Fred Langdon,	Ft. Fairfield.
Gould, Charles Benjamin,	Orono.
Hagerthy, George Ruthvin,	South Hancock.
Hancock, Willie Jerome,	Saco.
Howes, Claude Lorraine,	Boston, Mass.
Lord, Edwin Byron,	Stillwater.
Lord, Thomas George,	Skowhegan.
Leavitt, Cora Annie,	Norridgewock.
Leavitt, Nellie Louise,	Norridgewock.
Miller, Seymore Farrington,	Burlington.
Page, Frank Jackson,	Orono.
Perkins, Henry Fred,	Oakland.
Rogers, Seymour Everett,	Stetson.
Ring, Nathan Ayer,	Orono.
True, Joseph Sumner,	New Gloucester.
Wentworth, Charles Williams,	Windham Centre.

SPECIAL COURSE.

Benjamin, Alice,	Oakland.
Dority, Jennie Lillian,	Wells.
Gee, Archie,	Oakland.
Libby, Willard Alton,	South Auburn.
Libby, Charles Leon,	South Auburn.
Lull, George Frederic,	West Great Works.
Moor, Dudley Watson, Jr.,	Waterville.
Sherburn, William Percival,	Dover.

SUMMARY.

Post Graduate,	1	Sophomores,	25
Seniors,	16	Freshmen,	24
Juniors,	17	Special,	8
		Total,	91

PRIZES FOR 1884.

Coburn Prize, for best Junior Essay, awarded to F. E. Manter of Milo.

Coburn Prize, for best Sophomore Declamation, awarded to H. S. French of Bangor.

MILITARY DEPARTMENT.

COBURN CADETS.

Commandant—2d Lieut. EDGAR W. HOWE, 17th U. S. Infantry.

Captain—H. L. FERNALD.

Lieutenants—L. G. PAINE, L. W. RIGGS, E. E. MERRITT, E. O. GOODRIDGE and J. P. MOULTON.

First Sergeant—C. A. SEARS.

Sergeants—I. B. RAY, R. K. JONES, A. D. PAGE, G. F. BLACK and B. J. ALLAN.

Corporals—F. E. TRASK, E. V. COFFIN, B. E. CLARK, L. V. P. CILLEY, C. T. VOSE and A. R. SAUNDERS.

DESIGN OF THE INSTITUTION.

It is the design of the Maine State College of Agriculture and the Mechanic Arts to give the young men of the State, who may desire it, at a moderate cost, the advantages of a thorough, liberal and practical education. It proposes to do this by means of the most approved methods of instruction, by giving to every young man who pursues a course of study an opportunity practically to apply the lessons he learns in the class-room, and by furnishing him facilities for defraying a part of his expenses by his own labor.

By the act of Congress granting public lands for the endowment and maintenance of such colleges, it is provided that the leading object of such an institution 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."

While the courses of study fully meet this requisition, and are especially adapted to prepare the student for agricultural and mechanical pursuits, it is designed that they shall be also sufficiently comprehensive, and of such a character, as to secure to the student the discipline of mind and practical experience necessary for entering upon other callings or professions.

CONDITIONS OF ADMISSION.

Candidates for admission to the Freshman Class must be not less than fifteen years of age, and must pass a satisfactory examination in Arithmetic, Geography, English Grammar, (especial attention should be given to Orthography, Punctuation and Capitals,) History of the United States, Algebra as far as Quadratic Equations, and five books in Geometry.

Although the knowledge of Latin is not required as a condition of admission, yet the study of that language is earnestly recommended to all who intend to enter this Institution.

Candidates for advanced standing must sustain a satisfactory examination in the preparatory branches, and in all the studies previously pursued by the class they propose to enter.

Satisfactory testimonials of good moral character and industrious habits will be rigidly exacted. They should be presented on the day of examination.

The day after Commencement, which is the last Wednesday of June, and the day of the beginning of the first term, are the appointed times for the examination of candidates at the College.

Arrangements have been made by which applicants accommodated by the plan may pass examination for admission without incurring the expense of coming to Orono. The gentlemen named below have been appointed examiners for the sections of the State in which they severally reside:

C. P. Allen, B. S.,	Presque Isle.
H. M. Estabrooke, B. S.,	Gorham.
E. S. Danforth, B. S., S. W. Gould, B. S.,	Skowhegan.
Principal F. E. Parlin,	Greeley Institute, Cumberland.
O. C. Farrington, B. S.,	Cape Elizabeth.
S. K. Hitchings, B. S.,	Biddeford.
Henry K. White, A. M.,	Newcastle.
Wm. W. Allen, A. B.,	Dexter.
Charles A. Black, A. M.,	East Machias.
Rev. W. R. Cross,	Milltown, N. B.
Henry W. Johnson, A. B.,	Bethel.
I. C. Phillips, A. B.,	Wilton.

Examiners will indicate by postal card to parties applying, the time and special place of examination. Arrangements have also been made with the Seminary at Bucksport, by which students from that institution may be admitted to the College on certificate of qualification by the Principal, Rev. A. F. Chase.

All candidates, wherever they may arrange to be examined, should make early application to the President of the College. Applications will be recorded and regarded in the order of their reception.

COURSES OF INSTRUCTION.

Five full courses are provided, viz: A course in Agriculture, in Civil Engineering, in Mechanical Engineering, in Chemistry, and in Science and Literature.

The studies of the several courses are essentially common for the first year, and are valuable not only in themselves, but also as furnishing a necessary basis for the more technical studies and the practical instruction of the succeeding years.

Physical Geography, taught in the first term of the Freshman year, serves as a suitable introduction to Geology which is taken up later in each of the courses. Physiology serves as an introduction to Comparative Anatomy, and Algebra, Geometry and Trigonometry are needful preliminaries to the higher mathematics and the practical applications required in Surveying, Engineering proper, and Astronomy. Botany, Chemistry and Physics are highly important branches, common to all the assigned courses, and hence taken by all the students who are candidates for degrees.

Rhetoric, French and English Literature form the early part of the line of studies which later includes German, Logic, History of Civilization, U. S. Constitution, Political Economy, and Mental and Moral Science, branches, several of which relate not more to literary culture than to social and civil relations, and to the proper preparation for the rights and duties of citizenship.

Composition and Declamation are regular exercises in all the courses throughout the four years. For the characteristic features of each course reference is made to the explanatory statements following the several schemes of study.

SPECIAL COURSES.

Students may be received for less time than that required for a full course, and they may select from the studies of any class such branches as they are qualified to pursue successfully. Students in Special Courses are not entitled to degrees, but may receive certificates of proficiency.

DEGREES.

The full course in Civil Engineering entitles to the Degree of Bachelor of Civil Engineering; the full course in Mechanical Engineering, to the Degree of Bachelor of Mechanical Engineering; the full course in Agriculture, Chemistry, or Science and Literature, to the Degree of Bachelor of Science.

Three years after graduation, on presentation of a satisfactory thesis with the necessary drawing, and proof of professional work or study, the Bachelors of Civil Engineering may receive the Degree of Civil Engineer; the Bachelors of Mechanical Engineering, the Degree of Mechanical Engineer; the Bachelors of Science, the Degree of Master of Science.

COURSE IN AGRICULTURE.

FIRST YEAR.

First Term.	*Second Term.*
Physical Geography.	Rhetoric and Botany.
Physiology.	Algebra and Geometry.
Algebra.	French.
P. M. Labor on Farm.	P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.	*Second Term.*
Botany.	Descriptive Astronomy and Surveying or (L) History of England.
General Chemistry.	Physics.
French.	Qualitative Chemistry.
Trigonometry.	P. M. Mechanical Drawing.
P. M. Free-hand Drawing.	Field Work and Forge Work.

THIRD YEAR.

First Term.	*Second Term.*
Agricultural Engineering, including Farm Implements, Farm Drainage and Mechanical Cultivation of the Soil, Physics.	Agricultural Chemistry, Landscape Gardening, Horticulture and Arboriculture.
Agricultural Chemistry.	Zoology and Entomology.
English and American Literature.	German.
German.	P. M. Laboratory Work and Experimental Farming or *Analysis of English Authors.
P. M. Laboratory Work or *Analysis of English Authors and Translations from the French.	

FOURTH YEAR.

First Term.	*Second Term.*
Stock Breeding and Veterinary Science.	Cultivation of Cereals, Care and Feeding of Animals, Dairy Farming and Sheep Husbandry.
Comparative Anatomy.	Mineralogy and Geology.
History of Civilization.	U. S. Constitution and Political Economy.
Logic.	Mental and Moral Science.
P. M. Experimental Farming and Agricultural Botany or *Translations from German.	

* To be taken in Course in Science and Literature in place of study preceding.

EXPLANATORY STATEMENTS.

This course is designed to fit young men to follow Agriculture as a profession, with success, as well as to prepare them for the intelligent performance of the duties of citizenship.

To this end, the curriculum of studies is largely scientific and technical, not omitting, however, those branches that have been referred to as pertaining to social and civil relations.

The instruction in Agriculture is given largely by lectures, and embraces subjects of great practical importance to the farmer, which are briefly explained under the following heads:

Agricultural Engineering. Combined with recitations in mechanics from a text-book, lectures are given on the principles of construction and use of farm implements, illustrated by charts to the extent possible, on the construction of roads, culverts and masonry, and on soil physics, or the relations of the soil to heat and moisture, the mechanical conditions of the soil best adapted to plant growth, and the objects to be gained by cultivation.

Agricultural Chemistry.—Under this head are considered the various methods of retaining and increasing the fertility of the soil, the sources, composition and methods of valuation of commercial and farm manures, together with the principles governing their treatment and application, the composition of cattle foods, their changes and uses in the animal system, and the value and economic use of the various kinds of fodders.

Landscape Gardening.—The object of this study is to furnish correct ideas of the manner of laying out and beautifying grounds. This subject is followed by lectures on Horticulture and Arboriculture.

Cultivation of Cereals.—Lectures are given upon the best methods of cultivating the principal farm crops.

Dairy Farming.—This embraces the chemical and physical properties of milk, and the principles and practical operations that underlie its production and manufacture into butter and cheese.

Sheep Husbandry.—The characteristics and comparative merits of our different breeds of sheep are discussed, also their adaptability to different conditions and uses.

Botany. — Following recitations and practical work in Botany, lectures are given upon fungi injurious to the farmer.

Chemistry.—One term is devoted to General Chemistry, two terms to Agricultural Chemistry, one-half term to Organic Chemistry, and

the afternoons of several terms are devoted to laboratory practice, including analyses of farm products.

Zoölogy and Entomology.—In Zoölogy, the larger groups of the animal kingdom are taken up and described in lectures which are illustrated by means of diagrams, models, or the objects themselves, and the students are required to make critical studies of typical animals of each group. Such laboratory practice is regarded an indispensable training for the more advanced study of the higher animals, and also forms the basis of the study of Historical Geology.

The studies in Entomology are conducted in a similar manner. After a general review of the orders has been given, illustrated by such common insects as are familiar to all, the beneficial and injurious are taken up more in detail, their round of life described, together with the injuries they do to the products of the farmer, the gardener and the fruit-raiser, as well as to our forests and building materials, and the best known means of keeping them in check. For the purpose of making the instruction as practical and impressive as may be, many of the injurious insects are carried through their transformations in the class-room, where each student can note the various changes from day to day, and learn to recognize these insect enemies in any stage of their existence; and each member of the class is required to devote some time in field-collecting, and in observing the habits and work of insects in nature.

The subject of Bee-Keeping is taken up quite at length; the different kinds of bees in a swarm, their habits, anatomy, and the mode of collecting the different products are all described and illustrated by means of elaborate models, while artificial swarming, the mode of hybridizing a swarm, and the advantages of the same, with the most approved methods now in use for the care and management of bees, are also fully described.

Comparative Anatomy.—Under Comparative Anatomy are taken up the anatomy and physiology of our domestic animals, together with a brief outline of our wild animals, so far as time permits. This is followed by a course of illustrated lectures on Stock Breeding and Veterinary Science.

Mineralogy and Geology.—A preliminary course of lectures is given on Mineralogy, followed by laboratory practice in the determination of minerals, and in Lithology, special attention being called to gypsum, limestone, and such other minerals as are of direct importance to the students of Agriculture.

The instruction in Geology is by means of illustrated lectures and excursions, critical attention being given to the origin and formation of soils.

Law.—A course of lectures is given to the Senior Class on International and Rural Law.

Throughout the course, the endeavor is made to inculcate established principles in agricultural science, and to illustrate and enforce them to the full extent admitted by the appliances of the laboratory and the farm. So far as possible, students are associated with whatever experimental work is carried on, that they may be better fitted to continue such work in after life.

Those who complete this course receive instruction also in Mathematics, French, German, English Literature, Logic, United States Constitution, Political Economy, and Mental and Moral Philosophy, and on presenting satisfactory theses upon some agricultural topic, are entitled to the degree of Bachelor of Science.

The Course in Science and Literature includes French and German, the general, mathematical, and most of the scientific studies of the agricultural course. Instead of certain branches quite purely technical in the latter course, History, and English and American Literature are substituted.

In the special laws of the State, passed in 1872, it is provided that young ladies "who possess suitable qualifications for admission to the several classes may be admitted as students in the college."

In arranging the course in Science and Literature, reference has been had to this enactment. From this course, however, young men who desire it are not excluded, as, on the other hand, young ladies are not excluded from any of the other courses.

COURSE IN CIVIL ENGINEERING.

FIRST YEAR.

First Term.	*Second Term.*
Algebra.	Algebra and Geometry.
Physical Geography.	Rhetoric and Botany.
Physiology.	French.
P. M. Labor on Farm.	P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.	*Second Term.*
Trigonometry.	Descriptive Geometry.
General Chemistry.	Descriptive Astronomy and Surveying.
French.	Physics.
P. M. Free-hand Drawing.	P. M. Mechanical Drawing and Field Work.
Mechanical Drawing.	

THIRD YEAR.

First Term.	*Second Term.*
Henck's Field Book.	Mechanics.
Analytical Geometry.	Calculus.
Physics.	German.
German.	P. M. Isometric and Cabinet Projection and Perspective.
P. M. Field Work and Drawing.	

FOURTH YEAR.

First Term.	*Second Term.*
Civil Engineering.	Civil Engineering, Designs and Specifications.
Stereotomy.	Mineralogy and Geology.
Practical Astronomy.	Zoology.
Logic.	U. S. Constitution and Political Economy.
P. M. Topography and R. R. Work.	P. M. Analytical Chemistry, Designing and Thesis Work.

EXPLANATORY STATEMENTS.

The object of this course is to give the student a thorough knowledge of Higher Mathematics, Mechanics, Astronomy and Drawing, and, at the same time, a thorough drill in the use and care of the ordinary engineering instruments and in the application of mathematical principles and rules, so that the graduates can at once be made useful in engineering work and be fitted, after a limited amount of experience in the field, to fill positions of importance and trust. The course is also arranged so as to afford, so far as can be, the education required to prepare the graduate for a responsible position among *men*, as well as among engineers.

In this course the work is identical with that of the other courses during the first year. During the fall term of the Sophomore year, students in this course work two hours each afternoon, in the drawing room, on free-hand and mechanical drawing. In the last term of this year, the subject of land surveying is taken up. The first eight weeks are devoted to tinting, shading, etc., in water colors, while the remaining twelve weeks are given to practical surveying. Besides an hour's recitation each day, the class is engaged two hours, either in the field or drawing room, becoming familiar with the use and care of instruments, putting into practice the problems found in the text-book, and making actual surveys.

In the first term of the Junior year, Henck's Field Book is used as a text-book, from which the student obtains methods of running railroad curves, putting in switches and turnouts, setting slope-stakes, and the calculation of earthwork. This is supplemented with examples worked by the student, and lectures on levelling, preliminary and final surveys and on the resistance to trains offered by grades and curves, together with the theory and construction of country roads, streets and pavements. These methods of the text-book, so far as possible, are applied in the field and the drawing room, each student in the course being required to work two hours, either in the field or drawing room, every day.

The subject of Applied Mechanics is taken up the last term of this year, in which the students receive a thorough training in the principles underlying construction, illustrated as far as possible by practical examples, in which these principles are applied. During this term, each student in the class works two hours each day in

the drawing room, where isometric, cabinet and perspective projection are taught by means of lectures and problems drawn by the students.

During the Senior year, Rankine's Civil Engineering is the text-book employed, though other works are used for reference. Besides these, much material is given in the form of lectures and notes on the blackboard.

In the first term of this year the principles of the strength of material are taken up, supplemented by information as to durability, preservation and fitness for special purposes. The principles of hydraulics, as applied in engineering, the theories of ties, struts, beams, foundations, retaining walls and arches, are fully treated.

Stone cutting is taken up this term, by lectures and practical problems, each student being required to make a complete set of working drawings of the most common forms of masonry arches.

Six weeks of this term are devoted to sanitary engineering; especial attention being given to ventilation, heating, purity of water supply and the proper drainage of houses and towns.

Also the subjects of topographical and railroad surveying are taken up this term and illustrated by a topographical survey of a portion of the college farm, and by the preliminary and final surveys for a railroad extending from the College grounds to some point on the E. & N. A. railroad, together with the drawings, calculations of earthwork and estimate of cost of building and equipping.

The first part of the last term of this year is devoted to the theory of roof and bridge trusses, lectures on the locomotive engine and a short course in Analytical Chemistry, while the greater part is given to the application of the principles already learned, to the designing and calculation of various kinds of engineering structures, and to making out estimates and specifications.

This, together with the preparation of a satisfactory thesis, completes the work in the course in Civil Engineering.

MINERALOGY AND GEOLOGY.

Mineralogy is taught by an introductory course of lectures, followed by laboratory practice in the determination of minerals and rocks, especial attention being given to their value for building purposes. This is immediately followed by a course of lectures in Geology, together with excursions for the purpose of studying the

rocks *in situ*, and also superficial deposits. Critical examinations are made in various railroad cuts, of the hardness, slaty structure, jointed structure, etc., as bearing upon the cost of excavation.

ASTRONOMY.

In the first part of the spring term, Descriptive Astronomy is taken by the students of the Sophomore Class, and Practical Astronomy during the larger part of the first term, Senior year.

The course in Astronomy is designed to enable students to determine with accuracy geographical positions. The principal instruments employed are chronometer, sextant, transit, and for work of precision, the Repsold vertical circle, an instrument made in Hamburg, Germany, in 1874, for this Institution. Practical instruction is given in the use of these instruments, and in the most approved methods of reducing observations for the determination of latitude and longitude.

DEGREES.

Students in this department secure the degree of Bachelor of Civil Engineering on graduating, with the full degree of Civil Engineer three years after, on presentation of a satisfactory thesis, with proof of professional work or study.

COURSE IN MECHANICAL ENGINEERING.

FIRST YEAR.

First Term.	*Second Term.*
Algebra.	Algebra and Geometry.
Physiology.	Rhetoric and Botany.
Physical Geography.	French.
P. M. Labor on Farm.	P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.	*Second Term.*
Trigonometry.	Descriptive Geometry.
French.	Descriptive Astronomy.
General Chemistry.	Physics.
P. M. Free-Hand Drawing and Carpentry.	P. M. Mechanical Drawing and Forge Work.

THIRD YEAR.

First Term.	*Second Term.*
Kinematics.	Mechanics and Machine Design.
Analytical Geometry.	Calculus.
Vise Work, Physics.	Link and Valve Motions.
P. M. Machine Drawing.	P. M. Isometric and Cabinet Projection and Machine Drawing.

FOURTH YEAR.

First Term.	*Second Term.*
Steam Engineering.	Steam Engineering.
Practical Astronomy.	Hydraulic Engineering.
Logic.	U. S. Constitution and Political Economy.
P. M. Machine Drawing and Designing.	P. M. Machine Drawing, Designing and Thesis Work.

EXPLANATORY STATEMENTS.

It is the design of this course to give such a knowledge of Mathematics, Mechanics, Principles of Mechanism, Drawing and Manual Art as shall enable the student successfully to enter practical life as an engineer, with the same thorough education in subjects required to fit him for the general duties of life as is afforded by the other courses.

The first two years' work is identical with that of the students in Civil Engineering, except that carpentry and forge work are taken the second year in place of part of the drawing. In the Junior year, the first term is devoted to the geometry of machinery, showing the students how different motions may be obtained independently of the power required. Special attention is here given to the subject of gearing, and a full set of problems worked out, illustrating cases commonly occurring in practice. In the second term of this year the subject of the geometry of machinery is continued by lectures on other methods of transmitting motion, as by belts, cams, couplings, and links. Considerable time is given to the study and designing of the various valve and link motions used on the steam engine. During the same term instruction is given in mechanics and the laws of the strength of materials, the student being required to design machine details in accordance with those laws.

The first part of the first term, Senior year, is employed in studying the laws of the expansion of steam, and their influence upon the construction of steam engines and boilers, the subject being illustrated by experiments on the shop engine, with the aid of an indicator. During the remainder of the term, the students are engaged in designing engines and other machines, and in making detail drawings of the same, such as would be required to work from in the shop.

During the last term, Senior year, the study of steam engineering is continued in its application to compound engines, and the subject of hydraulic engineering is taken up briefly, by lectures on the storage of water for power and the theory and construction of modern water wheels.

TEXT-BOOKS AND BOOKS OF REFERENCE.

Rankine,	Machinery and Mill Work.	Goodeve,	Steam Engine.
Weisbach,	Mechanics of Engineering.	Marks,	Proportions of Steam Engine.
MacCord,	Kinematics.	Trowbridge,	Steam Boilers.
MacCord,	Slide Valve.	Zenner,	Valve and Link Motions.
Van Buren,	Strength of Machinery.	Auchincloss,	" " "
Knight,	Mechanical Dictionary.	Clark,	Manual.

SHOP WORK.

There are now three shops equipped according to the Russian system, and work in these is required of all students in this course. The first term of the Sophomore year, two hours of each day are devoted to work in carpentry, special attention being given to accuracy of workmanship.

During the second term of the same year, the student receives instruction in forge work, including the welding and tempering of steel. A course in vise work during the first term of the Junior year, gives the student practice in the various methods of shaping and fitting metals by the use of the chisel, hack-saw and file. During their second term, the Junior students in this course take turns in running the shop engine, and are taught the rules of safety and economy in this branch of engineering.

DRAWING.

The work in drawing commences with a course in Free-Hand and Elementary Mechanical Drawing, extending through the Sophomore year.

The first term of the Junior year, the student spends the time allotted to drawing in working out practical problems on the construction of gear teeth, cams, etc., and in elementary practice in line-shading and tinting.

The second term of this year is devoted to isometric projection, and the making of finished drawings in ink and in water colors. In the first term of the Senior year, the student prepares an original design of some machine, makes working drawings of its details on tracing cloth, and finally prepares copies by the blue print process. The afternoon work of the spring term consists of making calculations for designs of engines and boilers, the construction of the necessary working drawings, and making thesis drawings.

The remarks under Course in Civil Engineering, with regard to Astronomy, apply also to this course, and to them reference is made.

Theses are required of all students as a condition of graduation, and must be on some subject directly connected with Mechanical Engineering.

Students in this course receive the degree of Bachelor of Mechanical Engineering upon graduation, with full degree of Machanical Engineer three years afterwards upon presentation of a satisfactory thesis and proof of professional work or study.

COURSE IN CHEMISTRY.

FIRST YAER.

First Term.	*Second Term.*
Physical Geography.	Rhetoric and Botany.
Physiology.	Algebra and Geometry.
Algebra.	French.
P. M. Labor on Farm.	P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.	*Second Term.*
General Chemistry.	Qualitative Chemistry.
Botany.	Physics.
French.	Descrip. Astronomy and Surveying.
Trigonometry.	P. M. Mechanical Drawing and Field Work.
P. M. Free-Hand Drawing.	

THIRD YEAR.

First Term.	*Second Term.*
Chemistry.	Chemistry.
Physics.	Zoology and Entomology.
German.	German.
English and American Literature.	P. M. Laboratory Work.
P. M. Laboratory Work.	

FOURTH YEAR.

First Term.	*Second Term.*
Chemistry.	Chemistry.
Comparative Anatomy.	Mineralogy and Geology.
History of Civilization.	U. S. Constitution and Political Economy.
Logic.	
P. M. Laboratory Work.	P. M. Laboratory Work.

EXPLANATORY STATEMENTS.

This course aims to supply a want felt by students who wish to enter certain industries in which a somewhat extensive knowledge of Chemistry is important. The first two years are mainly like those of the other courses; Qualitative Analysis being, however, obligatory for these students in the second term of the Sophomore year.

During the Junior year, daily recitations are held in advanced Inorganic Chemistry. In the Senior year, advanced Organic Chemistry is taken up. The afternoons are devoted to Quantitative Chemical Analysis by the Junior and Senior students of the course. The work consists of the most useful gravimetric and volumetric methods, beginning with the simple estimations, which are followed by more complex analyses of alloys, minerals, fertilizers, farm products, &c. A short course in the assay of gold and silver is also given.

The class-room text-books used by this department are: Roscoe's Lessons in Elementary Chemistry and Naquet's Principes de Chimie. In the Laboratory are used: Craft's Qualitative Chemical Analysis, Fresenius' Quantitative Chemical Analysis, Caldwell's Agricultural Chemical Analysis, Wohler's Mineral Analysis, J. A. Wanklyn's Milk Analysis, Flint's Examination of Urine, and Rickett's Notes on Assaying.

Some valuable books of reference are found in the library.

Students taking qualitative analysis must furnish a deposit of at least five dollars when they begin; those taking quantitative analysis are required to deposit at least seven dollars. Students taking the Course in Chemistry or an extended course in quantitative analysis are expected to provide themselves with a small platinum crucible.

The students, after passing all the required examinations and presenting satisfactory theses upon some chemical subject, graduate with the degree of Bachelor of Science.

Post graduate and special students can make arrangements with the Professor of Chemistry for an advanced or special course of laboratory work and recitations.

TABLE OF HOURS—First Term.

Local Time.	Seniors.	Juniors.	Sophomores.	Freshmen.
8.00 A. M	Chapel Services.	Chapel Services.	Chapel Services.	Chapel Services.
8.15 A. M.	History of Civilization, I, IV, V. Civil Engineering, II.	German, I, II, IV, V. Kinematics, III.	General Chemistry.	Physical Geography.
9.10 A. M.	Stock Breeding and Veterinary Science I. Advanced Chemistry, IV. Practical Astronomy, II, III, V. (F. of T.)	Analytical Geometry, II, III. English and American Literature, I, IV, V.	Botany, I, IV, V.	Algebra.
10 05 A. M.	Stereotomy, II. (F. of T.) Sanitary Engineering, II. (L. of T.) Comparative Anatomy, I, IV, V. Steam Engineering, III.	Farm Drainage and Mechanics, I. Physics, I, II, III, IV, V. (L. of T.) Vise work, III. (F. of T.)	French.	
11.00 A.M	Logic, I, II, III, IV, V.	Agricultural Chemistry, I. (Optional for V.) Vise work, III. Advanced Chemistry, IV. (Optional for V.) Field Book, Roads and Railroads, II.	Trigonometry.	Physiology.
P. M.	Laboratory and Farm Practice, I. Designing and Drawing, III. Topography and R. R. work, II. Laboratory work, IV. Translations from German, V. Military Drill	Laboratory work, I, IV. Field work and Drawing, II. Machine Drawing, III. Translations from French and English Literature, V. Military Drill.	Free-hand Drawing. Mechanical Drawing, II. Carpentry, III. Military Drill.	Labor on Farm. Military Drill.

Note.—Roman numerals refer to courses as follows: I, Agriculture; II, Civil Eng; III, Mech Eng.; IV, Chemistry; V, Science and Lit.

TABLE OF HOURS—SECOND TERM.

LOCAL TIME.	SENIORS.	JUNIORS.	SOPHOMORES.	FRESHMEN.
8.00 A. M.	Chapel Services.	Chapel Services.	Chapel Services.	Chapel Services.
8.15 A. M.	Mineralogy and Geology, I, II, IV, V.	Calculus, II, III. Agricultural Chemistry, I, (Optional for V.) Advanced Chemistry, IV. (Optional for V.)	Descriptive Astronomy. (F of T.) Surveying, (L. of T.) I, II, IV, V. History of England, [L.] (L. of T.)	Rhetoric. (F of T.)
9.10 A. M.	Mental and Moral Science, I, V. Civil Engineering, II. (F. of T.) Lecture on Designs, Contracts and Specifications, II. (L. of T.) Laboratory work, IV.	German, I, II, IV, V. Mechanics and Machine Design, III.	Qualitative Analysis, I, IV, V.	Book-keeping. (F. of T.) Botany. (L. of T)
10.05 A.M.	Cultivation of Cereals, Care and Feeding of Animals, etc., I. Laboratory work, IV. Zoology, II. Steam Engineering & Hydraulics, III.	Applied Mechanics, II. (F of T.) Graphic Statics, II. (L of T.) Zoology and Entomology, I, IV, V.	Qualitative Analysis, I, IV, V. Descriptive Geometry, II, III.	French.
11.00 A.M.	U. S. Constitution and Political Economy, I, II, III, IV, V.	Zoology and Entomology, I, IV, V. Link and Valve Motions, III.	Physics	Algebra and Geometry.
P. M.	Machine Drawing, Designing and Thesis work, III. Laboratory work, IV. II, (F. of T.) Chemistry, IV. Designing and Thesis work, II. Translations from German, V. Military Drill.	Laboratory work and Garden Practice, I. Isometric and Cabinet Projection, and Perspective, II, III. Laboratory work, IV. Translations from French, V. Military Drill.	Mechanical Drawing, Forge work, III. Field work, I, II, IV, V. (L. of T.) Military Drill.	Labor. Military Drill.

LABOR.

It is a characteristic feature of the College, that it makes provision for labor, thus combining practice with theory, manual labor with scientific culture.

The maximum time of required labor is three hours a day for five days in the week.

In the lowest class the students are required to work on the farm, and they receive compensation for their labor according to their industry, faithfulness and efficiency, the educational character of their labor being also taken into account. The maximum price paid is ten cents an hour. In arranging for compensated labor, it should be understood that the College does not engage to furnish opportunities for such labor continuously, but rather as the farm and other interests require.

The students of the three upper classes carry on their principal labor in the laboratory, the drawing rooms, the workshops, or in the field, and for it they receive no pecuniary consideration, since their labor is of a purely educational character.

MILITARY INSTRUCTION.

Thorough instruction in Military Science is given by an officer detailed by the Secretary of War from the active list U S. Army, and is continued throughout the entire course. All able-bodied male students receive instruction in the school of the soldier, company and battalion drill. Arms and equipments are furnished by the United States Government. The uniform is a cadet gray; the blouse similar to the regulation blouse of an army officer, but with State of Maine buttons, and for officers with chevrons of dark blue; the pants with dark blue stripes, one and one-fourth inches wide, on outside seams; the cap gray, with dark blue bands and brass crossed rifles in front. The uniform is required to be worn during military exercises, and it is recommended that it be worn at recitations and at other class and general College exercises.

LOCATION.

The College has a pleasant and healthful location, between the villages of Orono and Stillwater, about a mile from each. Stillwater River, a tributary of the Penobscot, flows in front of the buildings,

forming the western boundary of the College farm, and adding much to the beauty of the surrounding scenery.

The Maine Central Railroad, over which trains pass many times each day, has a station at the village of Orono. The College is within nine miles of the city of Bangor, and is consequently easily accessible from all parts of the State.

FARM AND BUILDINGS.

The College farm contains three hundred and seventy acres of land, of high natural productiveness, and of great diversity of soil, and is therefore well adapted to the experimental purposes of the Institution.

White Hall, the building first erected, affords excellent accommodations for a limited number of students. The lower rooms of this building are appropriated to general and class purposes.

Brick Hall contains forty-eight rooms, and has connected with it a boarding-house for students. With these buildings, the Institution furnishes desirable accommodations for one hundred and twenty-five students.

The Laboratory contains two apparatus rooms, a lecture room, a cabinet, a library and weighing room, a recitation room, and rooms for analytical and other purposes, and is in all respects admirably adapted to the wants of the chemical and mineralogical departments.

The shop built during the summer of 1883, is equipped for instruction in three departments of mechanical work, viz: filing, forging, and working in wood.

APPARATUS.

The College is furnished with valuable apparatus for the departments of Physical Geography, Chemistry, Physics, Surveying, Civil Engineering and Mechanical Engineering, to which additions are made as the exigencies of the several departments require. Models have been obtained from the United States Patent Office, and others have been purchased, that serve for purposes of instruction.

LIBRARY.

The library contains nearly five thousand volumes, a large part of which has been obtained through the generosity of the late Ex-Governor Coburn. Valuable additions have also been made to it by other friends of the College, only a small number of the volumes having been purchased with money appropriated by the State. It is earnestly hoped that so important an auxiliary in the education of the student will not be disregarded by the people of the State, and that liberal contributions will be made to the library, not only of agricultural and scientific works, but also of those profitable to the general reader.

READING ROOM.

The reading room is supplied with a number of valuable newspapers and periodicals. Grateful acknowledgment is herewith made for the following papers, generously sent by the proprietors to the College:

American Cultivator, American Sentinel, Aroostook Republican, Western Rural, Oxford County Record, Minnesota Farmer, Gospel Banner, Home Farm, Kennebec Journal, Lewiston Journal, Maine Farmer, Maine Industrial Journal, New England Farmer, Oxford Democrat, Piscataquis Observer, Portland Transcript, Somerset Reporter, Whig and Courier, (Daily and Weekly), Zion's Herald, Official Gazette U. S. Patent Office, Bangor Daily Commercial, Farmington Chronicle, Phillips Phonograph, Springvale Advocate, Wilford's Microcosm, Ellsworth American, Mount Desert Herald, Maryland Farmer.

The following papers are furnished by subscription, principally by the students:

American Architect and Building News, American Machinist, Boston Journal of Chemistry, Cultivator and Country Gentleman, Harper's Weekly, Maine Mining Journal, Farmer and Dairyman, Colby Echo, Bowdoin Orient, New York Tribune, Scientific American, Scientific American Supplement, Eastern Argus, (furnished by S. W. Gould,) American Naturalist, Blackwood's, Engineering News, Lewiston Daily Journal, Mirror and Farmer, Journal of Education, New York Daily Herald, Prairie Farmer, Sanitary Engineer, Science, Sunday School Times, The Sunday Sun, Union Advocate.

The following are supplied by the College:

American Journal of Science and Art, Popular Science Monthly, National Live Stock Journal, American Agriculturist, Journal Royal Agricultural Society (England), Journal Franklin Institute, Eclectic, Engineering Magazine, Century Magazine, Atlantic Monthly, Harper's Monthly Magazine, North American Review, Education, American Machinist, Science.

CABINET.

Rooms have been fitted up with cases of minerals and specimens of natural history, and several hundred specimens have been presented to the College. The valuable private cabinets of Prof. C. H. Fernald and Ex-President C. F. Allen are placed in these rooms, and are accessible to the students. All specimens presented will be properly credited and placed on exhibition. Rocks illustrating the different geological formations, and minerals found within the State, are particularly solicited.

PUBLIC WORSHIP.

All students are required to attend daily prayers at the college, and public worship on the Sabbath at some one of the neighboring churches, unless excused by the President.

EXPENSES.

Tuition is thirty dollars a year, divided equally between the two terms. The cost of material and repair of tools for the course of instruction in the vise shop, is ten dollars; in the forge shop, nine dollars; in the wood shop, four dollars.

Laboratory expenses are at cost of glass ware broken, injury to apparatus and chemicals used. A deposit of five dollars is required of students entering upon a term's work in Qualitative Analysis, and of seven dollars per term from students in Quantitative Analysis. Room rent is four dollars for the first term and five dollars for the second term of the college year.

Students residing too remote from College to *live* at home are required to room in the college halls, except special permission to room elsewhere be granted by the President. Students receiving

such permission pay room rent and fuel rent as though residing at the College.

Bedding and furniture must be supplied by the students, who also furnish their own lights. Tables, chairs, bedsteads, sinks and husk mattresses can be purchased at the College at moderate rates.

The price of board is two dollars and sixty cents per week; washing averages not more than sixty cents per dozen.

The warming by steam of single rooms (each suitable for two occupants), has averaged for the past six years about eleven dollars a room for each term. The expense of heating recitation rooms and rooms for general purposes has been about two dollars a term for each student, and the incidental expenses, including pay for the services of janitor, pay for bringing mail, for cleaning and renovating rooms, for general repairs, &c., have been about three dollars per term for each student.

From the items given, with an allowance of a few dollars a year for necessary text-books, quite an accurate estimate of needful expenses can be made.

The College term bills are payable, one-half at the commencement, and the remainder at or before the close of each term.

As security for the payment of College bills, a bond of one hundred and fifty dollars with satisfactory securities is required. A blank form of bond will be given with the ticket of admission.

MEANS OF DEFRAYING EXPENSES.

The terms are so arranged that the long vacation occurs in the winter, that students may have an opportunity to teach during that time. The summer vacation is in the haying season, when farm labor is most profitable. By availing themselves of the opportunities thus afforded, together with the allowance for labor on the College farm, industrious and economical students can cancel the greater part of their College expenses.

SCHOLARSHIPS.

The trustees make provision for the establishing of free scholarships by the following action:

Voted, That any individual or society paying to the Treasurer a sum not less than seven hundred and fifty dollars, shall be entitled to one perpetual free scholarship in the college.

GRADUATES.

CLASS OF 1872.

Name and Occupation. — *Residence.*

Benjamin F. Gould, C. E , Farmer ..... San Juan, California
George E. Hammond, C. E., Civil Engineer..... Eliot
Edwin J. Haskell, B. S., Silk Manufacturer .. .. Saccarappa
Heddle Hilliard, C. E., Civil Engineer, International R. R., Oldtown
Eber D. Thomas, B. S., Civil Engineer..... Grand Rapids, Mich.
George O. Weston, B. S., Farmer..... Norridgewock

CLASS OF 1873.

Russell W. Eaton, C. E., Cotton Mill Engineer..Providence, R. I.
George H. Hamlin, C. E., Professor..... ... State College, Orono
Fred W. Holt, C. E., Civil Engineer, G. S. R. R., St. George, N. B.
John M. Oak, B. S., Salesman . ...Bangor
Charles E. Reed, C E., Farmer ....Clinton
Frank Lamson Scribner, B. S., Tutor, Girard College, Philadelphia
Harvey B. Thayer, B. S., Druggist .... Monson

CLASS OF 1874.

William A. Allen, C. E., Civil Engineer, M. C. R. R. .. Portland
Walter Balentine, M. S., Professor of Agriculture,
State College, Orono
William H. Gerrish, B. S., M. D., Physician.....Merrimac, Mass
John I. Gurney, B. S., Farmer ....Dorchester, Mass
David R. Hunter, B. S., Police Officer. . .....Oakland, Cal.
Louise H. Ramsdell, B. S., (wife of Milton D. Noyes, Farmer),
Atkinson

CLASS OF 1875.

Solomon W. Bates, C. E., Civil Engineer ..... Waterville
Wilbur A. Bumps, C. E., M. D., Physician ....Dexter
Samuel H. Clapp, C. E., Teacher .....Danvers, Mass.
Lewis F. Coburn, C. E., Teacher.....Crescent City, Cal.
Charles W. Colesworthy, B. S.. .....Nevada
*Charles F. Durham, C. E., Teacher..... Crescent City, Cal.
Alfred M. Goodale, B. S., Supt. Cotton Mills .. Waltham, Mass.

*Deceased.

Name and Occupation. *Residence.*

Edson F. Hitchings, C. E., Pattern Maker . . . . . Warren, Mass.
Whitman H. Jordan, M. S., Professor Agricultural Chemistry, State College, Penn.
Edward D. Mayo, M. E., Mill Furnisher and Draughtsman, Minneapolis, Minn.
Albert E. Mitchell, M. E., Mechanical Engineer . . . Altoona, Penn.
Allen G. Mitchell, C. E., Civil Engineer, Penn. R. R., Cornellsville, Pa.
*Fred W. Moore, B. S., Teacher . . . . . California
Luther W. Rogers, B. S., Merchant . . . . . Waterville
Minott W. Sewall, M. E., Mechanical Engineer . . Wilmington, Del.
George M. Shaw, C. E., Principal of Schools . . . . Oraville, Cal.
Wesley Webb, B. S., Professor of Agriculture, Delaware College, Newark, Del.
*Edgar A. Work, C. E. . . . . U. S. Military Academy

CLASS OF 1876.

Edmund Abbott, B. S., M. D., Physician . . . . . Winterport
Charles P. Allen, B. S., Lawyer . . . . . Presque Isle
Elbridge H. Beckler, C. E., Ass't Engineer N. P. R. R., Bozeman, Mon.
Fred M. Bisbee, C. E., Civil Engineer, Supt. of Tracklaying, A. T. & S. F. R. R, Wichita, Kansas
Edward M. Blanding, B. S., Editor Maine Industrial Journal, Bangor.
Charles M. Brainard, B. S., Lumberman . . . . . Skowhegan
*George H. Buker, B. S., Apothecary . . . . . Presque Isle
Florence H. Cowan, B. S., Teacher . . . . . Orono
Oliver Crosby, M. E., Proprietor Machine Shop . . . St. Paul, Minn.
Vetal Cyr, B. S., Principal of Madawaska Training School, Fort Kent
James E. Dike, C. E., U. S. Dep. Surveyor, Grand Forks, Dakota Ter.
*Willis O. Dike, B. S. . . . . Gorham
Horace M. Estabrooke, M. S., Teacher, Normal School, Gorham
Arthur M. Farrington, B. S., Veterinary Inspector and Supt. Quarantine Station, Garfield, N. J.
George O. Foss, C. E., Civil Engineer M. & St. L. R. R., Minneapolis.

* Deceased.

Name and Occupation. *Residence.*

William T. Haines, B. S., L. L. B., Lawyer.....Waterville
Henry F. Hamilton, B. S., D. D. S., Dentist, 124 Commonwealth Avenue, Boston; Jersey Stock Breeder, Saco, Me.
Newall P. Haskell, B. S., Farmer.....Orono
Edward S. How, M. E., Book-keeper.....Portland
Philip W. Hubbard, B. S., Apothecary.....Farmington
Samuel M. Jones, M. E., Engineer, Corliss Engine Works, Providence, R. I.
Albert A. Lewis, B. S., Clergyman.....Winterport
Herbert A. Long, M. E., Farmer....Longfellow's Island, Machias
Luther R. Lothrop, C. E., in Surveyor General's office, St. Paul, Minn.
Nelson H. Martin, B. S., Teacher.....Ft. Fairfield
Charles E. Oak, M. E., Surveyor.....Caribou
George D. Parks, C. E., Lawyer and Civil Engineer ...Brunswick
Hayward Pierce, B. S., West Waldo Granite Works.....Frankfort
Frank R. Reed, C. E., Carpenter.....Roxbury
Henry J. Reynolds, B. S., Druggist.....Eastport
Charles W. Rogers, M. E., Machinist.....Charlestown, Mass.
William L. Stevens, M. E., Grain Dealer.....Minneapolis, Minn.
John H. Williams, B. S., Gov't Surveyor.....Dakota

CLASS OF 1877.

Alvah D. Blackington, C. E., Civil Engineer.....Dunmore, Pa.
Robert B. Burns, C. E., in Sur. Gen. office.....Helena, Mon.
Eugene H. Dakin, B. S., Financial Agent, Industrial Journal, Bangor
Edward F. Danforth, B. S., Lawyer.....Skowhegan
Augustus J. Elkins, B. M. E., Draughtsman..Fergus Falls, Minn.
Alicia T. Emery, B. S., Teacher.....Orono
Samuel W. Gould, B. S., Lawyer.....Skowhegan
* Joseph C. Lunt, B. C. E., Civil Engineer, Mex. C. R. R., El Paso, Texas
Fred F. Phillips, B. S., Lawyer.....Bangor
* Samuel Shaw, B. M. E., Architectural Draughtsman, Boston, Mass.
Frank P. Stone, B. S., Farmer.....Livermore Falls
Thomas J. Stevens, B. M. E., Apothecary.....Portland
George E. Sturgis, B. C. E., Apothecary.....Oregon

* Deceased.

Name and Occupation. *Residence.*

Charles E. Towne, B. C. E., Government Surveyor, Helena, Montana
James W. Weeks, B. M. E., Draughtsman ..... Des Moines, Iowa
Nellie E. Weeks, B. S., (Mrs. Llewellyn Spencer) ..... Orono
Ivan E. Webster, B. S., Lumberman ..... Williamsport, Pa.

CLASS OF 1878.

Emma Brown, B. S., Teacher, (Mrs. Charles Gilman) ..... Enfield
Andrew J. Caldwell, B. M. E., Mech. Engineer... Brooklyn, N. Y.
Cecil C. Chamberlain, B. S., Merchant ..... Anoka, Minn.
George E. Fernald, B. C. E., Commercial Salesman, Waterloo, Iowa
James Heald, B. S., City Water Works ..... St. Paul, Minn.
John Locke, B. S. ..... Maine Central R. R., Portland
Frank J. Oakes, B. C. E., Draughtsman ..... Brooklyn, N. Y.
John C. Patterson, B. C. E., Civil Engineer, Minn. & St. L. R. R., Minneapolis, Minn.
Winfield E. Tripp, B. C. E. Commercial Salesman.. Madison, Wis.
Edward C. Walker, B. S., Lawyer ..... Lovell
Otis C. Webster, B. S., Druggist ..... Augusta

CLASS OF 1879.

Harry P. Bean, C. E., Civil Engineer, C. M. & St. Paul R. R., Tama City, Iowa
Edward J. Blake, C. E., Ass't Engineer, W. St. L. & P. R. R., Peoria, Ill.
Simon P. Crosby, B. S., Lawyer ..... St. Paul, Minn.
John D. Cutter, B. S., Physician, 336 West Washington St., Chicago, Ill.
Wilbur F. Decker, B. M. E., Instructor, Industrial Drawing, State University, Minneapolis, Minn.
David A. Decrow, B. C. E., Draughtsman, Holly Manf'g Company, Lockport, New York
Willis E. Ferguson, B. S., Farmer..... San Gabriel, California
Charles W. Gibbs, C. E., Civil Engineer, M. & St. L. R. R., Minneapolis, Minn.
Annie M. Gould, B. S., Teacher, (Mrs. Loomis F. Goodale) Oldtown.
Nellie M. Holt, B. S., Teacher, ... Orono.

Name and Occupation. *Residence.*

Frank E. Kidder, C. E., Architect.....Boston, Mass.
Mark D. Libby, B. C. E., Civil Engineer....Santa Fe, N. Mexico.
Charles S. Loring, B. M. E., Machinist, C. & S. Water Motor Co., Auburn.
George P. Merrill, M. S., Ass't, Nat. Museum, Washington, D. C.
John W. Meserve, B. M. E., Mech. Engineer, Cambridgeport, Mass.
Arthur L. Moore, B. S., Farmer... ... . Limerick
Charles A. Morse, B. C. E., Ass't Div. Engineer, Mex. C. R. R., El Paso, Texas
Fred D. Potter, B. M. E., Draughtsman, Edison Electric Light Co., N. Y.
Alton J. Shaw, B. M. E.....Auburn
Percia A. Vinal, M. S., (Mrs. Albert White)..... ...Orono
George O. Warren, B. S., Farmer.....Fryeburg
Herbert Webster, B. S., Express Messenger, Bangor and St. John, N. B.

CLASS OF 1880.

Horace W. Atwood, B. S., Veterinary Surgeon...Providence, R. I.
James M. Bartlett, M. S., Analytical Chemist, State College, Penn.
Albert H. Brown, B. S., Coal Merchant..... ..... Oldtown
Marcia Davis, B. S., Clerk, Office Registry of Deeds, West Bay City, Michigan
Fred B. Elliott, B. S., Farmer.... .....Bowdoin
Sarah P. Farrington, B. S., (Mrs. George P. Merrill) Washington, D. C.
Charles W. Fernald, B. S., Merchant.....Levant
Fred W. Fickett, B. S., U. S. Signal Service.....Portland, Oregon
George W. Lufkin, B. C. E., Civil Engineer, Duluth & Nor. R. R. St. Paul, Minn.
Frank A. Mansfield, M. S., Clergyman..... California
Annie A. Matthews, B. S., Teacher.....Stillwater
Henry W. Murray, B. C. E., Teacher.. .....Milton, California
Franklin R. Patten, B. C. E., Sanitary Engineer, Minneapolis, Minn.
Charles T. Pease, B. S., Civil Engineer.....Denver, Colorado
James F. Purington, B. S., Farmer .....Bowdoin

CLASS OF 1881.

Name and Occupation. *Residence.*

Henry H. Andrews, B. M. E., Lumber Manuf....Hampstead, Va.
Henry W. Brown, B. S., Student of Art .....New Haven, Conn.
Clara L. Buck, B. S., Teacher..... Oldtown
Fannie E. Colburn, B. S., Teacher.....Auburn
Edward H. Farrington, B. S., Chemist,
Agricultural Experiment Station, New Haven, Conn.
Oliver C. Farrington, B. S., Teacher ..... Cape Elizabeth
Charles H. Fogg, B. C. E., Div. Supt., Penn. R. R.,
Greensburg, Pa.
Aldana T. Ingalls, B. C. E., Division Engineer, C. & C. M. R. R.
Wilmington, Ohio
Robert John Johnson, B. C. E., Civil Engineer,
Minneapolis, Minn.
Clara A. Libby, B. S., Teacher .....Augusta
Horace F. McIntyre, B. M. E., Mill Business .....Waldoborough
Charles L. Moor, B. C. E. Law Student.....Portland
*Benjamin F. Murray, B. C. E.....Stillwater
Edwin W. Osborne, B. C. E., N. Pacific R. R., Brainard, Minn.
Oscar L. Pease, B. S., U. S. Signal Service.....Phœnix, Arizona
Harold M. Plaisted, B. M. E., M. E. (Stevens Institute) Draughtsman, Chi. Mil. & St. Paul R. R.....Milwaukee, Wis.
Alice I. Ring, B. S.....Orono
Mary L. Ring, B. S., Teacher.....Orono
*Roscoe L. Smith, B. S., Farmer.....Lewiston
George Washington Sturtevant, B. C. E., Civil Engineer,
St. Cloud, Minn.
Frank S. Wade, B. S., Physician, Hahnemann Medical College and Hospital..... Chicago, Ill.
Walter A. White, B. C. E., Law Student.....Ann Arbor, Mich.
John B. Wilson. B. S., Medical Student.....Eureka, Kan.
Levi A. Wyman, B. C. E., Farmer. .....Trenton

*Deceased.

CLASS OF 1882.

Name and Occupation. *Residence.*

Charles S. Bickford, B. S., Book-Keeper.....Belfast
Jacob L. Boynton, B. S., 11 Boylston Place.....Boston, Mass.
Charles W. Brown, B. M. E., Draughtsman, Patent Office,
Washington, D. C.
Stephen J. Buzzell, B. C. E., Book-Keeper....Minneapolis, Minn.
Oscar H. Dunton, B. M. E., Draughtsman.....Boston, Mass.
Walter Flint, B. M. E., Instructor, State College..... ...Orono
George R. Fuller, B. S., Teacher .....Tremont
Charles C. Garland, B. S., 211½ Nicollet Avenue, Minneapolis, Minn.
Joseph F. Gould, B. S., Teacher and Law Student.....Stillwater
Thomas W. Hine, B. S., Lawyer,.. .....Phœnix, Arizona
Will R. Howard, B. S., Instructor Math. & Mil. Sci.,
No. Granville, N. Y.
Alonzo L. Hurd, B. S., Rockford Watch Co.....Rockford, Ill.
Alfred J. Keith, B. C. E., Ass't Engineer with Col. Waring,
Newport, R. I.
Frank I. Kimball, B. C. E. Civil Engineer, Penn. R. R.,
Greensburg, Pa.
James H. Patten, B. S., Medical Student, University of the City of
New York
Frederic M. Reed, B. M. E., Draughtsman.....Hurricane Island
Gleason C. Snow, B. S., Farmer ....North Orrington
Avery P. Starrett, B. S., Farmer.....Warren
Frank H. Todd, B. C. E., Civil Engineer,.....St. Cloud, Minn.
Eben C. Webster, B. S., Lumber Manufacturer.....Orono
Willard A. Wight, B. C. E., Supt. Gas Works ....Trinidad, Col.
Daniel C. Woodward, B. M. E., Machinist.....Winthrop.

CLASS OF 1883.

James H. Cain, B. S ..... Lewiston
Jonathan V. Cilley, B. C. E., Railroad Engineer,
Buenos Ayres, Arg. Rep., S. A.
Frank E. Emery, B. S., 1st. Ass't, Houghton Farm,
Mountainville, Orange Co., N. Y.
Arthur L. Fernald, B. S., Commercial Salesman...Waterloo, Iowa
Bartholomew P. Kelleher, B. S., Farmer .....Orono

Name and Occupation.	*Residence.*
Lucius H. Merrill, B. S., Ass't, Nat. Museum,	Washington, D. C.
Jennie C. Michaels, B. S., Teacher	Stillwater.
Charles W. Mullen, B. C. E., Civil Engineer, Lake Megantic R. R.,	Oldtown
Truman M. Patten, B. C. E.	Hermon
Harry W. Powers, B. S.	Orono
Charles E. Putnam, B. C. E., Civil Engineer	Boston, Mass.
Lewis Robinson, Jr., B. M. E., Medical Student	Hampden
George A. Sutton, B. C. E., Civil Engineer	Orono
Levi W. Taylor, B. S., Principal Abbott Square Grammar School,	Bangor

CLASS OF 1884.

George H. Allan, B. S., Assistant, State Reform School,	Cape Elizabeth
* Will H. Burleigh, B. C. E.	Vassalboro
Mary F. Conroy, B. S., Teacher	Hurricane Island
Leslie W. Cutter, B. C. E.	Bangor
Hattie C. Fernald, B. S.	Orono
Elmer E. Hatch, B. S., Teacher.	So. Elliot
John E. Hill, B. C. E., U. S. Signal Service	Washington, D. C.
Joseph G. Kelley, B. C. E.	Orono
Edwin F. Ladd, B. S., Ass't Chemist, Experiment Station,	Geneva, N. Y.
Clarence S. Lunt, B. C. E., Reporter on Whig and Courier,	Bangor
Fred L. Stevens, B. S., Principal of High School	Manchester
William Webber, B. M. E., Draughtsman	Guilford

* Deceased.

OFFICERS OF THE ASSOCIATE ALUMNI.

PRESIDENT.

PROF. G. H. HAMLIN, Orono.

SECRETARY.

PROF. W. BALENTINE, Orono.

TREASURER.

PROF. C. H. BENJAMIN, Orono.

CLASS SECRETARIES.

1872. E. J. HASKELL, Saccarappa.
1873. J. M. OAK, Bangor.
1874. W. BALENTINE, Orono.
1875. W. H. JORDAN, State College, Penn.
1876. N. P. HASKELL, Orono.
1877. S. W. GOULD, Skowhegan.
1878. C. E. WALKER, Lovell.
1879. F. E. KIDDER, Boston, Mass.
1880. A. H. BROWN, Oldtown.
1881. A. T. INGALLS, Wilmington, Ohio.
1882. O. H. DUNTON, Boston, Mass.
1883. C. E. PUTNAM, Boston, Mass.
1884. G. H. ALLAN, Cape Elizabeth.

NON-GRADUATES.

Average period of attendance, one and a half years.

Present residence not being known, the former residence is given.

Special students are marked in the classes with which they principally recited.

[Corrections for a revised list are solicited.]

CLASS OF 1872.

Name and Occupation.	*Residence.*
John T. Bowler, Register of Deeds	Bangor
William H. Cary, Jr	St. Paul, Minn.
Edward F. Fisher, Trader, Pressed Hay	Bangor
William H. George, Presbyterian Clergyman	Topeka, Kansas
William L. Harlow, Farmer	Buckfield
George L. Macomber	Durham
Charles C. Norton	Buffalo Meadows, Nevada
William B. Oleson, Clergyman	Portland
Frank W. Rollins, Book-Keeper	Cloquete, Minn.
Oren S. Sargent, Physician	Lawrence, Mass.
*Marcus P. Shorey	Oldtown
Benjamin F. Watson, Farmer	Levant

CLASS OF 1873.

William H. Claflin, Clerk or Merchant	Boston
Joseph E. P. Clark, Book Business	Minneapolis, Minn.
* John Jackson	Alfred
Samuel Lane, Insurance Agent	Houlton
William F. Lovejoy, Book-Keeper	Winn
Thomas P. Pease	Bridgton
Clarence Pullen, Surveyor General of New Mexico,	Los Vegas, New Mexico
Frederic A. Ransom	Augusta

*Deceased.

CLASS OF 1874.

Name and Occupation.	*Residence.*
Frank P. Burleigh	Springfield
* Mark E. Burnham	Garland
Louville Curtis	Bowdoinham
Roland Curtis, Physician	Bowdoinham
Samuel C. Moore	Cherryfield
Charles F. Osgood, Farmer	Garland
* William H. Reed	Springfield
George I. Trickey, Lawyer	Caribou
Manly H. Whitehouse	Orrington
Edward R. Wingate, Lumber Business	Cherryfield
William I. Wood, Lawyer	Corinna

CLASS OF 1875.

Gustavus Bellows, Farmer; Specialty, Fruit	Freedom
Leander H. Blossom, Farmer	Turner
John H. Carver, Merchant	Boston, Mass.
William B. Dole, Mechanic	Bangor
George N. Gage, Physician	E. Washington, N. H.
Benson H. Ham, Merchant	Charleston
Alton A. Jackson, Physician	E. Jefferson
Manley Jackson, Organ and Sewing Machine Business	Jefferson
Freeland Jones, Merchant and Surveyor	Caribou
Ora Oak,	California
Sidney S. Soule, Farmer	Freeport
Louis C. Southard, Lawyer	Boston, Mass.
George W. Spratt, Merchant	Bangor
Charles H. Spring, Wool Grower	Buenos Ayres, Arg. Rep., S. A.

CLASS OF 1876.

Francis H. Bacon, Architect	98 Washington Street, Boston, Mass.
Russell A. Carver	Dixfield
Frank P. Gurney, Farmer	Dover, Dakota
Frank A. Hazeltine, Farmer	Dexter
Eugene Hopkins	Oldtown
James W. Linnell, Farmer	Exeter

*Deceased.

Name and Occupation.	*Residence.*
George J. Moody, Lawyer	Forest City, Dakota
Webster Mudgett	Albion
Edward B. Pillsbury, Telegrapher and Electrician	Boston, Mass.
Randall H. Rines, Merchant	Portland
Walter F. Robinson, Surveyor and Farmer	Hartford
Edward C. Shaw, in employ of Am. Watch Co	Waltham, Mass.
Frank E. Southard, Law Student	Augusta
Frank P. Whitaker, Physician	Hermon

CLASS OF 1877.

Charles F. Andrews	Biddeford
Fred S. Bunker, Student, Harvard College	Cambridge, Mass.
* Edson C. Chase	Stillwater
William W. Dow, Printer	Providence, R. I.
James T. Emery	Stillwater
Charles M. Freeman	Portland
Frank H. Goud, Clerk	Fort Fairfield
Austin I. Harvey, Physician	Carmel
Menzies F. Herring, Editor and Publisher	Dexter
Ardean Lovejoy	Orono
Fred B. Mallet, Lumbering Business	Minneapolis, Minn.
Fred L. Partridge	Stockton
Fred H. Pullen	Foxcroft
* Frank E. Reed	Springfield
Woodbury D. Roberts, Merchant	Cheney, Wyoming
Thomas B. Seavey, Clerk	Chicago, Ill.
Henry C. Townsend, Farmer	Fort Fairfield
Clara E. Webb, Teacher	Unity
Fred S. Wiggin, Farmer	Presque Isle
William B. Whitney	Stillwater

CLASS OF 1878.

Charles H. Benjamin, Professor Mech. Eng., M. S. C.	Orono
Eugene M. Berry	Sumner
* Nathaniel A. Crocker	W. Enfield
Charles C. Elwell, Civil Engineer	Boston, Mass.
Howard H. Hartwell	Vinalhaven

* Deceased.

Name and Occupation.	*Residence.*
John E. Haynes, Jeweller	Oldtown
Fred H. Hinckley, Clerk in U. S. Land Office	Eureka, Nev.
Richard S. Howe, Hotel Clerk	Fryeburg
Carl S. Jameson, Boot and Shoe Dealer	Providence, R. I.
William S. Jameson, Dealer in Sugar Machinery	Guadalajara, Mex.
Edgar H. Lancaster, Mechanic in R. R. Shop	Oldtown
* Alvra W. Leathers	Dover
James Lunt	Bangor
Herbert A. Mallett, Lumberman	Stillwater, Minn.
Silas N. Miller, Prospecting for Gold and Silver	Fairplay, Colorado
Frank J. Perkins, Dry Goods Dealer	Oldtown
Charles F. Plumley, Merchant	Lincoln
John O. Richardson, Trader, Paints and Oil	Oldtown
A. Judson Small	No. Lubec
Albert H. Stewart, Piano Regulator	Boston, Mass.
Edson Warriner, Watchmaker and Jeweller	Fryeburg
Erastus G. Weeks, Merchant	Jefferson

CLASS OF 1879.

Daniel Allison	Linneus
Arthur P. Brown, Mechanic	Orono
Benjamin V. Carver, Machinist	Hartford, Conn.
Byron H. Cochrane	Woonsocket, R. I.
Fred A. Colburn, Clerk and Scaler	Stillwater, Minn.
James W. Cousens, Teacher	Stillwater
John A. Curtis, U. S. Deputy Surveyor	Laramie, Wyoming
George A. Dustin, Machinist and Trader	Dexter
Loomis F. Goodale, Civil Eng., Can. Pac. R. R.,	Winnipeg, Manitoba
Edwin A. Hawes, Mechanic	Ontario, Cal.
* Edwin C. Johnson	Gorham
Oliver S. Jones, Farmer	Corinna
Albert Y. Merrill, Lawyer, Judge of Probate	Aitkin, Minn.
Asa C. Morton	Bangor
Harry W. Peakes, Merchant	Charleston
David S. Plummer, Book-Keeper	Boston, Mass.
* Eugene G. Smith	Richmond
William N. Titus, Lawyer, Judge Mun. Court	Bristol, R. I.

* Deceased.

Name and Occupation.	*Residence.*
Howard E. Webster, Lumberman	Orono
Arthur L. Wellington, Shipping Agent	Detroit, Mich.
Charles M. Wilson,	San Francisco, Cal.

CLASS OF 1880.

Charles M. Allen, Teacher	Kingston, Penn.
Edward N. Atwood, Asst. Supt., Ker. Oil Works	Portland
Granville Austin, Clerk	Boston, Mass.
Sylvester A. Brown, Clerk	Boston, Mass.
Ada M. L. Buswell, Teacher	Stetson
Charles E. Cheney, Farmer	W. Scarboro'
Woodbury F. Cleveland, Physician	Winterport
Samuel H. Dyer	Yarmouth
Osgood E. Fuller, Druggist	Albany, N. Y.
Harry H. Goodwin, Lawyer	Biddeford
John B. Horton, Book-Keeper	Sandusky, Ohio
Daniel S. Jones, Watchmaker and Jeweller	Fort Fairfield
Prescott Keyes, Jr., Farmer	Richmond
*Charles W. Nash	Addison
Willis L. Oak, Clerk	Presque Isle
Fred W. Powers, Farmer and Teacher	Fryeburg
Emily Ramsdell, Teacher	Atkinson
Mortier C. Randall	Stillwater
William J. Rich, Asst. to Prof. R. H. Richards, Ins. Tech.,	Boston, Mass.
Charles S. Simpson, Civil Engineer and County Surveyor,	Florence, Wis.
Frank A. Spratt	Corinth
Daniel Webster, Clerk, Am. Exp. Co	Bangor

CLASS OF 1881.

Henry W. Adams, Lumberman	Wisconsin
*Lorin T. Boynton	Ashland
Charles P. Chandler, Machinist	New Gloucester
Elmer C. Chapin, Commercial Traveller	Bangor
*Frank P. Fessenden	South Bridgton
Archy S. Gee, Tinman	Oakland
George W. Holmes, Merchant	Norway

*Deceased.

Name and Occupation.	*Residence.*
John F. Horne, Shoe Manufacturer	Auburn
Benjamin Johnson	Portland
Edward C. Luques	Biddeford
Charles S. Macomber, Lawyer	Carrollton, Iowa
Charles I. D. Nichols, Farmer	Hollis
Martin Nowland, Farmer	Ashland
Charles C. Ross, Runner	St. Stephens, N. B.
Clara Southard (Mrs. Hammond)	Lincoln Center
Charles P. Tidd, Tel. Operator	Higbee, Missouri
Harry P. Tidd	Wingleton, Mich.
William R. Tilden, Workman in Shoe Factory	Campello, Mass.
William A. Vinal, Scaler	Orono
Willliam G. Wales, Farmer	Iowa
Frank B. Weeks, Government Quartermaster	San Francisco, Cal.
Flora Welch, in Training School for Nurses, City Hospital,	Boston, Mass.
George H. Wilson, Clerk, Gov. Storehouse	Maricopa, Arizona

CLASS OF 1882.

Joseph B. Bartlett, Fruit Grower	San Gabriel, California
Charles C. Dunn, Farmer	Ashland
Charles W. Fenlason	Bridgewater
John I. Greenlaw, Merchant	N. Fryeburg
William H. Hatch	Lisbon
Wesley J. Jameson	Frankfort
Frederick A. Kenniston, Clerk	Waltham, Mass.
Frederick O. Kent	Bremen
Walter H. Nason, Medical Student	New York City
Atta L. Nutter, Teacher	Wilmington, N. C.
Parker J. Page, Law Student	Orono
Harry K. Poole	Bremen
Louis C. Tilley, Farmer	Castle Hill

CLASS OF 1883.

George R. Currier, Teacher	E. Wilton
Arthur T. Drummond, Farmer	Sidney
William E. Emery, Medical Student	New York City
Norman F. Kelsea	Brockton, Mass.
Edwin P. Kendall, Farmer and Miller	Bowdoinham

Name and Occupation.	*Residence.*
Henry W. Longfellow, Clerk	Machias
Charles S. Murray	Stillwater
George A. Rich, Student in University	Middletown, Conn.
Everett F. Rich, Clerk	Bangor
Ralph Starbird, Manufacturer	Boston, Mass.
Ralph R. Ulmer, Law Student	Rockland
Frank C. Webster, Clerk, Am. Exp. Co.	Bangor
Frank G. Webster, Clerk	Orono
Lewis H. White	Newport

CLASS OF 1884.

Edward S. Abbott, Instructor in Physiology, Hahnemann Medical College,	Chicago, Ill.
Edward M. Bailey, Mechanic	Orono
Joseph B. Bartlett	Nottingham, N. H.
William A. Berry, Sailor	Hampden
James A. Dunning	Bangor
Freeland Ellis, Clerk	Guilford
Eugene L. Folsom, Machinist	Stillwater
Evie M. Hamblen	Stillwater
Robert S. Leighton	Steuben
*Gilbert Longfellow, Jr	Machias
Cephas R. Moore, Trader	Anson
William Morey, Jr., Draughtsman	Bucksport
William R. Pattangall, Law Student	Calais
Robert C. Patterson, Surveyor	Minneapolis, Minn.
Charles S. Pendleton, Farmer	Philbrook, Montana
Herbert L. Rich	Attleboro', Mass.
Flora M. Ricker (Mrs. P. J. Page)	Orono
Warren J. Ridley, Conductor Street R. R.	South Boston, Mass.
Elmer A. Savage	Minneapolis, Minn.
Mertie Sawyer	Hampden
Charles F. Smith, Law Student	Belfast
*Horace G. Trueworthy	Orono
Jotham Whipple, Jr	Solon

* Deceased.

CLASS OF 1885.

Name and Occupation.	*Residence.*
James W. Bishop, Farmer	Milo
Frederick H. Butler	Hampden
Harry W. Davis, Banker	Buxton, Dakota
Fred W. Dickerson	Belfast
Samuel W. Hill	Machias
Dennis D. Merrill, Ass't, State Reform School	Cape Elizabeth
William Philbrook	Bethel
Carl H. Prince, Farmer	Turner
Elisha C. Vose, Law Student	Bangor
Charles S. Williams	Monhegan Island

CLASS OF 1886.

Eugene C. Bartlett	Orono
John I. Chase	Orono
Harry E. Powers	Bowdoinham
Harold E. Trueworthy	Houlton

CLASS OF 1887.

John W. Allen	Presque Isle
James S. Kennedy	Ludlow
William L. Perham	Paris

CALENDAR.

1885—Feb.	10.	Tuesday, Second Term commences.
June	18, 19.	Thursday and Friday, Examinations.
"	20.	Saturday, Prize Declamations by Sophomores.
"	21.	Sunday, Baccalaureate Address.
"	22.	Monday, Prize Essays by Juniors.
"	24.	Wednesday, Commencement.
"	25.	Thursday, Examination of Candidates for Admission.
		Vacation of five weeks.
Aug.	4.	Tuesday, Examination of Candidates for Admission.
		First Term commences.
Nov.	23, 24.	Monday and Tuesday, Examinations.
		Vacation of eleven weeks.
1886—Feb.	9.	Tuesday, Second Term commences.

SUMMARY OF

Meteorological Observations,

TAKEN AT THE

MAINE STATE COLLEGE of AGRICULTURE and the MECHANIC ARTS,

Latitude, 44° 54′ 2″ N. Longitude, 68° 40′ 11″ W.

From January, 1869, to January, 1885,

BY PRESIDENT FERNALD.

Height of instruments above the level of the sea, 134 feet until June, 1879, and 129 feet since that date.

EXPLANATIONS, DEDUCTIONS AND REMARKS.

The hours of observation are the same as those formerly adopted by the Smithsonian Institution, viz: 7 A. M., and 2 P. M., and 9 P. M., local time.

The figures in the columns headed "Force or pressure of vapor," show the height at which a column of mercury is maintained by the weight of the moisture of the air.

The warmest day of the year 1884 was August 18th, when the mean temperature was 77°.2, and the coldest day was December 20th, when the mean temperature was 10°.4 below zero.

The highest temperature (89°.2) recorded during the year was on the 18th of August, and the lowest temperature (29° below zero) on the 28th of January.

The range of temperature between the two extremes is 118°.2, which is greater by 3°.6 than the average range between the extremes for the last sixteen years.

The warmest day within the period covered by the tables was August 7th, 1876, when the mean temperature was 85°.3, and the coldest day January 8, 1878, when the mean temperature was 17°.2 below zero. The highest temperature (96°.7) occurred on August 6th, 1876, and the lowest temperature (35°.6 below zero) on January 8th, 1878.

A comparison, as regards temperature, of the several months of 1884, with the mean temperature of corresponding months for sixteen years, is given below:

Months.	Mean temperature from 1869 to 1884, inclusive.	Mean temperature for 1884.	
January	15°.24	12°.10	3°.14 colder.
February	19°.37	22°.40	3°.03 warmer.
March	27°.29	27°.12	0°.17 colder.
April	39°.76	42°.50	2°.74 warmer.
May	52°.25	49°.95	2°.30 colder.
June	62°.42	64°.82	2°.40 warmer.
July	67°.51	64°.25	3°.26 colder.
August	65°.98	66°.12	0°.14 warmer.
September	57°.74	58°.92	1°.18 "
October	46°.22	45°.32	0°.90 colder.
November	33°.05	37°.13	4°.08 warmer.
December	20°.65	23°.61	2°.96 "

The year 1884 (mean temperature 42°.85) averaged 0°.56 warmer than the mean temperature of the sixteen years under notice.

Late spring frosts occurred on May 30th and 31st, a light summer frost on the morning of June 14th, early autumnal frosts on September 13th and 14th, and a heavier frost on the mornings of September 15th and 19th.

The principal thunder showers of 1884 were on May 9th and 24th, June 5th, 9th and 24th, July 2d and 19th, August 22d, September 11th, and October 13th.

The rainfall of this year was 44.95 inches, greater by 1.46 inches than the average annual rainfall for sixteen years; the amount of snow was 90 inches, less by only 0.3 inch than the average annual snowfall for the same period.

The number of days in 1884 on which the sky was at least eight-tenths covered with clouds was 115, or 31 per cent of the whole number. The number of days on which at least .01 of an inch of rain or snow fell was 160, or 44 per cent of the whole number; the number of days, therefore, without any considerable quantity of rain or snow, was 206, or 56 per cent of the whole number.

From June to October, inclusive, the prevailing wind was S. W. and S.; during April and May, N. E. and N., and during the remaining months of the year, N. W. and W. Heavy winds prevailed on Feb. 20th and 29th, March 4th, 10th, 30th and 31st, Sept. 27th, Oct. 22d, and Nov. 6th and 8th, and on the night of Nov. 23d, and morning of Nov. 24th the wind rose to a strong gale.

The prevailing wind for the sixteen years from 1869 to 1884, inclusive, was from the northwest and west. The relative direction and force of the wind for this period are indicated approximately by the following numbers: N. W. and W., 4; S. W. and S., 3; S. E. and E., 1; N. E. and N., 2.

The principal auroras of 1884 were on the evenings of March 1st, 20th and 21st, April 14th, 24th, 26th and 27th, October 2d, and November 9th

The principal lunar halos were on January 8th and 16th, May 6th and October 29th; and the principal solar halos, on March 23d, May 1st, September 5th, and October 2d, and 29th.

The barometer indicated the greatest pressure in the month of December, and the least in February. The range between the two extremes was 1.948 inches

The least mean pressure was during July, and the greatest during December, when the average height of the mercury in the barometer, at an elevation of 129 feet above sea level, was 29.986 inches. The mean humidity of the air was .81.

SUMMARY BY MONTHS—1884.

Months.	Thermometer in the Open Air.											Rain and Snow.		Cl'ds.	Winds.				Barometer.			Relative humidity or fraction of saturation.		
	Mean of warmest day		Mean of coldest day.		Highest temperature.		Lowest temperature.		Mean of maximum temperatures.	Mean of minimum temperatures.	Mean of three daily observations.	Amount of rain or melted snow—inches.	Amount of snow—inches.	Mean percentage of cloudiness.	Per cent of direction and force.				Barometer height reduced to freezing point of water.					
	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.							N. W. and W.	S. W. and S.	S. E. and E.	N. E. and N.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
		°		°		°		°	°	°	°													
January	9	38.7	28	-9.9	9	43.4	28	-29.0	23.02	0.49	12.10	4.44	17.5	.51	.42	.34	.17	.07	30.654	28.880	29.909	100	52	86
February	14	38.5	24	5.4	14	43.5	25	-8.4	30.89	13.42	22.40	6.85	26.5	.70	.60	.10	.07	.23	30.631	28.768	29.956	100	57	88
March	24	41.9	2	2.6	22	50.3	3	-14.4	35.12	16.95	27.12	4.37	22.5	.59	.43	.26	.12	.19	30.310	29.326	29.862	100	43	82
April	26	54.7	1	33.6	26	65.9	2	23.8	49.77	34.60	42.50	3.38	0.5	.65	.24	.07	.28	.41	30.079	28.828	29.707	100	30	76
May	24	65.8	14	39.4	24	75.5	31	34.1	58.80	41.77	49.95	5.42	–	.55	.29	.18	.23	.30	30.220	29.279	29.806	100	16	75
June	30	73.6	14	51.8	17	88.6	2	38.2	75.87	53.97	64.82	1.37	–	.36	.14	.46	.18	.22	30.437	29.600	29.937	100	21	68
July	2	73.3	9	55.6	2	84.1	10	49.4	73.06	54.78	64.25	2.38	–	.62	.30	.33	.23	.14	29.985	29.365	29.692	98	49	84
August	18	77.2	26	52.5	18	89.2	25	44.2	75.73	57.66	66.12	3.12	–	.53	.23	.56	.18	.03	30.142	29.667	29.928	100	48	85
September	4	73.0	14	42.3	4	87.8	15	30.3	68.59	49.32	58.92	2.19	–	.46	.29	.56	.09	.06	30.283	29.487	29.925	100	38	82
October	1	62.7	26	32.8	1	77.7	16	22.7	53.38	36.53	45.32	2.70	–	.61	.35	.43	.01	.21	30.451	29.477	29.946	100	51	80
November	23	48.5	18	19.8	24	58.4	19	9.0	42.03	25.11	37.13	3.99	7.0	.56	.51	.40	.04	.05	30.395	29.174	29.847	100	30	78
December	7	51.4	20	-10.4	7	58.6	20	-20.2	32.60	14.17	23.61	4.74	16.0	.57	.41	.29	.07	.23	30.716	29.265	29.986	100	46	84
Year	Aug 18	77.2	Dec. 20	-10.4	Aug 18	89.2	Jan. 28	-29.0	51.57	33.23	42.85	44.95	90.0	.56	.35	.33	.14	.18	30.716	28.768	29.875	100	16	81

SUMMARY BY YEARS—From 1869 to 1884, Inclusive.

Year	Temperature in the Open Air.											Rain and Snow.		Cl'ds.	Winds.				Barometer.			Force or pressure of vapor in inches.			Relative humidity or fraction of saturation.		
	Mean of hottest day.		Mean of coldest day.		Highest temperature		Lowest temperature		Mean of maximum temperatures	Mean of minimum temperatures.	Mean of three daily observations.	Amount of rain or melted snow in guage—inches.	Depth of snow—inches.	Mean percentage of cloudiness.	Per cent of direction.				Barometer height reduced to freezing point.								
	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.							N. W. and W.	S. W. and S.	S. E. and E.	N. E. and N.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
		°		°		°		°	°	°	°																
1869,	July 11	74.2	Jan. 22	-3.8	July 11	87.2	Mar. 6	-22.0	50.01	33.37	41.77	44.72	84.92	.55	.41	.29	.14	.16	30.519	28.858	29.780	.826	.005	.250	100	25	76
1870,	July 24	82.8	Jan. 14	-9.7	July 24	94.0	Feb. 4	-17.0	53.02	35.45	44.26	40.98	78.75	.50	.35	33	10	.22	30.578	28.902	29.791	.878	.016	.279	100	13	74
1871,	May 30	76.0	Jan. 23	-14.9	May 30	88.6	Jan. 23	-20.6	50.44	33.33	41.92	41.63	80.50	.50	.42	.33	.10	.15	30.585	29.000	29.795	.956	.006	.244	100	17	75
1872,	July 16	79.5	Dec. 25	-11.8	June 30	90.6	Dec 25	-23 0	50.02	33.22	41.60	48.54	113.00	.53	.37	.28	.13	.22	30.446	28.712	29.706	.793	.011	.258	100	23	77
1873,	July 30	75.5	Jan. 30	-4.9	July 26	92.0	Jan. 30	-26.5	49.93	31.28	40.93	40.78	124.00	.49	.38	.30	.10	.22	30.680	28.423	29.794	.778	.009	.232	100	20	74
1874,	July 15	76.3	Jan. 26	15.5	July 15	86.3	Feb. 2	-26.0	50.18	32.21	41 35	44.94	132.00	.52	.37	.36	.08	.19	30.719	28 981	29.825	.794	.009	.240	100	19	76
1875,	Aug. 29	74 8	Nov 30	-9.8	Aug. 29	87.8	Dec 20	-23.0	48.49	30 11	39.58	41 94	93 80	.50	.40	.30	.09	.15	30.550	28.939	29 814	.844	.014	.239	100	24	76
1876,	Aug. 7	85.3	Feb. 24	-13.4	Aug. 6	96.7	Dec 26	-21,5	50.74	32 32	42.03	52.37	123.00	.49	43	.30	.08	.19	30.783	28.458	29.808	.935	.014	.250	100	21	76
1877,	Aug. 24	75 1	Jan. 25	11.3	June 1	89 0	Jan 26	-32.5	52.45	33.63	43.39	40.17	66.50	.52	.34	.30	.12	24	30 494	28.888	29.837	.762	.009	.269	100	19	76
1878,	June 30	81.9	Jan. 8	17.2	June 30	93.5	Jan. 8	-35.6	52 07	35.38	44.34	48.57	59.50	.56	.33	.33	.13	.21	30.554	28.794	29.796	.872	.009	.280	100	20	78
1879,	July 16	77 8	Dec. 21	-11.7	Aug 2	88.0	Dec 27	-26 0	50.10	31.67	41.62	46.73	112.00	.51	.38	.37	.07	.18	30.638	28.537	29 851	.843	.012	.258	100	15	75
1880,	July 10	82.3	Feb. 2	-4.4	July 10	94.8	Jan. 14	-15.4	52.05	33.50	43.85	33.81	69.00	.50	.39	.23	.18	.20	30.644	29.090	29 874	.790	.015	.269	100	23	75
1881,	Aug. 5	78.1	Feb. 2	-9.1	Aug. 5	91.0	Jan. 2	-18.2	52.11	34 98	43.87	42 80	54 50	.54	.45	18	.14	.23	30.647	28.919	29 86[illegible]	.891	.019	.281	100	21	77
1882,	Aug. 6	80.7	Jan. 24	-10.0	Aug. 5	92.0	Jan. 25	22.4	50.76	33.10	42.54	41.26	110.00	.49	.46	.18	.12	.24	30.724	29.121	29.885	.819	.016	.261	100	24	75
1883,	July 6	75.1	Dec 23	13.1	July 7	85.6	Jan. 6	-25.0	50.04	31.79	40.72	40.60	53 00	.48	.41	.30	13	.16	30 641	28.750	29 904	860	.015	.259	100	18	78
	1876.		1878.		1876.		1878.					Mn.	Mean.														
16 yrs	Aug. 7	85.3	Jan. 8	-17.2	Aug. 6	96.7	Jan. 8	-35.6	50.88	33.72	42 30	43.49	90.28	.52	.40	29	.11	.20	30 783	28.423	29.830	-	-	-	100	13	76

APPENDIX.

Laws Pertaining to the College.

ENDOWMENT ACT.

An act donating lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there be granted to the several states, for the purposes hereinafter mentioned, an amount of public land, to be apportioned to each state a quantity equal to thirty thousand acres for each senator and representative in Congress to which the states are respectively entitled by the apportionment under the census of eighteen hundred and sixty. *Provided*, That no mineral lands shall be selected or purchased under the provisions of this act.

SECT. 2. *And be it further enacted*, That the land aforesaid, after being surveyed, shall be apportioned to the several states in sections or subdivisions of sections, not less than one-quarter of a section; and whenever there are public lands in a state subject to sale at private entry at one dollar and twenty-five cents per acre, the quantity to which said state shall be entitled shall be selected from such lands within the limits of such state, and the Secretary of the Interior is hereby directed to issue to each of the states in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said state may be entitled under the provisions of this act, land scrip to the amount in acres for the deficiency of its distributive share; said scrip to be sold by said states and the proceeds thereof applied to the uses and purposes prescribed in this act, and for no other use or purpose whatever: *Provided*, That in no case shall any state to which land scrip may thus be issued be allowed to locate the same within the limits of any other state, or of any territory in the United States, but their assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents per acre: *And provided further*, That not more than one million acres shall be located by such assignees in any one of the states: *And provided further*, That no such location shall be made before one year from the passage of this act.

SECT. 3. *And be it further enacted*, That all the expenses of management, superintendence, and taxes from date of selection of said lands, previous to their sales, and all expenses incurred in the management and

disbursement of the moneys which may be received therefrom, shall be paid by the states to which they may belong, out of the treasury of said states, so that the entire proceeds of the sale of said lands shall be applied without any diminution whatever to the purposes hereinafter mentioned.

SECT. 4. *And be it further enacted*, That all moneys derived from the sale of the lands aforesaid by the state to which the lands are apportioned, and from the sales of land scrip hereinbefore provided for, shall be invested in stocks of the United States, or of the states, or some other safe stocks yielding not less than five per centum upon the par value of said stocks; and that the moneys so invested shall constitute a perpetual fund, the capital of which shall remain forever undiminished, (except so far as may be provided in section fifth of this act), and the interest of which shall be inviolably appropriated, by each state which may claim the benefit of this act, to the endowment, support and maintenance of at least one college where 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 manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.

SECT. 5. *And be it further enacted*, That the grant of land and land scrip hereby authorized shall be made on the following conditions, to which, as well as to the provisions hereinbefore contained, the previous assent of the several states shall be signified by legislative acts:

First. If any portion of the fund invested as provided by the foregoing section, or any portion of the interest thereon, shall, by any action or contingency, be diminished or lost, it shall be replaced by the state to which it belongs, so that the capital of the fund shall remain forever undiminished; and the annual interest shall be regularly applied without diminution to the purposes mentioned in the fourth section of this act, except that a sum not exceeding ten per centum upon the amount received by any state under the provisions of this act, may be expended for the purchase of lands for sites or experimental farms, whenever authorized by the respective legislatures of said states.

Second. No portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretence whatever, to the purchase, erection, preservation or repair of any building or buildings.

Third. Any state which may take and claim the benefit of the provisions of this act shall provide, within five years at least, not less than one college, as described in the fourth section of this act, or the grant to such state shall cease; and said state shall be bound to pay the United States the amount received of any lands previously sold, and that the title to purchasers under the state shall be valid.

Fourth. An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their cost and results, and such other matters, including state industrial and economical statistics, as may be supposed useful; one copy of which shall

be transmitted by mail, free, by each, to all the other colleges which may be endowed under the provisions of this act, and also one copy to the Secretary of the Interior.

Fifth. When lands shall be selected from those which have been raised to double the minimum price, in consequence of railroad grants, they shall be computed to the states at the maximum price, and the number of acres proportionally diminished.

Sixth. No state while in a condition of rebellion or insurrection against the government of the United States shall be entitled to the benefit of this act.

Seventh. No state shall be entitled to the benefits of this act, unless it shall express its acceptance thereof by its legislature within two years from the date of its approval by the President.

SECT. 6. *And be it further enacted*, That land scrip issued under the provisions of this act shall not be subject to location until after the first day of January, one thousand eight hundred and sixty-three.

SECT. 7. *And be it further enacted*, That the land officers shall receive the same fees for locating land scrip issued under the provisions of this act, as are now allowed for the location of military bounty land warrants under existing laws: *Provided*, Their maximum compensation shall not be thereby increased.

SECT. 8. *And be it further enacted*, That the governors of the several states to which scrip shall be issued under this act, shall be required to report annually to Congress all sales made of such scrip until the whole shall be disposed of, the amount received for the same, and what appropriation has been made of the proceeds.

Approved July 2, 1862.

STATE COLLEGE OF AGRICULTURE AND THE MECHANIC ARTS.

Private and Special Laws of 1865, Chapter 532.

SECT. 1. Samuel F. Perley, N. T. Hill, Bradford Cummings, Thomas S. Lang, Dennis Moore, William D. Dana, S. L. Goodale, Robert Martin, Alfred S. Perkins, Joseph Farwell, Seward Dill, Joseph Day, Ebenezer Knowlton, Hannibal Hamlin, Charles A. Everett and William Wirt Virgin are hereby constituted a body politic and corporate, by the name of the Trustees of the State College of Agriculture and the Mechanic Arts, having succession as hereinafter provided, with power to establish and maintain, subject to the provisions and limitations of this act, such a college as is authorized and provided for by the act of the Congress of the United States, passed on the second day of July, in the year eighteen hundred and sixty-two, entitled "an act donating lands to the several states and territories which may provide colleges for the benefit of agriculture and

the mechanic arts." They shall be entitled to receive from the state the income which shall accrue from the funds granted to the state by the act aforesaid, and shall apply the same, together with all such income as they shall receive from any other sources, to the maintenance of the college in conformity with the act of Congress.

SECT. 2. The trustees shall annually elect one of their number to be president of the board. They shall appoint a clerk and treasurer, both of whom shall be sworn, and shall hold their offices at the pleasure of the trustees. The clerk shall record all proceedings of the board, and copies of their records certified by him shall be evidence in all cases in which the originals might be used. The treasurer shall be required to give suitable bond, and to renew the same whenever the trustees shall require.

SECT. 3. The governor and council shall at all times have power, by themselves or such committee as they shall appoint, to examine into the affairs of the college, and the doings of the trustees, and to inspect all their records and accounts, and the buildings and premises occupied by the college. Whenever the governor and council shall have reason to believe that the trustees are exercising or attempting to exercise any unlawful powers, or unlawfully omitting to perform any legal duty, they may direct the attorney general to institute process against the trustees in their corporate capacity, in the nature of a complaint in equity before the supreme judicial court, in the county in which the college may be established, and the court, after notice, shall hear and determine the same by summary proceeding in term time, or by any judge in vacation, and may make any suitable decree restraining the trustees from performing or continuing the unlawful acts complained of, for requiring them to perform whatever is unlawfully omitted, and may enforce such decrees. In like manner a complaint may be instituted against any individual trustee, and be heard in the county where he resides, alleging against him any cause deemed by the governor and council sufficient to disqualify him for the trust; and if in the judgment of the court such allegation shall be sustained, a decree shall be made removing such trustee from office, and his place shall be thereby vacated.

SECT. 4. No person shall be a trustee, who is not an inhabitant of this state, nor any one who has reached the age of seventy years. The clerk of the trustees shall give notice of all vacancies to the governor and council; vacancies occurring in any of the foregoing modes, or by the resignation or decease of any trustee, shall be filled in the following manner: The first vacancy that shall occur shall be filled by the legislature at the next session thereafter by joint ballot of the two branches; the second vacancy shall be filled by the trustees at their next meeting: and all succeeding vacancies shall be filled in like manner, alternately by the legislature and the trustees.

SECT. 5. The trustees, in their corporate capacity, may take and hold in addition to the income which they shall receive through the state from the endowment made by Congress, such other real and personal property as may be granted or devised to them for the purpose of pro-

moting the objects of this act. But they shall not be entitled to receive any benefactions made to them upon conditions inconsistent with the act of Congress aforesaid, or for purposes different from what is therein prescribed.

SECT. 6. The governor and council shall take measures, as soon as may be advantageously done after the passage of this act, to sell the land scrip received by this state under the act of Congress, and to invest the same as required by the fourth section of said act. The securities shall be kept by the state treasurer, and he shall report annually to the legislature the amount and condition of the investments, and of the income of the same. He shall from time to time, as the income shall accrue, pay over the same to the treasurer of the college.

SECT. 7. It shall be the duty of the trustees, as soon as may be after their organization, to procure a tract of land suitable as a site for the establishment of the college. If no other provision shall be made therefor, there shall be placed at the disposal of the trustees for this purpose, such proportion as the governor and council may deem suitable, of that part of the fund which is authorized by the fifth section of the act of Congress to be expended for the purchase of lands for sites or experimental farms.

SECT. 8. The trustees shall appoint such directors, professors, lecturers and teachers in the college, and employ such other persons therein from time to time, as the means at their command may permit for the accomplishment of the objects enumerated and described in the fourth section of the act of Congress. Every officer and every person employed shall hold his office or employment at the pleasure of the trustees. They shall, as soon as may be, arrange and make known the several courses of instruction which they will undertake at the outset of the college, and shall enlarge and improve the same whenever practicable, subject to the limitations prescribed by Congress. They shall also establish the qualifications for admission, and modify the same, as circumstances may require. But no student shall be admitted into or continued in the college, nor shall any person be employed in any office or service, who is not of good moral character and pure life.

SECT. 9. In addition to the instruction which is to be given by classes, text-books, lectures and apparatus, in such branches of learning as are related to agriculture and the mechanic arts, the trustees shall provide, as fully as may be, for practical experiments and demonstrations of scientific principles and rules. They shall encourage, and for due proportions of time, at different seasons of the year, and with reference to other exercises, require all the students to engage in actual labor upon the lands and in the workshops with which the college may be furnished, and shall provide suitable oversight and direction in such labor, so that they may become habituated to skilful and productive industry.

SECT. 10. Military tactics shall be taught, during some suitable part of each year, to all the students; and they shall be required to form and maintain such habits of obedience and subordination as may be useful to

them if called into military service. The adjutant general shall be authorized to furnish to the college, for military drill, such arms and equipments not needed by the state for other service, as may suffice for the number of students. He shall also furnish to the college a United States flag.

SECT. 11. Such other studies are to be taught, within the limitations of the act of Congress, as the facilities of the college and the periods of instruction will permit.

SECT. 12. Students who satisfactorily complete any one or more of the prescribed courses of study may receive public testimonials thereof, under the direction of the trustees, stating their proficiency.

SECT. 13. No charge shall be made for tuition, to any student who is an inhabitant of this state; and the trustees and all persons employed by them shall constantly endeavor, by the adoption of judicious and effective arrangements in all the labor departments of the college, to reduce the cost of subsistence to the students, and to render the institution, as far as possible, self-sustaining.

SECT. 14. It shall be the duty of the trustees, directors and teachers of the college, to impress on the minds of the students the principles of morality and justice and a sacred regard to truth; love to their country; humanity and universal benevolence; sobriety, industry and frugality, chastity, moderation and temperance, and all other virtues which are the ornaments of human society; and among other means to promote these ends, and to secure the best personal improvement of the students, the trustees shall provide, as fully as may be practicable, that the internal organization of the college shall be on the plan of one or more well regulated households and families, so that the students may be brought into relations of domestic intimacy and confidence with their teachers.

SECT. 15. If at any time, the number of students applying for admission shall be greater than the means of the trustees will enable them to receive, they shall make regulations for the number to be admitted, having reference to the proportions of population in the several senatorial districts in the state, and equalize the admissions according to such proportions as nearly as may be.

SECT. 16. The trustees shall hold a regular session at the college at least once in each year; and may provide for periodical visitations by committees. No trustee shall receive any compensation, except actual travelling expenses to be paid from the treasury of the college.

SECT. 17. The treasurer of the college shall make, as often as once in six months, a detailed report of all receipts and expenditures, and the trustees shall cause the same to be verified by full inspection and settlement of all his accounts, and shall transmit a copy of the same as verified by them to the governor and council. The trustees shall also cause to be made annually such report as is required by the fifth section of the act of Congress, and communicate the same as therein provided.

SECT. 18. The legislature shall have the right to grant any further powers, to alter, limit or restrain any of the powers vested in the trustees

of the college established by this act, as shall be judged necessary to promote the best interests thereof. And this act shall take effect upon its approval by the governor.

* Private and Special Laws of 1866, Chapter 59.

The inhabitants of Orono are hereby authorized to raise money by taxation or loan, not exceeding eleven thousand dollars, for the purchase of the White farm and the Goddard or Frost farm, so called, in said Orono. and convey the same, or cause them to be conveyed, to the trustees of the Maine State College of Agriculture and the Mechanic Arts; *provided* that the inhabitants of said Orono, at a legal meeting within thirty days from the approval of this act, by a vote of two-thirds of their legal voters present and voting, shall agree thereto.

* Private and Special Laws of 1866, Chapter 66.

The inhabitants of Oldtown are hereby authorized to raise money by taxation or loan, to aid in the purchase of land in Orono for the use of the State College of Agriculture and the Mechanic Arts, and to convey the same, or cause it to be conveyed to the trustees of said college; *provided* that the inhabitants of said Oldtown, at a legal meeting, within thirty days from the approval of this act, by a vote of two-thirds of their legal voters present and voting, shall agree thereto.

Private and Special Laws of 1867, Chapter 362.

SECT. 1. No vacancy occurring in the board of trustees of the State College of Agriculture and the Mechanic Arts shall hereafter be filled, until the number of said trustees shall be less than seven; and thereafterwards the number of said trustees shall be seven and no more.

SECT. 2. The appointment of the new board of trustees shall be made by the governor, with the advice and consent of the council. As soon as may be after the new board of trustees shall have been appointed, they shall designate by lot one of their number to hold office one year; one two years; one three years; one four years; one five years; one six years, and one seven years, so that the office of one trustee shall become vacant every year. And thereafter, the term of office of every trustee shall be seven years; but any vacancy occurring by reason of death, resignation or otherwise, before the expiration of the term of office, shall be filled for the remainder of the term.

SECT. 3. All vacancies occurring in the board of trustees shall be filled by the governor and council, on the nomination of the trustees. In case the nomination by the trustees shall not be confirmed by the gov-

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* In accordance with the above, the inhabitants of Orono and of Oldtown raised respectively eight thousand and three thousand dollars, purchased the farms referred to, and presented the same to the State for college purposes.

ernor and council, the trustees shall make another nomination, and so on till the nomination shall be confirmed.

SECT. 4. All laws inconsistent with this act are hereby repealed. This law shall take effect upon its approval by the governor.

Approved February 25, 1867.

Private and Special Laws of 1872, Chapter 147.

SECT. 1. Females who possess the suitable qualifications for admission to the several classes, may be admitted as students in the college; subject to the requirements of labor and study, which may be determined by the faculty of instruction and by the trustees of the college.

SECT. 2. This act shall take effect when approved.

Public Laws of 1874, Chapter 194.

SECT. 1. All vacancies occurring in the board of trustees of the State College of Agriculture and the Mechanic Arts shall be filled by the governor with the advice and consent of the council.

SECT. 2. All laws inconsistent with this act are hereby repealed.

Private and Special Laws of 1879, Chapter 173.

Section thirteen of chapter five hundred and thirty-two of the private and special laws of eighteen hundred and sixty-five is hereby amended so as to read as follows:

SECT. 13. A reasonable charge shall be made for tuition, the amount of which shall be determined from time to time by the trustees; and the trustees and all persons employed by them shall constantly endeavor, by the adoption of judicious and effective arrangements in all the labor departments of the college, to reduce the cost of subsistence to the students, and render the institution, as far as possible, self-sustaining.

Approved February 27, 1879.

NOTES ON THE CHARACTER OF THE ROCK FORMATIONS IN THE VICINITY OF AUBURN, MAINE.

By G. P. Merrill, M. S.

The prevailing rock in the vicinity of Auburn is a coarse and quite variable gneiss. This is the rock forming the bed of the river at the falls of the Androscoggin, and the high ridge of hills running in a general northeasterly and southwesterly direction just west of the main portion of the city of Auburn. The typical gneiss is a compact rock of a slight greenish color and is quarried quite extensively in an itinerant manner for the rough work of foundations. For fine work it is entirely unsuited owing to its uneven texture. So far as observed, no stone suitable for architectural purposes occurs in the immediate vicinity, or, indeed, nearer than North Yarmouth, some fifteen or eighteen miles to the south.

Mineralogically, the rock consists of quartz, orthoclase, an undetermined plagioclase feldspar, and varying amounts of hornblende and mica with, usually, a light green pyroxene. As seen under the microscope, the orthoclase is quite impure and often shows a peculiar basket-work structure such as is sometimes produced by interlaminations of albite. The quartz occurs in the irregular grains characteristic of granitoid rocks, and is sometimes rendered fairly murky through the abundance of minute cavities, each containing a liquid and a rapidly moving bubble. These cavities are especially abundant in a sample of gneiss taken from a cut of the Maine Central Railroad, about a mile south of the city. The hornblende of the rock sometimes occurs in dark green, thin-bladed crystals, several inches in length. Ordinarily, however, it is found only in minute crystals which, under the microscope, are of a light green color and very imperfect in crystalline form. A black, lustrous mica is quite abundant in the coarser parts of the gneiss, which, in thin sections, is of a deep reddish brown color and strongly dichroic. A faint greenish, undetermined variety of pyroxene is nearly always

present, which is nearly colorless as seen under the microscope, though polarizing in brilliant red and yellow. Apatite occurs in colorless, hexagonal prisms, visible only with the microscope. Minute rounded or wedge-shaped crystals of a brownish color were frequently observed, which are probably sphene; the largest noted were about one and one-half millimeters long. In a few instances, minute, nearly colorless but brilliantly polarizing crystals were observed which are thought to be zircon. Iron pyrites occurs in scattered grains which are often much decomposed, staining the rock a yellowish red or rust color.

In texture this gneiss is by no means uniform, for it runs from a fine, even-grained, grayish or greenish rock, through all variations, to a coarse aggregate of quartz and feldspar in which the individual crystals are sometimes several inches in diameter. The orthoclase in this coarse rock is, when first quarried, of a beautiful translucency and waxy luster, but soon weathers to a dull opaque mass of almost snowy whiteness. In these coarser varieties of the rock, are often found minerals not observable elsewhere, chief among which are black tourmaline, beryl and garnet. These, however, so far as observed, although sometimes in crystals of considerable size, are never of sufficient perfection and purity to make them desirable as cabinet specimens. The beryls, which are of a greenish yellow color and quite opaque, are rarely in crystals of more than one-fourth an inch in diameter. The prismatic faces are sometimes well developed, but good terminations are always lacking. Tourmalines, although sometimes of considerable size, are brittle and lusterless. Garnets are abundent and of all sizes up to several inches in diameter. They are nearly always very imperfect, especially the larger forms, and of a dull red color. The mica frequently occurs in the feldspathic portions of the rock in lenticular masses several inches in diameter, often enclosing crystals of orthoclase and quartz grains. In one locality, a little to the west of the Maine Central Railroad and south of the freight depot, graphite is found in masses of about the size of a pea, scattered throughout the more feldspathic portions of the rock. The largest specimen of graphite I have ever seen from this locality was a len-shaped mass of perhaps the bulk of half an egg, which was enclosed in an envelope composed of scales of black mica.

The general strike of the gneiss in this vicinity is northeast and southwest, and within an area of a few square miles it is cut by not less than twenty trap dikes, all nearly vertical and running due east

and west. The dikes are all small, the largest being but about five feet in width, while the smallest are not more than four or five inches. These traps are all nearly black in color and of a texture too fine to allow an accurate determination of the composition by the unaided eye. In thin sections, under the microscope, they are found to consist essentially of plagioclase, augite and magnetite and hence must be classed as diabases. Many of them contain olivine and in several instances this occurs in crystals of sufficient size to be visible to the naked eye. The small dikes exposed in the cut of the Lewiston and Auburn Railroad, on the opposite side of the river from the Barker Cotton Mill, are especially rich in olivine which has, however, in nearly every instance undergone extensive alteration into a serpentinous substance. A small quantity of calcite is nearly always present in these diabases, which is also an alteration product. These dikes, having essentially the same mineral composition, though differing somewhat in texture and general appearance, and all running in an east and west direction, are doubtless all of the same geological age; though what this age may be I will not attempt to say excepting that they are of course younger than the gneisses that they cut.

Mineralogically the rocks of the immediate vicinity of the city are of little interest. A few miles to the west and near the Minot line, however, are found deposits of an entirely different nature, which furnish much more interesting field for the mineralogist. The prevaling gneiss here gives way, for a limited though as yet undetermined area, to a deposit consisting largely of a albite, var. cleavelandite, and quartz, in which occur in imbedded masses and pockets, lepidolite, green, red and black tourmaline, cookeite, apatite, autunite, beryl, garnet, zircon and cassiterite. The lepidolite is most abundant of these and is of a beautiful pink color. The apatite crystals are small and of a faint bluish color, but so perfect and transparent as to be of value as gems, as are also many of the tourmalines.

It may be well to remark in closing, that the property upon which this formation occurs has been bonded by interested parties, and hence is no longer accessible to collectors at large.

U. S. Nat. Museum,
Washington, April 7, 1884.

ABSTRACT OF A THESIS ON THE PRECIPITATION OF CASEIN.

By L. H. Merrill (Class of 1883).

In this thesis Mr. Merrill enumerates some of the difficulties attending a perfectly accurate determination of casein in milk.

He then gives the results of his experiments upon the subject.

The ordinary method of precipitating casein from milk was tested. The method was carried out in the following manner:

Five cubic centimeters of milk were taken, then diluted with water, dilute acetic acid was added very cautiously, as the casein precipitates slowly and a very slight excess of the acid re-dissolves the precipitate. Carbonic acid was passed through the liquid containing the precipitate for about half an hour. The casein separated as large white flocs which slowly settle to the bottom, leaving a clear supernatant liquid. It was filtered a few hours after precipitation. If allowed to stand longer the precipitate was very liable to pass through the filter. The casein was washed with water, alcohol and ether; thoroughly dried at 110° and weighed in a drying bottle with the previously weighed filter. The results thus obtained are given below:

	I.	II.	III.
A,	2.75 per cent,	2.81 per cent,	3.17 per cent of casein.
B,	2.79 "	2.99 "	2.96 " "

These results were obtained at three different times from as many samples of milk. As will be seen, the greatest difference between any two is .21 per cent.

A number of precipitations were next made by using a solution of bromine, a precipitant recommended by Husson for volumetric determinations of casein.

A standard solution was made by dissolving 1 c.c. of bromine in $\frac{1}{2}$ litre of water. Five cubic centimeters of milk were taken, diluted with twice its volume of water and the bromine solution added by means of a pipette as long as any precipitate formed. The amount required varied from 10 c.c. to 12.5 c.c. After com-

plete precipitation more water was added, the whole well shaken and allowed to stand about ½ hour before filtration. The precipitate was washed with water, alcohol and ether. It was somewhat heavier than that obtained by the previous method and had a slightly yellowish tint which was not entirely removed by washing it. The results are stated below:

	I.	II.	III.
A,	3.42 per cent,	4.78 per cent,	3.69 per cent of casein.
B,	3.36 "	4.59 "	3.62 " "

As a rule the filtration was not accomplished as readily as when acetic acid was employed. The two methods were then compared by making a precipitation by each method from the same sample of milk.

Acetic acid	3.11 per cent of casein.
Bromine solution	3.94 " "

The bromine solution here, as in the preceding tests, gave a result so large as to lead to the belief that albumen was thrown down with the casein. Two more precipitations were made, and the albumen still in solution in the filtrate was determined in the manner recommended by Hoppe-Seyler.

	I.		II.	
	Casein.	Albumen.	Casein	Albumen.
Acetic acid,	4.29 per cent.	.42 per cent.	3.05 per cent.	.36 per cent.
Bromine solution,	4.51 "	.14 "	3.75 "	.05 "

As a confirmatory test, an experiment was made to determine the effect of the bromine upon a simple water solution of albumen. The white of an egg was shaken up with water and filtered.

On the addition of a bromine solution to this a precipitate was at once formed. By filtering, a clear solution was obtained, which, on boiling, yielded a further precipitate of albumen. It was found that the precipitate first formed by the bromine solution was dissolved by an excess of that reagent. It is possible, therefore, that by using an excess in the case of milk, casein free from albumen might be precipitated. This experiment was performed, but the precipitate was so difficult to filter, even with vacuum, that the effort had to be abandoned.

In a previous report (1880) it was shown that the bromine solution was not a very reliable reagent for the volumetric estimation of casein. These experiments show that without further modification it cannot be relied upon for a gravimetric method of determination.

ABSTRACT OF A THESIS ON THE VOLUMETRIC DETERMINATION OF FIXED FATTY ACIDS IN BUTTER AND OTHER FATS.

By H. W. Powers (Class of 1883).

The method here devised and tested is very similar to that of Hehner, only the volume of the melted acids at 100° Centigrade is determined instead of their weight.

It is carried out in the following manner:—A tube, closed at one end, having an interior diameter of $\frac{3}{4}$ of an inch, and about $2\frac{1}{4}$ feet in length, is taken and properly graduated. This is done in the following manner:

Ten cubic centimeters of melted butter fat (pure) is taken and saponified. The melted butter is heated in water both to 100° and measured at that temperature. The saponified butter is now poured into the tube to be graduated; the vessel in which saponification was performed is thoroughly washed into the tube. A sufficient quantity of sulphuric acid is added to decompose the soap, and water enough is added to bring the quantity of liquid about up to 100 c.c. The tube with contents is now plunged into boiling water and kept there until all the melted fixed fatty acids have collected on top. The space occupied by the fats is very carefully marked upon the glass tube.

Pure pork fat is now taken, saponified, transferred to the tube, the soap decomposed and enough hot water added to about raise the upper level of the fatty acids in pork fat to the position occupied by the upper level of those in butter fat. The tube is now put into boiling water and the upper level of the fats made to coincide accurately with the mark on the tube. When the fats have completely risen it will be seen that the column is longer than that of the butter acids, so that it projects below the lower mark of the butter acids; this is marked upon the tube and the space between the lower mark

for butter and that for pork fat is graduated into eight equal parts. Each of these parts represents very nearly 1 per cent of fatty acid.

The tube is now ready for use.

In order to test its accuracy the following experiments were performed:

Four samples of mixed fats were analyzed.

The first containing about 93 per cent of fixed fats, the second about 91 per cent, the third 93 per cent, the fourth 89 per cent.

The results were as follows:

For the first, approximatively.....92¼ per cent.
" second, approximatively.....90¾ "
" third, approximatively.....93 "
" fourth, approximatively.....89½ "

This method, with properly constructed tubes and carefully carried out, may be expected to give approximate results only—but results that will be of value when one wishes to avoid making a gravimetric determination. Many steps in the process need but little attention —it is, therefore, more rapid, though less accurate, than the ordinary gravimetric process introduced by Hehner.

The lowest point reached by the butter fatty acids was marked 87, as the butter used contained very nearly 87 per cent of fixed acids. The lowest point of the pork acids was marked 95, that being the per cent of fixed acids in pork fat.

ABSTRACT OF A THESIS ON AN EXAMINATION OF SPRUCE GUM.

By F. L. Stevens (Class of 1884).

Spruce gum is obtained from the white spruce *(abies alba)*, and possibly also from the black spruce *(abies nigra)*.

The color of the gum varies according to purity and age; it is generally brown, with reddish tinge, sometimes much lighter. When old it is brittle enough to be powdered in a mortar. It has a resinous terebinthinate odor which becomes more intense on heating. Its taste is persistent, acrid and somewhat aromatic. Its specific gravity is 1.198. When subjected to a gradually increasing heat it softens at about 35° and melts at about 60°.

It is insoluble in cold water, some of its constituents seem to be slightly soluble in warm water. Sodic hydrate dissolves it readily. It is hardly acted upon by hydrochloric acid. Sulphuric acid dissolves it with carbonization, giving a thick black solution. On adding water to this solution a purplish precipitate is formed. Nitric is a good solvent of the gum, giving a clear, yellow solution, which, on being rendered alkaline with sodic hydrate and then neutralized with sulphuric acid, gives a yellow precipitate, which, when dry, is quite inflammable, probably owing to the presence of some nitro-substitution product.

Cold 90 per cent alcohol dissolves it readily and upon heating, only the impurities, such as bark and woody fibre, remain undissolved. Benzole dissolves about 25 per cent of the gum, the remainder giving a dark brown solution with alcohol. This would indicate that in spruce gum at least two resins exist; one soluble in benzole, while both are soluble in alcohol. Chloroform is a good solvent for the gum.

It is also soluble in ammonia and ether. When spruce gum is submitted to dry distillation it at first swells and froths considerably;

soon, however, water distils over. This is followed by turpentine, and then a thickish, dark-colored, resinous liquid is seen to condense.

In order to determine any acid products that the gum might contain, it was boiled with milk of lime, the solution filtered and the acid precipitated. It is a light-colored, granular substance, which, upon standing, turns of an orange yellow color.

If this precipitate be mixed with powdered zinc and heated, an odor of napthaline is easily distinguished.

An examination of this precipitate led to the conclusion that it was composed in greater part of pinic acid, with small quantities of perhaps abeitic and other organic acids of that class.