

MAINE STATE LEGISLATURE

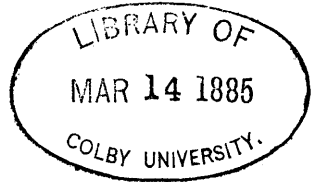
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BEING THE



ANNUAL REPORTS

OF THE VARIOUS

Public Officers and Institutions

FOR THE YEAR

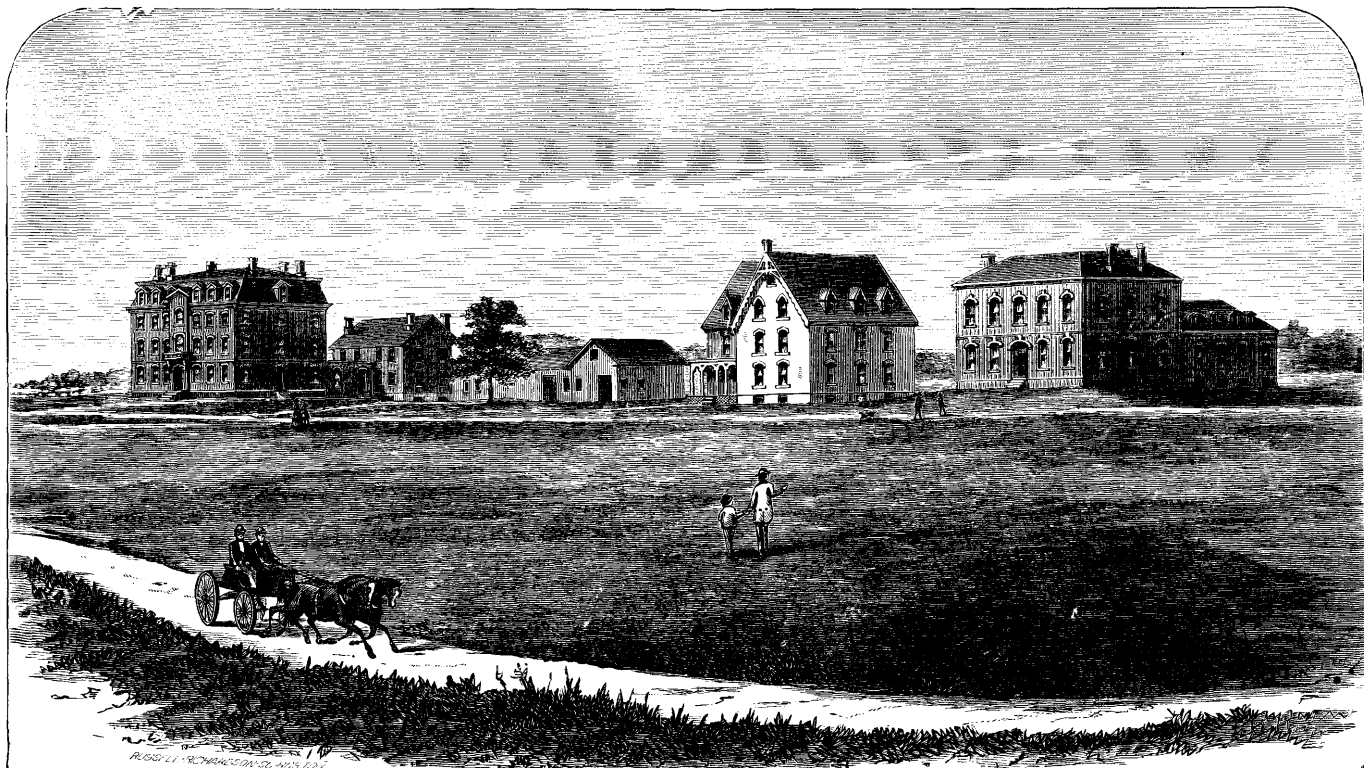
1884.

VOLUME II.

AUGUSTA :

SPRAGUE & SON, PRINTERS TO THE STATE.

1884.



ROOSELL & CO. PHOTODUPLICATIONS

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., 1883.

Published agreeably to a Resolve approved February 25, 1871.

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



TRUSTEES' REPORT.

*To his Excellency, the Governor, and Executive Council
of the State of Maine :*

The trustees of the State college respectfully submit their sixteenth annual report, together with the reports of the president and members of the Board of Instruction, and of the treasurer of the college.

These several reports will show the present condition of the institution.

In response to a recommendation of the trustees in their report of last year, the Legislature appropriated \$2,800 to build and equip shops to afford facilities for the instruction of students in several branches of shop work. The plan outlined in the report referred to has been carried out. The result is a substantial wooden structure in two parts, the main building, 56x36, two stories high, and an ell, 56x24, one story high, with monitor roof to promote ventilation. The length of the structure, including main building and ell, is 112 feet.

The outside has been completed and presents a substantial and attractive appearance.

A small sum of money will be required to complete the interior. The appropriation has not been exceeded. The building committee, Hon. Wm. P. Wingate and President Fernald, are entitled to much credit for having secured so good a structure at a cost so moderate. Its interior comprises shops for vise and forge works, for joinery and wood turning and for casting and working iron. The courses in vise and forge work which were established several years ago and

have been maintained under great disadvantages, will now be carried on with increased usefulness. The course in wood work was instituted upon the completion of the shop in September, and has been attended with gratifying results. For a more particular description of the building, and its purposes and adaptations, attention is respectfully directed to the report of Prof. Benjamin.

THE BOARDING HOUSE.

Mr. Henry M. Lander, who has had charge of the boarding house during the last seven years, has asked to be relieved from further service for the college. The success of Mr. and Mrs. Lander in meeting the exacting requirements of their position has been remarkable. If complaints have been made they have not reached the ears of the trustees. The scrupulous neatness observable in every department of the establishment, the excellence of the food spread upon the tables, their kindly bearing towards students and visitors have been subjects of much favorable comment. Nor has Mr. Lander's usefulness been limited to the interior of the boarding house. It was observable in the faultless condition of the out-buildings, and in the well kept grounds connected with the establishment. The large number of ornamental trees (more than one hundred and twenty-five), planted with his own hands, and now growing, will, in the years to come, attest his interest in the welfare of the college, and the beneficence of his connection with it.

CHEMICAL DEPARTMENT.

An appropriation of \$1,000 was made by the Legislature for the benefit of the chemical department. A part of this sum has been used to supply a new gas making machine and other apparatus much needed, and the usefulness of the department has been largely increased by this moderate expenditure in its behalf.

THE FARM.

The farm affords unmistakable evidence of intelligent and vigorous management. At each regular visit of the trustees (in June and November), it discloses fresh and important improvements. At the rear of the college buildings, a short distance from them, is an area of twenty acres of land, known as the "brick yard field."

Its shallow surface of clayey loam is underlaid by a sub-soil of rank, strong clay, which is naturally suggestive of unlimited material for the manufacture of bricks. The substantial walls of the chemical laboratory and Brick Hall are of material excavated from a corner of this field.

Its flat surface was considerably broken by depressions from which the water scarcely disappeared in the drouth of summer. The present farm superintendent entered upon the discharge of his duties April 1, 1882. Within seven months thereafter, in addition to meeting the exacting requirements of regular farm work, he found time to clear this piece of land of "stones and boulders," to relieve it from the influence of water by careful ditching, and to plow it into beds thirty to thirty-six feet in width. Last spring, after receiving applications of unleached ashes and phosphate, it was sown to oats and stocked to grass.

The results were a crop of 800 bushels of excellent oats, and a "fine growth of young grass and clover."

Thus, this unpromising lot of twenty acres, which had produced less than three-fourths of a ton of hay per acre, has been added to the area of productive grass lands.

An adjoining lot of eighteen acres, similar in character to that above described, has been marked for reclamation. It has already been cleared of bushes, stumps and swamp grass, with which it was nearly covered, has been ditched to relieve it of surface water, and plowed into beds ready for the resumption of treatment the coming spring.

NEAT STOCK.

The neat stock of the farm has been increased in numbers and largely improved in quality within the last two years. Six or seven valuable thorough-bred Jerseys have been added to the dairy stock in the last year. Hon. Z. A. Gilbert and Superintendent Gowell, who made these purchases in behalf of the trustees, are entitled to much credit for the excellence of their selections. A recent careful inspection of the small herds showed them to be in excellent condition, and the trustees are fully prepared to indorse the statement of the farm superintendent, that they do not comprise "one inferior animal."

The statements found in the report of the farm superintendent pertaining to the quality of the dairy stock, and to the important experiments that have been made to ascertain the positive value of hay fed to such stock in connection with concentrated food, and to determine the relative value of early and late cut hay, and of indian meal, cotton seed meal and shorts, cannot fail to be of general interest.

CHANGES.

Mr. J. Fred Webster was elected to the office of treasurer of the college in September last, to fill the vacancy occasioned by the sudden and widely lamented death of Col. Eben Webster.

Col. Webster was elected treasurer in 1879, and was the successor of the late Hon. Isaiah Stetson, who had resigned the office on account of poor health.

Col. Webster was an earnest friend of the institution, and gave it his warm support, not only when its prospects seemed flattering, but in the darker days of doubt and discouragement, when its friends were few and its chances of success or failure seemed to hang "in even scale." Whether as private citizen, or legislator, or an officer of the institution, he freely gave to it the benefit of his valuable influence.

His services as treasurer and his unwavering friendliness to the college were held in high appreciation by the trustees.

BOARD OF TRUSTEES.

The original board of trustees was appointed in the year 1865, and consisted of sixteen members, each county in the State being represented in it.

This board was found too large for practical purposes and its members, by common consent, sent their resignations to the Governor in 1867, with the recommendation that a law be passed providing for a board with a smaller membership. These resignations were accepted and a law was passed providing "that 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 thereafterward the number of said trustees shall be seven and no more." A year or two later the law was so modified as to make the secretary of the board of agriculture *ex-officio* a member of the board of trustees, which increased the number to eight members. In 1883, the Legislature provided by law for an additional trustee to be selected from the alumni of the State college.

Wm. T. Haynes, Esq., of Waterville, was appointed to fill the trusteeship thus established. The board now consists of nine members.

In the year 1879, Hon. Emery O. Bean of Readfield, was appointed trustee to fill the unexpired term of the Rev. Samuel F. Dike, the latter having resigned. At the expiration of this term in April last, Capt. Charles W. Keyes of Farmington was appointed to the place.

Judge Bean was esteemed by his associates as an earnest, able and faithful member of the board, and performed valuable service for the college during his term.

At the late annual meeting of the trustees, Hon. Wm. P. Wingate, who had been elected to the presidency of the board in 1879, to fill the vacancy in that office made by the resignation of Hon. Abner Coburn, and who had been re-elected to the position at each annual meeting since, declined another re-election in anticipation of the close of his term of

service at an early date. Mr. Wingate was largely influential in the movement that resulted in the location of the college at Orono, and has been one of its trustees from the beginning of active efforts to provide the necessary buildings for its development. He was appointed to the board by Governor Chamberlain, and commenced service for the college in April, 1867.

His term of service, which has extended through a period of nearly sixteen years, reaches back farther than that of any officer now connected with the college, with a single exception.

The period of Mr. Wingate's connection with the college has been a period of construction. Numerous buildings have been erected—some of them large, involving the necessity of large excavations and heavy foundations of stone—grounds have been graded, and streets constructed and gravelled and provided with heavy stone culverts.

Such varied and important operations must be conducted under responsible direction.

Mr. Wingate's large experience in the direction of labor, his wide acquaintance with practical builders, his opportunities to make himself familiar with the value of materials entering into the construction of buildings, etc., has made him a prominent and useful member. He has been a member of the executive committee of the board from the first, and, for much of the time its chairman, and a prominent member of nearly every building committee through the years of his connection with the board. His excellent judgment has also made him a valuable adviser in many things pertaining to the interior policy of the college.

He has performed his full share in laying the foundations of an institution that has been described by the United States Commissioner of Education as "eminently practical in its purposes and methods."

CONCLUSION.

The trustees found the college at the close of the year in a highly satisfactory condition.

The spirit pervading each department is full of encouragement, and promises much for the future of the institution. The character for efficiency and usefulness of the instruction in the class rooms, which has been noticed in former reports, has been fully maintained at every point. There has been no break in the harmony that has bound the officers of the institution together in the common purpose of raising it to the highest plane of usefulness attainable with present means. The farm management has been strengthened and improved, and brought more in harmony with the purposes of the institution. By the favorable action of the Legislature, the trustees have been able to realize the accomplishment of the long cherished purpose of the construction of a building for shop work. When fully completed and equipped, it will prove an important adjunct of the institution.

Respectfully submitted,

LYNDON OAK,
President Board of Trustees.



PRESIDENT'S REPORT.

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

GENTLEMEN: The favorable action of the Legislature toward the college, at its session of last winter, has been a source of great encouragement and has contributed also to substantial progress.

The intelligent interest evinced by its members in the affairs of the college, and the kindly spirit manifested by them have furnished occasion of no little satisfaction to all having the welfare and advancement of the institution at heart.

As you are well aware, this enlightened appreciation of its work and of its wants resulted in fair provision for its most pressing needs for two years.

The almost unanimous action of both branches of the Legislature in this result indicates a better comprehension of the design and actual workings of the college than has been evident at any previous period in its history, a circumstance which, in its relations to the future of the institution, must be regarded as auspicious of the highest good.

CONDENSED STATEMENT OF MATERIAL PROGRESS.

In the present report, it is proposed to omit any account of simply routine work, and hence reports of departments are included only so far as changes within the year seem to render them necessary.

As no legislative action touching the college is expected during the coming winter, the customary statements and items pertaining to wants and future plans may also, with propriety, be omitted, and hence this portion of the report

will present simply a condensed statement of changes and progress.

Early in the season the old gas apparatus, which had served its day, was removed, and a new, neat and easily managed machine for the manufacture from gasoline was substituted. The old gasometer is retained and answers well for storage. The supply of gas to the analytical laboratory from the new apparatus has been abundant and reliable, and the quality satisfactory.

The new shop has been a marked feature in the improvements of the year. A full description of this building will be found in the report of the professor of mechanical engineering. Nine young men have availed themselves of the advantages now offered for a course of instruction in wood working, and have given evidence of a degree of skill which seems truly remarkable when we consider the brief time in which it has been acquired. Courses in filing and forging will be given next season in the new rooms now essentially equipped for these purposes.

You will recall that when proposals for building were received, it was found impossible to finish all the rooms in the shop without exceeding the sum appropriated for this building. The rooms which have been left unfinished, but which were designed for immediate use are an office, a recitation room for students in mechanical engineering, and a drawing room. The transfer of the mechanical department to the new building can be, therefore, only partial until the necessary funds (about two hundred dollars) for finishing these rooms can be secured. A statement of expenses of construction and equipment, so far as completed, may be of general interest, and is herewith submitted:

Main building, 56 feet by 36 feet; ell, 56 feet by 24 feet.	
Foundation of shop, including foundations	
for engine and boiler.....	\$409 25
Two chimneys.....	120 00
Material and construction of shop.....	1,728 46

Plans and specifications, grading, advertising and insurance.....	\$35 45	—————
		\$2,293 16

EQUIPMENT.

Benches :.....	\$127 45
Tools for wood room	173 41
Forges.....	103 98
Smoke stack, piping and conductors.....	68 90
Setting engine, repairs on the same, locks, &c.	13 15
Freight on forges, smoke stack and piping..	5 25
	—————
	\$492 14

\$2,293.16+\$492.14=\$2,785.30, or \$14.70 less than the amount assigned by the Legislature for this purpose.

In order to furnish water for the engine and supply it for other uses, it has been found necessary to build a cistern in close proximity to the shop.

A cement cistern has been made, 11 feet in diameter and nearly 11 feet deep, of capacity of 75 hogsheads of 100 gallons each, at an expense of \$100. Towards the payment of this bill, Prof. Benjamin devotes fifty dollars allowed for apparatus in his department, and the remaining fifty dollars it is proposed to obtain by limitations in other directions, that no over-draft on the treasury may occur on this account.

The cistern is indispensable in the work of the shop to be commenced next term.

The old shop divested of its forges and interior fittings has been removed to a location in the rear of White Hall, where it has been clapboarded and painted and is to be equipped for a gymnasium. The work of removal and repairs has been done by students who have obtained by subscription the funds requisite for the materials for repairs, and in part the funds for furnishing the interior of the building, Ex-Governor Coburn contributing fifty dollars for this object.

The lumber with which this shop was constructed, you will remember, was originally given by citizens of Orono, for a drill-hall and gymnasium, but by permission was devoted

to the shop. It seems fitting that it should now fulfil, in part at least, the earlier design.

During the vacation of last summer, the floors and wood-work in nearly all of the rooms of Brick Hall and White Hall, received two coats of paint and other repairs were made in these buildings by which their condition was much improved.

The drain from Brick Hall which terminated in the low ground west of the hall and just below the county road has been continued to the river, which affords a place of exit much more desirable on sanitary grounds.

Trees that have failed to thrive have been replaced by others; gravel has been distributed to the paths and where most needed to the roads; and in general, throughout the season the college lawn and grounds have presented an attractive appearance, furnishing an inviting resort for visitors and pleasant views for students and for all residing upon the college premises.

Changes and improvements made on the farm will appear in the report of the farm superintendent, and progress in experimental work will appear in the report of the professor of agriculture.

INSTRUCTION.

Instruction in the several departments has been maintained essentially as indicated in the report of last year, except that the introduction of a course in wood working required certain minor modifications, especially in the studies pursued by students in mechanical engineering.

In the spring term, Lieut. Howe kindly relieved me of my recitation in Descriptive Astronomy, and in the term just closed he has taught the Sophomore class in Plain and Spherical Trigonometry.

In the military department, target practice has been introduced and instruction in such practice has been given to members of the Senior and Junior classes.

Prof. Aubert has added to his former instruction in General Chemistry a series of experiments which largely enhances the

interest in this branch of study as well as the value of the instruction given.

STANDARD WEIGHTS AND MEASURES.

On March 3, 1881, the following joint resolution, having passed both branches of Congress, was approved by the President :

“ *Resolved*, by the Senate and House of Representatives of the United States of America, in Congress assembled : That the Secretary of the Treasury be, and he is hereby directed to cause a complete set of all the weights and measures adopted as standards, to be delivered to the Governor of each State in the Union, for the use of agricultural colleges in the states respectively, which have received a grant of land from the United States.”

The execution of the foregoing act was committed by the Secretary of the Treasury, to the Office of the U. S. Coast and Geodetic Survey, and the weights and measures were prepared and adjusted in conformity with the established standards.

When informed that they were ready for distribution, the Governor of the State indicated that the set prepared for Maine should be sent to this college. Set No. 30, designed for this institution, was received on Nov. 10, 1883. The complete set embraces the following :

1. *Measure of length.*

A yard scale, divided to inches and tenths, with a matrix for comparison of end yards.

2. *Weights.*

25, 10, 5, 5, 2, 2 and 1 pound in one box.

8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ ounces and
500, 200, 200, 100, 50, 20, 20, 10, } in one box.
5, 2, 2, +1 grains.

3. *Capacity Measures—Liquid.*

A gallon }
A quart } in one box.
A pint }

4. *Capacity Measures—Dry.*

A half bushel	in one box.
A peck	} in one box.
A half peck	
A quart	

Inasmuch as these weights and measures, prepared with great exactness, would suffer from undue exposure to moisture and dust, or from careless handling, some special arrangement for protection and preservation will be found necessary. They may be expected to prove not only of value for the purpose intended, but also objects of special interest when properly placed on exhibition.

COMMENCEMENT AND DEGREES CONFERRED.

The accustomed order of exercises was observed during commencement week with evidence of lively interest maintained to the close.

The Coburn prize for excellence in declamation was awarded to Fremont Lincoln Russell of North Fayette, the committee making honorable mention of George Walter Chamberlain of West Lebanon. The Sophomore exhibition was given on Saturday evening, June 23, 1883.

Baccalaureate services were observed on Sunday evening, June 24, Rev. Prof. John S. Sewall of Bangor, giving a scholarly and impressive discourse on "The Right Use of Power."

The prize for excellence in composition was accorded to Will Hall Burleigh of Vassalboro', the writer of the essay, "Physical Education in College," the committee commending as worthy of special mention the essays, "The Spirit of the Present Age" and "Communism," the former written by William Webber of Guilford, the latter by Edwin Fremont Ladd of Stark. The Junior exhibition was on Monday evening, June 25.

The President's reception occurred on Tuesday evening, and the graduating exercises of the Senior class on Wednesday, June 27. The names and subjects of graduating parts of those receiving degrees are herewith submitted.

Bachelor's Degree in Course. Degree of Bachelor of Science—Course in Agriculture, Frank Edwin Emery, Canaan; Success in Life. Thesis, Farm Management. Degree of Bachelor of Science—Course in Chemistry, James Henry Cain, Orono; God Manifest in His Works. Bartholomew Patrick Kelleher, Orono; Is England Our Mother Country? Lucius Herbert Merrill, Auburn; The Monroe Doctrine. Harry Wilson Powers, Orono; Glass. Degree of Bachelor of Science—Course in Science and Literature, Arthur Liddell Fernald, South Levant; Public Opinion. Jennie Chase Michaels, Stillwater; Ruins. Levi William Taylor, Jay; Progress. Degree of Bachelor of Civil Engineering—Jonathan Vernet Cilley, Rockland; Decline of American Shipping. Charles Ward Mullen, Oldtown; Taxation of Railroads and Railroad Securities. Truman Miller Patten, Hermon; State Ownership of Railroads. Charles Edgar Putnam, Jackson; Sanitary Engineering. George Arthur Sutton, Orono; Abuse of the Ballot and its Remedy. Degree of Bachelor of Mechanical Engineering—Lewis Robinson, Jr., Hampden; Dangers to the Republic.

Bachelor's Degree out of Course. Bachelor of Mechanical Engineering—John William Meserve, Cambridgeport, Mass., class 1879. Thesis, Modern Practice in the Construction of Steam Pumping Engines.

Master's Degree in Course. Master of Science—James Monroe Bartlett, Ithaca, N. Y. Thesis, The Artificial Digestion and the Estimation of Protein Compounds by Stutzer's Method. Frank Albert Mansfield, Theo. Seminary, Bangor. Oration, Teleology in the Light of Development.

Master's Degree out of Course. Civil Engineer—Alvah DeOrville Blackington, Rockland, class of 1877. Thesis, Specifications for the Water Supply of the City of Rockland. Harry Percy Bean, Wisconsin C. R. R., class of 1879. Thesis, The Swell or Expansion of Solid Rock Transferred from Excavation to Embankment.

VARIOUS ITEMS.

Since the issue of the last catalogue, twenty-four new students have been admitted to the college; two to the Sophomore class, two for special courses of study, and twenty to the Freshman class.

The members of the latter class have shown themselves, for the most part, to be earnest workers in the field as well as at their books, twelve in the labor list electing to do and performing extra work, or a larger amount than required by the regulations pertaining to labor.

By invitation of President Prince, of the Maine State Agricultural Society, the Coburn Cadets, under the charge of their military professor, passed very pleasantly the several days of the State Fair, this autumn, in Lewiston, tenting on the fair grounds. It is a pleasure to state that their soldierly bearing and discipline won for them much commendation, and that they acquitted themselves in a manner creditable to their instructor and the college, as well as to themselves. For transportation over the railroad, they are indebted to the courtesy of General Manager Payson Tucker, Esq., of the M. C. R. R., who kindly furnished them passes from Orono to Lewiston and return.

The library has received within the year the benefit of one hundred and fifty dollars by the favor of ex-Governor Coburn, who also furnished the prizes for excellence in composition and declamation, and who has provided fifty dollars for periodicals for 1884. It is a pleasing duty to make record of his continued thoughtfulness of the college and to make acknowledgment of his generous pecuniary aid.

The Alumni number one hundred and ninety-four, less seven who have fallen from their ranks by death.

The college may well regard with satisfaction the record of achievement they are making, and with a just pride may ask attention to the important and responsible positions to which many have already attained, and to the varied and useful forms of industry in which nearly all are engaged.

It is proposed to publish in the catalogue accompanying the report, a record of the names, residences, and occupations so far as they can be ascertained, of all non-graduating students of the college from its establishment to the present date.

Such a list, together with that pertaining to the Alumni will be found valuable for reference, and will furnish a tolerably accurate record of service already rendered in the way of instruction by the college.

CONCLUSION.

It is not too much to say that the year now closing has brought large satisfaction to those immediately engaged in the work of instruction and internal management of the affairs of the college, in that, from the action of the Legislature and other indications of favor, they have had reason to believe that the educational advantages of a practical nature afforded by this institution, are coming to be better understood and appreciated.

In the future, as in the past, it will be their endeavor, so far as the result depends upon them, to render the college still worthy of the consideration, the approval and the fostering care of all good citizens of the State.

Respectfully submitted,

M. C. FERNALD, *President.*

CONDITION OF THE LIBRARY.

During the past year the books and pamphlets in the library have all been catalogued, with the exception of duplicate government and agricultural reports, old text books and odd numbers of magazines.

The additions to the library during the year have been 129 volumes of books and pamphlets from the following sources :

From the Coburn fund, 35 volumes.

Senator Eugene Hale, 14 volumes.

Department of Interior, Washington, 8 volumes, 1 pamphlet.

Department of Agriculture, Washington, 4 volumes, 2 pamphlets.

Department of War, Washington, 1 pamphlet.

Department of Navy, Washington, 1 volume 2 pamphlets.

Bureau of Education, Washington, 1 volume, 4 pamphlets.

Smithsonian Institution, 7 volumes.

Department of Agriculture, Georgia, 3 volumes.

U. S. Coast Survey Office, 2 volumes.

State of Maine, 3 volumes.

Washington Astronomical Observatory, 2 volumes.

Prof. Jordan, 2 pamphlets.

American Ephemeris Office, 1 pamphlet.

Hiram Sibley & Co., 7 pamphlets.

L. P. Lernay, 4 volumes.

Hon. C. A. Boutelle, 1 volume.

Rev. E. P. Fletcher, 1 volume, 2 pamphlets.

Maine Pedagogical Society, 1 volume.

Catalogues and reports have been received from the following Institutions : Rutger's Scientific School, University of Vermont, University of Ohio, University of Minnesota,

Mass. Institute of Technology, Connecticut Experiment Station, Illinois Ind. University, Cornell University, Bridgton Academy, Mass. Agricultural College, Alabama State College, Kansas Agricultural College, Perdue University, Hampton Institute, Yale College, Colby University, Bowdoin College, University of Tennessee, New Jersey Experiment Station, Michigan Agricultural College.

G. H. HAMLIN, *Librarian.*

DEPARTMENT OF MECHANICAL ENGINEERING.

President Fernald:

I have the honor to report progress made in the direction of shop instruction, and manifest improvement in the facilities therefor.

The new shop building, authorized by the present Legislature, was completed Thursday, September 6th, and work began in the wood shop the same day. The main building is a plain but substantial wooden structure, two stories in height, measuring 36 feet by 56 feet on the ground. The first story contains a machine shop 28 feet by 30 feet, a vise shop 11 feet by 34 feet, a sink room, engine room and tool rooms. The machine shop is not equipped at present, but the vise shop has been furnished with hard wood benches fitted with vises and drawers. The engine belonging to the college has been mounted on a permanent foundation of brick and stone, reaching below the action of the frost.

The second story contains a wood shop 19 feet by 38 feet, a drawing room 16 feet by 34 feet, a lecture room and an office. The three latter rooms have been left in an unfinished condition, for lack of funds to complete them. The wood shop has been equipped with benches, vises and tools. Each set of tools comprises the following; panel, back and rip saws; jack, smoothing and block planes; bits and brace, chisels, draw-shave and hatchet; try-square, bevel and gauge, hammer and mallet, rule and dividers, and oil slip. A steel square, compass saw, jointer plane, plow and match plane, and full sets of bits and chisels, are kept by the instructor to be used when needed.

The principal aim of the instruction in wood work, is to secure the greatest possible accuracy with the least expenditure of time and labor. Hence special attention is given to

keeping the several tools used in order, and the condition of each set at the close of the term enters largely into the basis of the ranking.

A large share of the time in this course is given to joinery, as the most important branch of the carpenter's trade. All the more common forms of joints, such as halves, mortise-and-tenon, miter, dowel, open and blind dove-tail, etc., etc., are executed in both hard and soft wood. I here insert one or two examples with the points noted on inspection.

Exercise No. 1. To halve together two sticks at their ends. Material, spruce; dimension, 3 by 3 inches.

Point No. 1.	Angle square on outside and inside,	25	per cent.
“ 2.	Pieces square and of uniform size,	25	“
“ 3.	Good joint all around,	25	“
“ 4.	No twist in joint,	25	“
		100	“

Exercise No. 3. To make an open, double, mortise-and-tenon joint. Material, birch or maple; dimension, 3 by 3 inches.

Point No. 1.	Angle square on outside and inside,	24	per cent.
“ 2.	Pieces square and of uniform size,	23	“
“ 3.	Good joint,	25	“
“ 4.	No twist in joint,	24	“
“ 5.	Good corners,	4	“
		100	“

It speaks well for the system, and for the instructor, Mr. Flint, that the students in this course have been enabled in a few weeks to do better work than they could have done after as many months spent in an ordinary apprenticeship.

The full amount of work was not done this term, on account of the delay in commencing. On a series of ten lessons the highest average rank attained by any student was 97, and the lowest 84, the number in the class being nine, working in two divisions.

Adjoining the main building is an ell, one story in height, measuring 56 feet by 24 feet on the ground, and containing a

forge shop, foundry, and a small room for patterns. The monitor roof on this building, with its adjustable windows, secures good ventilation, while the clay floors are essential to safety from fire.

The foundry is unfinished. The forge shop contains the boiler for the engine, and has been fitted up with new cast iron forges of an approved pattern. A cistern, with a capacity of 7,500 gallons, just outside the building, will furnish an abundant supply of water for the boiler.

The three rooms now fitted up, the wood shop, forge shop, and vise shop, are each arranged to accommodate a division of eight students at one time. In designing this shop, the aim has been to have the several rooms well lighted, spacious and convenient, without regard to considerations of architectural beauty.

While we are well pleased with the progress made this year, we are sensible that many details are yet imperfect, and that even those rooms now fitted up in the new building are incomplete. Many necessary fixtures have been omitted for the present, in order that the cost of equipping the shop may not exceed the amount appropriated for that purpose. We hope that the good quality of the work done here will so commend itself to the people of the State, that they may authorize the further extension of the plan, and the equipment of the machine shop and foundry.

Very respectfully.

CHARLES H. BENJAMIN.

ABSTRACT OF THESIS.

THE ARTIFICIAL DIGESTION, AND THE ESTIMATION OF PROTEIN COMPOUNDS, BY STUTZER'S METHODS.

BY JAMES MONROE BARTLETT, B. S.

Dr. A. Stutzer, in a paper published in *Journal für Landwirthschaft* for 1880, page 195, describes a method for the artificial digestion of protein compounds by which the approximate value of nitrogenous foods may be determined in the laboratory. The digestive fluid used for the purpose is best made from the stomach of the swine, and is prepared as follows:

The inner coating of the stomach of a recently slaughtered swine is cut in small pieces with the shears, and digested with water containing 10cc con. Hcl to the litre, for twelve hours, with frequent stirring. Two litres are used for digesting and 3 for washing, after filtering first through cloth, and lastly through paper, making the whole up to 5 litres. The filtrate and washings are then thoroughly mixed, and if put in well stoppered bottles in a cool place, will keep for several weeks. It is necessary that the animal should be fed a short time before killing so that the cells may be well filled with gastric juice.

The gastric juice extracted in this way, when brought to the proper temperature, has nearly the same action on protein compounds as when in the stomach, converting them into soluble and absorbable acid albuminates, peptones, &c., when a sufficient amount of Hcl is likewise present, to facilitate and continue that action.

The fluid may be prepared from the stomach of any other animal, but Dr. Stutzer found that that of a swine was preferable, making a clearer solution, less liable to putrefaction, and on the whole, giving more satisfactory results.

He published a large number of experiments made to ascertain the proper amount of fluid to use, time of digestion and the quantity of Hcl to add to secure the best results, and from them deduced the following method :

2 grains of substance are weighed into a beaker covered with a watch glass, 250cc digestive fluid added, and then placed in a water bath heated to 40°C. At the end of 2 hours, 0.1 gram of Hcl is added for every 100cc of digestive extract, and the heating continued 12 hours, adding every 2 hours 0.1 gram Hcl for each 100cc of the liquid.

It is allowed to cool down at night, and the heating continued for another 12 hours the next day, adding the Hcl every 2 hours till the liquid contains 1 per cent. of the acid. It is then filtered through washed paper, washed with water till free from Hcl and peptones, then with alcohol two or three times to displace the water, dried at 100° to 110°C, and the nitrogen in the residue determined by soda-lime method.

Dr. Stutzer found that, using a larger amount of the fluid or continuing the digestion for a longer time with a larger amount of acid, removed no more of the nitrogenous matter.

He also made several experiments with pancreatic juice, to ascertain if that did not further act upon and digest protein; but in no case was it possible to remove a greater amount of protein, or any of that left in the residue after treating with gastric juice extract.

EXPERIMENTS ON FODDERS.

The following experiments were performed in order to compare the digestibility of a few fodders, and more especially that of ensilage, and the materials from which it is made.

The digestive fluid was prepared from the stomach of a swine, as directed above. The liquid filtered very slowly, but by a frequent change of filters this difficulty could be, in a measure, obviated. For each experiment about two grains of substance were taken, digested with 250cc of pepsin extract for 24 hours at 40° Centigrade, allowing it to cool down at night and continuing the heating next day.

.01 gram of chlorhydric acid was added every two hours till the solution contained 1 per cent. of the acid. After the digestion was completed, the liquid was filtered off, residue washed with water

until free from chlorhydric acid and peptones, dried at from 100° to 110°C, and the nitrogen remaining determined by soda-lime process.

The results are given in the following table :

No. of analysis.....	No. of exp't.		Total nitrogen per cent.		Albuminoid nitrogen per cent.		Nitrogen in residue undigested per cent.		Per cent of total nitrogen digested.		
	1	2	1	2	1	2	1	2	-	-	
Ensilage.....	1	1.311	1.313	1.003	1.002	0.501	0.492	62.18	50.53		
Ensilage material (in ensilage No. 1)	2	2.180	2.190	1.688	1.715	0.429	0.438	80.16	74.53		
Ensilage.....	3	1.160	1.170	0.763	0.688	0.283	0.282	75.76	61.06		
Ensilage material (in ensilage No. 3)	4	1.160	1.14	0.944	0.914	0.344	0.336	70.43	63.40		
Cotton seed meal.....	5	7.30	7.20	aver. 6.641	0.591	0.647	91.46	90.68			
Cotton seed meal.....	6	7.70	7.72	7.397	7.397	0.504	0.477	93.64	93.37		
Malt sprouts.....	7	4.718	4.786	3.142	3.204	0.690	0.676	85.63	75.18		
Wheat bran.....	8	2.964	2.986	2.280	2.180	0.238	0.230	92.14	89.51		

The results are all calculated to per cent. of dry substance. The albuminoid nitrogen was determined by Stutzer's method, a description of which will be found in the Report of the Cornell University Experiment Station for 1882-83, as translated by Dr. S. B. Newberry.

The ensilage in experiment No. 1 was made from a mixture of clover and timothy, and it will be seen, contains quite a per cent. less of nitrogen than the sample of the original material. This is in part due to the fact that it is next to impossible to get samples accurately representing the whole. But, for some unaccountable reason, it appears that in the ensilage material cured by ordinary drying, the albuminoid nitrogen is 24 per cent. more digestible than in the ensilage itself; both samples having been treated exactly alike throughout the process.

The sample of original material, however, looked much better than the ensilage, being fresh and green in appearance, while the latter looked bleached and devoid of good color.

The other sample of ensilage was made from corn fodder, (stalks), and agrees very closely in total nitrogen with the original material, but contains somewhat less albuminoid nitrogen. The digestibility appears to be about the same.

Both samples of ensilage used in these experiments were taken from the cans in the dry condition, having been removed from the

silo and dried some months before, and it may be possible that drying decreases the digestibility.

Of all the fodders examined, cotton seed meal stands first in digestible protein; wheat bran, second; malt sprouts, third; hay, (clover and timothy), fourth; corn-stalks fifth, and ensilage sixth.

EXPERIMENTS UPON STUTZER'S METHOD FOR THE ESTIMATION OF PROTEIN COMPOUNDS.

It is universally known that the nitrogenous constituents of most fodder materials do not consist entirely of albuminoids, but that often quite a large per cent. of amides, alkaloids, nitrates, nitrogenous glucosides, etc., may be present. The albuminoids being of the highest nutritive value, while the amides have but little or no value, it becomes necessary to devise some method by which a separation of the two classes of compounds can be brought about.

Of a variety of methods that have been proposed, Stutzer's seems, on the whole, the most satisfactory. The method is given in the Report of the Cornell University Experiment Station, 1882-83.

Suffice it here to state that the albuminoids in about 1 gram of the fodder are precipitated by from .3 to .4 gram of pure cupric hydrate in suspension in water. This precipitate is dried, and the amount of nitrogen in it determined by the soda-lime process, from which determination the quantity of albuminoids present may easily be calculated.

Dr. Stutzer states (Journal fur Landwerthschaft 1881, page 476 that he has used as high as 0.5 gram of cupric hydrate with good results, but whether a larger amount would interfere with the escape of nitrogen during the combustion he could not say.

In order to test the matter, I instituted a short series of experiments, the results of which are stated tabularly below:

	Cuprichydrate used in gram.	Total nitrogen.		Albuminoid nitrogen.	
		1	2	1	2
Wheat bran	0.3-0.4	2.964 per cent	2.986 per cent	2.180 per cent	2.280 per cent
Wheat bran.....	0.8	" "	" "	2.25 "	" "
Cotton seed meal..	0.5	7.720 "	7.700 "	7.396 "	7.397 "
Cotton seed meal..	0.7	" "	" "	7.396 "	" "
Malt sprouts.....	0.8	4.718 "	4.786 "	3.142 "	3.204 "
Cotton seed meal (2d sample)	1.0	7.30 "	7.20 "	6.719 "	6.533 "
Cotton seed meal..	0.8	" "	" "	6.656 "	" "
Cotton seed meal..	0.5	" "	" "	6.656 "	" "

When I added from 0.7 to 1.0 gram of cupric hydrate and washed, first, with hot water by decantation, I found no difficulty in filtering in case of any of the substances experimented upon; also the precipitate, though somewhat harder on drying than with fodders less rich in nitrogen, could be pulverized quite easily in the mortar.

In the case of bran, when only 0.3 to 0.4 gram of cupric hydrate was used, the filtration was less rapid and the dried precipitate quite difficult to pulverize; but when 0.8 gram was added, these difficulties appeared only very slightly. With the second sample of cotton seed meal I failed to get as good results as with the other substances, owing in part, I think, to incomplete combustion, it being almost impossible to keep the acid free from color.



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, 1883. The year has been devoted to a continuation of the lines of work undertaken last season.

All products of the fields have been made subservient to the great staple of this soil, hay, and the best energies of the farm force have been devoted to a course of husbandry looking primarily to its welfare.

The acreage of the principal crops and their yields is as follows:

Grass 70 acres.....	155 tons
Barley 5 “	190 bushels
Oats 20 “	813 “
Beans 5½ “	56 “
Potatoes 8 “	1190 “

In addition to the above, one and one-half acres were used in testing different varieties of crops, seeds, and to garden purposes. Twenty-five acres were seeded to grass and clover, and a good stand secured.

The field of five and one-half acres, upon which farming by aid of chemical fertilizers alone was undertaken last year, was this season fertilized, four acres with Bradley's superphosphate, five hundred pounds per acre, and one acre received a preparation nearly destitute of phosphoric acid. The crop, beans, upon the superphosphate made good growth and gave promise of a heavy yield, but the very severe drouth at the time the seed was forming reduced the yield to about

one-half crop. That part of the field which received nitrogen and potash but no phosphoric acid, made but little better growth than when no fertilizer was applied, showing, as did the tests made last season, that the leading want of this soil is phosphoric acid. The yield of beans upon the field was fifty-seven bushels. Notwithstanding the injury sustained, the crop is worth more than the cost of production, which was two dollars fifty-two and one-half cents per bushel. Next season the field will be fertilized with superphosphate and raw bone, and be sown to barley and stocked to grass and clover, which should occupy the ground two years in this rotation course.

The work of renovating the twenty acre "brick yard field," which I indicated in my last report to trustees had been undertaken, is completed. Its drainage is now sufficient. It is well fertilized with unleached ashes and superphosphate, is covered with a fine growth of young grass and clover, and is evidently in condition to produce a succession of good crops of hay.

Adjoining this field is a tract of valley pasture land, which was nearly covered with bushes, stumps and swamp grass, but possessing the necessary natural conditions, when developed, for grass growing. Eighteen acres of this have been cleared, plowed into beds and provided with means of drainage, at a cost of \$431.05.

This field can be cropped with oats next season, and the year following seeded to grass, with grain, when it will be one of the best parts of the farm.

There are still remaining unredeemed, some twelve or fifteen acres of a similar character and condition as the above.

Preparations for next season's crops have been made. Upwards of forty acres are ready for cultivation, all of the farm manure which is to be used upon them having been applied to the land this fall, thus avoiding much delay in the hurry of seed time.

In connection with the field operations, I wish to speak of a few new implements that have been used this season to facil-

itate the work and relieve it of its drudgery. By aid of the broadcast grain and fertilizer distributor, we were enabled to sow by horse power all the seed and phosphate used upon the grain fields with accuracy, speed and ease.

The Planet Jr. Drill No. 2 was used for applying phosphate to potatoes and drilled crops at a cost for labor of thirty-one cents per acre. Whenever special fertilizers are used in drills, an implement of this character cannot be profitably dispensed with. Aside from the economy of its use, it changes a heavy, disagreeable task into comparatively light and pleasant work.

In harvesting potatoes, "Rigby's Digger," a Maine invention, saved, by careful tests, one-third of the entire cost of harvesting.

ANIMALS.

Earnest efforts have been made to improve the stock, and there are now forty cattle, twenty-four of them being thoroughbred.

The Short Horn herd contains five animals. The A. J. C. C. herd consists of eight, and of Maine Jerseys there are twelve. Among the members of these three herds I am free to say there is not an inferior animal. In the breeding of Short Horns, the aim has been to unite, so far as possible, the qualities of growth, thrift and flesh, with the ability to produce milk. In breeding both classes of Jerseys, constitutional vigor and rich milking powers have been sought for.

The remainder of the animals are of a cross between the Jersey and Ayrshire breeds.

In managing the stock, it receives nearly all its food from the barn throughout the entire year, but little dependence being placed upon the very limited pasturage aside from the opportunity it affords for recreation.

There has been an average of twenty-two cows and heifers in the dairy during the year. They have furnished 117,695 pounds of milk, 109,290 pounds of which have been made

into butter, producing 6,017 pounds, thus requiring 18.25 pounds of milk to produce one pound of butter. Had no milk or cream been sold, the amount of butter to each cow must have approximated very closely to three hundred pounds.

Butter sold for.....	\$1,839 73	
Milk and cream sold for.....	236 91	
Value of calves at birth.....	130 00	
		————— \$2,206 64

This gives a gross income to each cow of \$100.30. More than one-half of these animals are young, not yet having arrived at maturity.

The cost of grain fed to the herd was \$704.44. Cost of salt, &c., used by stock and in dairy, \$14.40. These expenses taken from receipts leave \$1,487.80—to pay for the hay consumed, which by repeated weighings was found to be seventy-one tons. This gives \$20.95 for each ton of hay used. No charge is made for labor, caring for stock or manufacturing butter, neither is credit claimed for skimmed milk or for manure resulting from food consumed.

The flock of Shropshire sheep and lambs numbers thirty-five good samples of this now popular breed, which unites early maturity and good size with a satisfactory fleece of medium wool.

Of swine, there are twelve breeding animals, and thirty-five pigs and shoats, all pure bred Chesters. It is the intention to make a specialty of producing a limited number of these sheep and pigs for sale as breeding animals.

FARM STATEMENTS.

APPRAISAL OF PROPERTY BY TRUSTEES NOVEMBER 30, 1882.

Live Stock.....	\$2,255 00	
Crops.....	1,636 50	
		————— \$3,891 50

APPRAISAL OF PROPERTY BY TRUSTEES NOVEMBER 30, 1883.

Live Stock.....	\$3,600 00	
Crops	2,956 00	
Experiments.....	230 00	
Machinery and Implements purchased during the year less 20 per cent.	150 14	
		————— \$6,936 14
Cash receipts for the year ending November 30, 1883.....		\$5,074 25
Cash expenditures for the year end- ing November 30, 1883.....		4,951 58
Liabilities November 30, 1882.....		1,877 47
Liabilities November 30, 1883		3,478 62

FARM CREDITS.

By excess of receipts above expend- itures.....	\$122 67	
By excess of appraisal of November 30, 1883, above appraisal of November 30, 1882.	3,044 64	
		————— \$3,167 31

FARM DEBITS.

To excess of liabilities of November, 1883 above liabilities of November 30, 1882..	\$1,601 15	
To appropriation for stock purchase..	1,000 00	
		————— \$2,601 15

—————
\$566 16

PERMANENT IMPROVEMENTS.

Not included in the above is the expenditure for clearing and plowing twenty acres of new land, and for erection of buildings and fence — all new work — and worth at least its cost of..... \$578 30

Balance in favor of farm..... \$1,144 46

SEED TRIALS.

“Arnold’s Gold Medal” Winter Wheat, sown September 18, 1882, upon well prepared clay soil, passed the winter without killing and gave at the rate of thirty-one bushels of grain per acre.

It is a smooth, white, beardless variety, and gives evidence of value, this being its second year’s trial here.

“Silbey’s No. 1” Spring Wheat, sown May 12. Late — failed to mature — worthless.

“Hallett’s Pedigree Original Red” Wheat made but little growth although on good soil — worthless.

“Egyptian” Oats. Large growth, heavy straw, too late to be of value.

“White Australian” Oats, claimed to be heavy and productive with stiff straw. With us they gave good straw but proved late and shelled badly before fully ripe.

“White Russian” Oats, large straw, but many light grains.

“Hogan” Oats. This is the second year’s trial of this seed. Last season, one acre, under high culture, gave eighty-seven bushels. This year, twenty acres of rank clay land, somewhat worn, was fertilized and seeded with two and one-fourth bushels per acre. This light seeding was to avoid smothering the young grass with a heavy growth of grain. The yield upon the field was eight hundred and thirteen bushels, or forty bushels per acre. These oats are of Irish origin—heavy strawed—the grain weighing forty pounds per bushel.

“Mensury” Barley. This is a new barley, having been from the Department of Agriculture but a short time. In the barley growing section of New York, where this seed was obtained, it is highly valued by both farmers and brewers. It is a large, stiff strawed, six rowed variety, having longer, heavier heads than any other barley I am acquainted with. Seven bushels of seed were sown on two and three-fourths acres and yielded one hundred and fourteen bushels.

“Purple Hulless” Barley. This is a dark colored grain without husk or hull, weighing sixty pounds per bushel. Last year a few quarts of the seed were received by the farm from the National Department of Agriculture, and sown, giving evidence of its worth. This season two and one-fourth bushels were sown on one and one-third acres of clay land in good condition. It made a rank, vigorous growth, stooling very freely. Heavy winds and rain broke it down badly, and occasioned much loss. Under these disadvantages, however, the yield was fifty-six and one-half bushels, weighing sixty-two pounds per bushel.

“Southern Cow” Peas. Although the growth was vigorous, the season proved far too short for their full development. Indications are that we have other plants better suited to our locality for forage, however valuable it may be in a warmer climate.

POTATO SEEDING.

Very large and very small potatoes were selected and planted whole. Medium sized ones were cut through the centre, leaving seed on one piece and stem on the other, and all planted alike.

Large potatoes yielded per plat	135 lbs. large,	16 lbs. small.
Small “ “ “	90 “	8 “
Seed end “ “ “	151 “	16 “
Stem end “ “ “	150 “	8 “

Fertilizer and feeding tests have been carried on during the year, an account of which is appended. In this work, Prof. Balentine was associated with me, and the analyses are due to him.

The care and labor involved in these tests, covering periods of from sixty to eighty-four days is considerable, and it is believed they will form a part of important investigations.

The comparison of early and late cut hay, and of corn meal, cotton seed meal and bran, will be repeated this winter.

An important question in economy is: Shall animals be fed to repletion, or will lighter feeding give more satisfactory results?

An examination of this subject will be commenced very soon and cover periods of several months; the animals selected will be cows in milk, and growing pigs. Employing classes of animals differing so widely will give greater breadth and value to the work.

Respectfully,

G. M. GOWELL.

FARM EXPERIMENTS.

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

EXPERIMENT No. 3.

Manuring with different forms of phosphoric acid.

This is the continuation of a series of experiments commenced on the farm in 1880, and has for its object the determination of the relative agricultural values of the different forms of phosphoric acid, known as soluble, reverted and insoluble.

The field selected for the experiment was a clay loam soil, that had been in grass for many years. It was divided into plots 38 rods long by $3\frac{1}{2}$ feet wide, each containing one-twentieth of an acre. To each of these plots, except two that were left without manure of any kind, was added a basal mixture of sulphate of ammonia and muriate of potash. To this were added the various forms of phosphoric acid. Dissolved bone black, containing 15 per cent. of soluble phosphoric acid was used for the soluble; dissolved bone black, reverted by mixing with wood ashes and moistening with water, furnished the reverted phosphoric acid. The insoluble acid was furnished in one case by ground bone, and in the other by South Carolina rock.

The fertilizers were all applied in the drill and thoroughly mixed with the soil, and the field planted with potatoes, receiving clean culture throughout. Below, in a tabulated form, are given the results of the work :

Plot.	Quantities of fertilizers per plot.	Yield, per plot.	Yield, per acre.
No. 1.	No manure,	111 lbs.	37 bu.
No. 2.	25 lbs. ground bone, 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	198 "	66 "
No. 3.	25 lbs. South Carolina rock (ground), 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	201 "	67 "
No. 4.	20 lbs. dissolved bone black, 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	271½ "	90½ "
No. 5.	20 lbs. dissolved bone black, reverted with ashes, 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	175½ "	58½ "
No. 6.	20 lbs. dissolved bone black, reverted with ashes, 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	153 "	51 "
No. 7.	20 lbs. dissolved bone black, 10 lbs. muriate of potash, 10 lbs. sulphate of ammonia,	429 "	143 "
No. 8.	Nothing,	117 "	39 "

EXPERIMENT NO. 4.

Comparison of Feeding Values of Early and Late Cut Hay.

A field of grass of uniform quantity and quality, consisting mostly of clean herds-grass, with a very little white-weed intermixed, was selected and divided into plots two and one-half rods in width and twenty rods in length. The grass upon the first, third, and fifth plots was cut when in full bloom—July 11th; and the second, fourth and sixth plots were cut twenty days later—August 3d, when the seed had become hard but not sufficiently ripe to shell in harvesting.

The weight of hay cut early, at time of putting in the barn, was 2,931 lbs. per acre. Weight of same Feb. 14th, 2,675 lbs.; shrinkage, $8\frac{3}{4}$ per cent.

The weight of hay cut late, at time of harvesting was 3,150 lbs. per acre. Weight of same Feb. 14th, 2,662 lbs.; shrinkage, $15\frac{1}{2}$ per cent.

The greater shrinkage in the late cut hay is probably owing to its being weighed directly from the bunches that had stood in the field over night. The amount of winter dry hay from each cutting was practically the same.

Chemical analysis of the hay showed the following composition:

EARLY HAY.

Moisture	10.7 per cent.
Protein	6. "
Fat	3.3 "
Nitrogen-free extract	48.5 "
Crude Fibre	27.7 "
Ash	3.8 "

LATE HAY.

Moisture	7.8 per cent.
Protein	4.6 "
Fat	2.8 "
Nitrogen-free extract	51. "
Crude Fibre	30.2 "
Ash	3.6 "

To test the comparative feeding value of this hay two cows as evenly mated as possible were selected, each being cross-bred, seven-eighths Jersey and one-eighth Ayrshire. They were comparatively fresh, having been in milk but a few weeks. They each received

three lbs. of corn meal, three lbs. of cotton seed meal, one and one-half lbs. of bran, and twenty lbs. of hay daily throughout the entire period of feeding.

Bess was fed during the first period of twelve days upon late hay, the first six being in preparation and to overcome the influence of previous feeding, and the milk product of the last six days of the period was taken as the result of the late hay. At the close of the first period her feed was changed to early hay, and she was fed upon this during the second period of twelve days, the first six to destroy the influence of previous feeding as before, and the last six the milk produced represented the result of the early hay consumed during that time. The third period her hay was the late cut, fed as in the first. This feeding alternately on late and early hay was continued through six periods of twelve days each, or seventy-two days.

The cream was raised and butter made from it under similar conditions during each period, the butter being made from the milk of one day, and calculated for the period from the number of pounds of milk required for one pound of butter. The total amount of fat contained in each day's milk was ascertained by chemical examination.

This same course of feeding and testing was repeated with Pet, excepting when Bess had late hay Pet had early, and when Bess had early, Pet had late. This was for the purpose of equalizing the influence of the variation of temperature that might occur.

BESS.

Periods of six days each.	Feed.	Pounds milk for period.	Per cent of cream.	Pounds milk required for 1 pound butter.	Pounds butter for period.	Pounds fat in milk for period.	Weight of cows at end of periods.
First	Late Hay	160.12	21	14.46	11.07	5.88	860
Second	Early Hay	163.87	19	18.54	8.33	6.33	860
Third	Late Hay	149.18	19	19.40	7.69	5.97	865
Fourth.....	Early Hay.....	150.25	22	14.69	10.23	5.99	860
Fifth.....	Late Hay.....	133.68	20	15.41	8.67	5.51	870
Sixth.....	Early Hay.....	144.18	19	21.44	6.72	5.63	845

PET.

First	Early Hay.....	187.37	21.5	19.46	9.62	6.33	862
Second.....	Late Hay	169.37	19.5	20.5	8.21	6.51	865
Third	Early Hay.....	178.43	20.	21.75	8.20	6.73	862
Fourth.....	Late Hay	157.68	22.5	17.04	9.25	5.88	910
Fifth.....	Early Hay.....	166.06	20.	17.69	9.38	6.35	912
Sixth.....	Late Hay	151.12	20.	18.94	7.97	5.55	905

It was found that 270 lbs. of mixed grain and 720 lbs. of early hay produced 990.12 lbs. of milk, which yielded 52.98 lbs. of butter, and the milk contained 37.36 lbs. of fat. The same quantity and quality of grain as above, fed in connection with 720 lbs. of late hay, gave 921.15 lbs. of milk, which yielded 52.85 lbs. butter, the milk containing 35.3 lbs. fat.

In this test the comparative value of the early and late hay for milk production was as 100 to 93.34, or the daily feeding ration of 20 lbs. of early hay was equal to 21.42 lbs. of late hay for the same purpose. There was practically no difference in the amounts of butter obtained from each fodder. It was feared that the appetites of the animals might not be as good for the late as for the early hay, but such was not the case to any serious extent. In only two of the six changes from early to late was there any dislike exhibited, and this was overcome during the first day of feeding upon it.

In one of the six changes from late to early there was nearly the same dislike manifested. This was somewhat surprising, as the early hay was green and fresh, while the late was evidently nearly ripe.

It must, however, be borne in mind that the weather during the last haying season was unusually favorable to late standing grass, no rain of consequence occurring after July 10th.

These results show much less difference in the nutritive value and palatability of hay harvested when in full bloom, and that harvested at a much later period, than has generally been supposed to exist.

EXPERIMENT NO. 5.

Hungarian and Mixed Hay Compared in Feeding.

The important position which Hungarian grass is destined to occupy among the forage crops of the State, together with the lack of accurate data bearing upon its feeding value, prompted its comparison by careful feeding tests with a good quality of mixed Timothy and Red Clover hay. When it is remembered that Hungarian is an annual, to be sown in June, ready for harvest in August, and yielding from two to four tons of cured hay per acre, succeeding upon light or heavy soils if sufficiently fertile, its value as a means of increasing the stock carrying capacity of farms becomes apparent.

The Hungarian hay fed was grown last season and harvested in fine order, as was also the mixed hay with which it was compared.

Two cows fresh in milk—"Helen Hart" and "Maggie 3d"—were selected and fed upon the same plan that the animals were in the late and early hay test, the cream, butter and fats being obtained by the same processes there employed.

They each received the same quantity and quality of mixed grain throughout, viz: 3 lbs. corn meal, 3 lbs. cotton seed meal and one and one-half lbs. of bran daily. Each one also consumed twenty-two pounds of Hungarian, or mixed hay per day. This course extended through five periods or sixty days.

The composition of the Hungarian and mixed hay was as follows:

HUNGARIAN HAY.

Moisture	8.7 per cent.
Protein	6.8 "
Fat	3.5 "
Nitrogen-free extract	48.7 "
Crude Fibre	26.4 "
Ash	5.9 "

MIXED HAY.

Moisture	8.2 per cent.
Protein	5.5 "
Fat	2.7 "
Nitrogen-free extract	48 "
Crude Fibre	30.8 "
Ash	3.9 "

HELEN HART.

Periods of six days each.	Feed.	Pounds milk.	Per cent of cream.	Pounds milk required for 1 pound butter.	Pounds butter.	Pounds fat in milk.	Weight of cows at end of periods.
First	Hungarian	174.62	22.5	19.04	9.176	6.09	985
Second	Timothy and Clover	163.93	25.5	15.43	10.624	6.21	990
Third	Hungarian	173.0	19.0	22.25	7.775	6.13	990
Fourth	Timothy and Clover	155.18	21.5	22.5	6.897	5.76	1005
Fifth	Hungarian	159.0	21.	22.44	7.085	6.04	980

MAGGIE 3d.

First	Timothy and Clover	204.5	22.	23.12	8.845	6.39	1050
Second	Hungarian	213.06	22.	23.16	9.199	7.18	975
Third	Timothy and Clover	187.18	22.	24.59	7.612	6.37	1028
Fourth	Hungarian	206.0	21.5	19.67	10.508	7.27	1026
Fifth	Timothy and Clover	193.43	21.5	23.32	8.295	6.76	1040

Two hundred and twenty-five pounds of mixed grain and 660 lbs. of Hungarian hay furnished 925.68 lbs. of milk, and 43,743 lbs. of butter—the milk containing 32.71 lbs. of fat.

The same quantity of grain and 660 lbs. mixed hay gave 904.22 lbs. of milk, 42,273 lbs. butter, and the milk contained 31.49 lbs. of fat.

The relative value of the Hungarian to the mixed hay was as 100 to 97.68 for milk production, and for butter production as 100 to 96.64.

The twenty-two pounds mixed hay was all the animals would consume per day. The same quantity of Hungarian was eaten with much apparent relish, and evidently more would have been utilized had it been supplied.

EXPERIMENT No. 6.

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

To learn the comparative practical feeding values of cotton seed meal, corn meal and bran, as milk and butter producers when used in connection with good hay, was the purpose of this feeding test.

Two cows, Clover and Rockaway, were fed through seven twelve-day periods, upon good mixed hay, the quality of which was uniform throughout the whole time of feeding. Rockaway received twenty pounds daily, while nineteen pounds was all Clover would consume.

During the first period Clover received, in addition to the hay, six lbs. per day of cotton seed meal. During the second period six lbs. of corn meal, and during the third period six lbs. of wheat bran or shorts. In the fourth, fifth and sixth periods, the work of the first three periods was duplicated. In the seventh period, the feed was hay alone.

Rockaway was fed through the several periods upon the same plan pursued with Clover. The resulting butter and fats were obtained by the same processes employed in the early and late hay test.

The cows at the commencement of this experiment had been in milk some seven months, which accounts for their small yields.

The grain used in this experiment, as well as in experiments Nos. 4 and 5, had the following compositions, and may be considered as fair representatives of these feeds, as usually found in the markets:

COTTON SEED MEAL.

Moisture	9.0 per cent.
Protein	40.2 "
Fat	12.5 "
Nitrogen-free extract	24.7 "
Crude Fibre	5.2 "
Ash	8.8 "

CORN MEAL.

Moisture	14.6 per cent.
Protein	9.2 "
Fat	3.6 "
Nitrogen-free extract	69.1 "
Crude Fibre	1.9 "
Ash	1.6 "

WHEAT BRAN.

Moisture	11.6 per cent.
Protein	14.0 "
Fat	2.9 "
Nitrogen-free extract	56.8 "
Crude Fibre	8.4 "
Ash	6.3 "

The hay fed in this test was the same as that used in experiment No. 5 against Hungarian.

CLOVER.

Periods of six days each.	Feed.	Pounds milk for period.	Per cent of cream.	Pounds milk required for 1 pound butter.	Pounds butter for period.	Pounds fat in milk for period.	Weight of cows at end of periods.
First.....	Cotton seed meal...	94.25	22.5	25.20	3.74	3.27	847
Second....	Corn meal	87.81	19.5	28.25	3.104	3.22	825
Third.....	Bran	73.62	21.	18.9	3.89	2.92	835
Fourth....	Corn meal	87.06	24.	20.4	4.267	3.36	855
Fifth.....	Cotton seed meal..	90.06	19.5	20.6	4.372	2.91	865
Sixth.....	Bran	76.56	21.5	19.24	4.979	2.98	862
Seventh..	Nothing.....	45.75	24.5	17.12	2.671		864

ROCKAWAY.

First.....	Corn meal.....	105.62	No separation of cream from milk detectable	21.98	4.85	4.20	1010
Second....	Cotton seed meal...	103.37		19.50	5.301	4.82	1007
Third.....	Bran	94.12		18.66	5.04	3.97	1020
Fourth....	Cotton seed meal...	107.5		28.40	3.785	4.52	1012
Fifth.....	Corn meal.....	108.68		23.83	4.561	4.75	1045
Sixth.....	Bran	98.5		25.53	3.858	4.20	1013
Seventh..	Nothing	62.		25.	2.481		1021

It was found that 468 lbs. of hay and 144 lbs. of cotton seed meal gave 395.18 lbs. of milk, 17,198 lbs. of butter, and 15.52 lbs. of fat.

That 468 lbs. of hay and 144 lbs. of corn meal gave 389.17 lbs. of milk, 16,782 lbs. of butter and 15.53 lbs. of fat.

That 468 lbs. of hay and 144 lbs. of bran gave 342.8 lbs. of milk, 16,767 lbs. of butter and 14.07 lbs. of fat.

The relative values of these foods for milk production are represented as follows: Cotton seed meal, 100; corn meal, 98.4; bran, 86.7. As butter producers, cotton seed meal, 100; corn meal, 97.5; bran, 97.4.

Regarding the economy of the foods, the cotton seed and corn meal each cost one and one-half cents per lb. and the bran cost one and one-fourth cents per lb.

The cotton seed used in the production of 100 lbs. of milk cost 54.6 cents. The corn meal used in the production of 100 lbs. of milk cost 55.5 cents. The bran used in the production of 100 lbs. of milk cost 52.5 cents. The cotton seed meal used in the production of 1 lb. of butter cost 12.56 cents. The corn meal used in the production of 1 lb. of butter cost 12.87 cents. The bran used in the production of 1 lb. of butter cost 10.73 cents. These costs are in addition to the value of hay employed.

Had these materials been used in connection with a poor quality of hay or straw, the results might have varied more widely in their relations to each other. Again, had the cows fed been fresh in milk rather than in the latter part of their year's work, the yield from the foods would have been much larger, costing less per pound, yet relatively they might not have been affected.

The several samples of butter made from cotton seed meal were very good in both texture and color. Those from bran were so much like the cotton seed samples that no difference could be detected, while those produced from corn meal were superior in firmness and color to all others. The butter from hay with no grain was of decidedly inferior quality in every respect.

It is not claimed that these experiments definitely settle any disputed point or mooted question. Many such are required before a truth can be established, yet, from the length of time over which they have extended, the number of periods employed, and the care devoted to the work throughout, they do furnish data which may not be disregarded.

TREASURER'S REPORT.

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

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

GENERAL ACCOUNT.

RECEIPTS.	
On the State appropriation.....	\$6,000 00
Drawn from Hallowell Savings Bank.....	1,000 00
Tuition of students.....	795 00
Balance on hand Dec. 7, 1882.....	475 43
ENDOWMENT.	
Interest on State bonds.....	4,449 00
“ Hallowell Academy bonds.....	240 00
“ Bangor city bonds.....	180 00
Total.....	\$13,139 43
DISBURSEMENTS.	
GENERAL.	
Repairs on White House.....	\$323 25
G. M. Gowell, loaned for farm use.....	1,000 00
Insurance.....	701 82
Advertising.....	35 00
G. H. Hamlin, general expenses.....	18 00
Gas apparatus.....	500 00
Apparatus for department.....	300 00
W. Balentine, experimental work.....	50 00
P. Wall, on work shop.....	200 00
A. T. Wing, on work shop.....	1,000 00
W. P. Wingate, Trustee expenses.....	19 00
L Oak, “ “.....	27 87
ENDOWMENT.	
G. M. Gowell, Farm Superintendent, salary.....	650 00
The Faculty, salaries.....	5,741 67
Total.....	10,566 61
Balance due College account.....	2,572 82
Total.....	\$13,139 43

The above embraces the account of Eben Webster, Treasurer, to the date of his death, Aug. 24, 1883. Settled with the administrator.

The following embraces the account of your present Treasurer to the present date :

RECEIPTS.	
GENERAL ACCOUNT.	
Cash balance of my predecessor's account Sept 6, 1883.....	\$2,572 82
Loan by Treasury note Sept. 6.....	1,500 00
Tuition of students	1,201 00
On State appropriation.....	500 00
ENDOWMENT.	
Interest on State bonds.....	2,649 00
Total	\$8,422 82
DISBURSEMENTS.	
Items on account of work shop, M. C. Fernald	\$300 00
Balance of contract on work shop, P. Wall.....	281 25
Payment " " A. T. Wing.....	48 00
" " " "	700 00
" " " "	154 55
Payment on general account to M. C. Fernald	119 95
" " " "	116 20
" " " "	23 25
Payment for instruction to W. Flint.....	75 00
D. H. Thfng, Trustee expenses.....	49 47
Z. A. Gilbert, " "	32 60
W. T. Haines, " "	15 20
L. S. Moore, " "	18 50
A. M. Robinson, " "	20 00
L. Oak, " "	16 45
W. P. Wingate, " "	26 00
ENDOWMENT.	
G. M. Gowell, salary.....	\$250 00
The Faculty, salaries.....	5,698 62
Total.....	\$7,945 04
SUMMARY.	
EMBRACING THE TWO ACCOUNTS AND FOR THE ENTIRE YEAR.	
Balance on hand last report.....	\$475 43
Total receipts for the year.....	18,514 00
Total payments.....	18,511 65
Balance on hand Dec. 18, 1883.....	477 78
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.....	477 78
	\$129,777 78

J. FRED WEBSTER, *Treasurer.*

ORONO, Dec. 18, 1883.

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

By direction of the Trustees.

W. P. WINGATE.

CATALOGUE

OF THE

Maine State College of Agriculture and Mechanic Arts.

ORONO, MAINE, 1883-84.

TRUSTEES.

HON. LYNDON OAK, GARLAND, *President.*
HON. WILLIAM P. WINGATE, BANGOR.
HON. CALEB A. CHAPLIN, HARRISON.
HON. LUTHER S. MOORE, LIMERICK.
HON. A. M. ROBINSON, DOVER.
HON. DANIEL H. THING, Mt. VERNON.
CAPT. CHARLES W. KEYES, FARMINGTON.
WM. T. HAINES, Esq., WATERVILLE, *Secretary.*
HON. Z. A. GILBERT, EAST TURNER,
Secretary of Maine Board of Agriculture, *ex-officio.*

TREASURER :

J. FRED WEBSTER, ORONO.

EXECUTIVE COMMITTEE :

HON. LYNDON OAK.
HON. A. M. ROBINSON.
WM. T. HAINES, Esq.

EXAMINING COMMITTEE :

HIS EXCELLENCY FREDERICK ROBIE.
REV. CHARLES F. ALLEN, D. D.
JOHN F. ANDERSON, C. E.

FACULTY.

MERRITT C. FERNALD, A. M., PH. D., PRESIDENT,
and Professor of Physics and Mental and Moral Science.

ALFRED. B. AUBERT, B. S.,
Professor of Chemistry, and Secretary of the Faculty.

CHARLES H. FERNALD, A. M.,
Professor of Natural History.

GEORGE H. HAMLIN, C. E.,
Professor of Civil Engineering, and Librarian.

ALLEN E. ROGERS, A. M.,
Professor of Modern Languages, Logic and Political Economy.

WALTER BALENTINE, M. S.,
Professor of Agriculture.

CHARLES H. BENJAMIN, M. E.,
Professor of Mechanical Engineering, and Registrar.

LIEUT. EDGAR W. HOWE, 17TH INFANTRY, U. S. A.,
Professor of Military Science and Tactics.

WALTER FLINT, B. M. E.,
Instructor in Wise-work and Forge-work.

GILBERT M. GOWELL,
Farm Superintendent.

HENRY M. LANDER,*
Steward.

*Jesse G. Johnson, Steward after January 1, 1884.

STUDENTS.

SENIOR CLASS.

Allan, George Herman,
Burleigh, Will Hall,
Conroy, Mary Frances,
Cutter, Leslie Willard,
Fernald, Hattie Converse,
Hatch, Elmer Ellsworth,
Hill, John Edward,
Kelley, Joseph Grant,
Ladd, Edwin Fremont,
Lunt, Clarence Sumner,
Morey, William, Jr.,
Pattangall, William Robinson,
Stevens, Fred Leroy,
Webber, William,

Dennysville.
Vassalboro'.
Brewer.
Bangor.
Orono.
Lagrange.
Bangor. 57
Orono. 48
Starks. 59
Stillwater. 7
Hampden. 22
Pembroke. 24
Temple. 28
Guilford. 31

JUNIOR CLASS.

Chamberlain, George Walter,	W. Lebanon.
Dole, Ashar,	Brewer.
Dutton, Orion Jesse,	Vassalboro'.
Fernald, Henry Leroy,	Orono.
Goodridge, Elmer Orlando,	Milo.
Hanscom, George Loring,	Orono.
Hart, James Norris,	Howard.
Hull, Frank Eugene,	Warren.
Keyes, Austin Herbert,	Orland.
Manter, Frank Ellsworth,	Milo.
Merrill, Dennis D.,	Orono.
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.

SOPHOMORE CLASS.

Allan, Bert John,	Pembroke.
Ayer, Josiah Murch,	Freedom.
Barker, George Greenleaf,	Roekland.
Bartlett, Eugene Clarence,	Orono.
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.
Williams, Charles Sampson,	Monhegan Island.

FRESHMAN CLASS.

Allen, John Wallace,	Presque Isle.
Brick, Francis Stephen,	Biddeford.
Cilley, Luis Vernet Prince,	Rockland.
Clark, Bert Elmer,	West Tremont.
Coffin, Edwin Voranus,	Harrington.
Harris, William John,	Groton, Mass.
Houghton, Austin Dinsmore,	Ft. Fairfield.
Kennedy, James Samuel,	Ludlow.
Kirkpatrick, Fred Hudson,	Bangor.
Lazell, James Draper,	Rockland.
Leland, Charles Herbert,	East Sangerville.
Lincoln, Harry Foster,	Dennysville.
Mason, Charles Ayers,	Bethel.
Merrill, Fenton,	Orono.
Perham, William Lincoln,	Paris.
Ruth, Alfred Smith,	Linneus.
Stevens, Charles Hildreth,	Ft. Fairfield.
Trask, Frank Ellsworth,	Bethel.
Tucker, Frank Lincoln,	Norway.
Wentworth, Charles Williams,	Windham.
Young, Rodney Adelbert Buxton,	Greenbush.

SPECIAL COURSE.

Butler, Frederick Heywood,	Hampden.
Dickerson, Fred William,	Belfast.
Libby, Willard Alton,	South Auburn.
Libby, Charles Leon,	South Auburn.
Moore, Dudley Watson, Jr.,	Waterville.
Vose, Elisha Chick,	Bangor.

SUMMARY.

Seniors,	14	Freshmen,	21
Juniors,	17*	Special,	6
Sophomores,	18		—
		Total,	76

PRIZES FOR 1882.

- Coburn Prize for best Junior Essay, awarded to W. H. Burleigh.
 Coburn Prize for best Sophomore Declamation, awarded to F. L. Russell.
 Second Prize, Sophomore Declamation, awarded to G. W. Chamberlain.
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MILITARY DEPARTMENT.

COBURN CADETS.

- Commandant*—2d Lieut. EDGAR W. HOWE, 17th U. S. Infantry.
Captain—C. S. LUNT.
Lieutenants—J. E. HILL, E. F. LADD, WM. WEBBER and F. L. STEVENS.
First Sergeant—H. L. FERNALD.
Sergeants—E. O. GOODRIDGE, L. W. RIGGS, A. H. KEYES and L. G. PAINE.
Corporals—H. S. FRENCH, I. B. RAY, R. K. JONES, A. D. PAGE, E. C. BARTLETT and C. A. SEARS.

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.,	} Skowhegan.
S. W. Gould, B. S.,	
Principal Hoyt, and	} Greeley Institute, Cumberland.
O. C. Farrington, B. S.,	
S. K. Hitchings, B. S.,	Biddeford.
A. P. Soule, A. B.,	Dexter.
Henry K. White, A. M.,	East Machias.
Rev. W. R. Cross,	Milltown, N. B.
Henry W. Johnson, A. B.,	Bethel.
I. C. Phillips, A. B.,	Wilton.
W. P. Foster, A. B.,	Ellsworth.

Examinations may be taken before the three examiners last named, on June 14, 1884, at their respective places of residence, or at the institutions over which they preside.

The other 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. M. W. Prince, A. M.

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 two years, 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 Junior and Senior 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.

<i>First Term.</i>	<i>Second Term.</i>
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.

<i>First Term.</i>	<i>Second Term.</i>
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.

<i>First Term.</i>	<i>Second Term.</i>
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.

<i>First Term.</i>	<i>Second Term.</i>
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.

Algebra.
 Physical Geography.
 Physiology.
 P. M. Labor on Farm.

Second Term.

Algebra and Geometry.
 Rhetoric and Botany.
 French.
 P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.

Trigonometry.
 General Chemistry.
 French.
 P. M. Free-Hand Drawing.
 Mechanical Drawing.

Second Term.

Analytical Geometry and Calculus.
 Descriptive Astronomy and Surveying.
 Physics.
 P. M. Mechanical Drawing and Field Work.

THIRD YEAR.

First Term.

Henck's Field Book.
 Calculus.
 Physics.
 German.
 P. M. Field Work and Drawing.

Second Term.

Mechanics.
 Descriptive Geometry.
 German.
 P. M. Isometric and Cabinet Projection and Perspective.

FOURTH YEAR.

First Term.

Civil Engineering.
 Stereotomy.
 Practical Astronomy.
 Logic.
 P. M. Topography and R. R. Work.

Second Term.

Civil Engineering, Designs and Specifications.
 Mineralogy and Geology.
 Zoology.
 U. S. Constitution and Political Economy.
 P. M. Analytical Chemistry, Designing and Thesis Work.

EXPLANATORY STATEMENT.

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 textbook 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 materials 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 Engineering three years after, on presentation of a satisfactory thesis with proof of professional work or study.

COURSE IN MECHANICAL ENGINEERING.

FIRST YEAR.

First Term.

Algebra.
 Physiology.
 Physical Geography.
 P. M. Labor on Farm.

Second Term.

Algebra and Geometry.
 Rhetoric and Botany.
 French.
 P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.

Trigonometry.
 French.
 General Chemistry.
 P. M. Free-Hand Drawing and
 Carpentry.

Second Term.

Descriptive Geometry.
 Descriptive Astronomy.
 Physics.
 P. M. Mechanical Drawing and
 Forge Work.

THIRD YEAR.

First Term.

Kinematics.
 Analytical Geometry.
 Vise Work, Physics.
 P. M. Machine Drawing.

Second Term.

Dynamics and Machine Design.
 Calculus.
 Machine Drawing.
 P. M. Isometric and Cabinet Pro-
 jection and Machine Drawing.

FOURTH YEAR.

First Term.

Hydraulic Motors.
 Practical Astronomy.
 Logic.
 P. M. Machine Drawing and
 Designing.

Second Term.

Steam Engine, and Boiler Designs
 and Specifications.
 Valve and Link Motions.
 U. S. Constitution and Political
 Economy.
 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 time is given to dynamics and the laws of the strength of materials, the student being required to design machine details in accordance with those laws.

In the Senior year, during the first term, instruction is given by lectures on the storage of water for power, and on the theory and construction of modern water-wheels. Practical problems on these subjects are worked out by the students. The first part of the spring term 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, in making detail drawings of the same, such as would be required to work from in the shop, and in preparing their thesis.

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 Vavle.	Zenner,	Valve and Link Motions.
Van Buren,	Strength of Machinery.	Auchincloers,	" " "
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 the full degree of Mechanical Engineer three years afterwards upon presentation of a satisfactory thesis and proof of professional work or study.

COURSE IN CHEMISTRY.

FIRST YEAR.

First Term.
 Physical Geography.
 Physiology.
 Algebra.
 P. M. Labor on Farm.

Second Term.
 Rhetoric and Botany.
 Algebra and Geometry.
 French.
 P. M. Book-Keeping and Labor on Farm.

SECOND YEAR.

First Term.
 General Chemistry.
 Botany.
 French.
 Trigonometry.
 P. M. Free-Hand Drawing.

Second Term.
 Qualitative Chemistry.
 Physics.
 Descrip. Astronomy and Surveying.
 P. M. Mechanical Drawing and Field Work.

THIRD YEAR.

First Term.
 Chemistry.
 Physics.
 German.
 English and American Literature.
 P. M. Laboratory Work.

Second Term.
 Chemistry.
 Zoology and Entomology.
 German.
 P. M. Laboratory Work.

FOURTH YEAR.

First Term.
 Chemistry.
 Comparative Anatomy.
 History of Civilization.
 Logic.
 P. M. Laboratory Work.

Second Term.
 Chemistry.
 Mineralogy and Geology.
 U. S. Constitution and Political Economy.
 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.

STANDARD TIME.	SENIORS.	JUNIORS.	SOPHOMORES.	FRESHMEN.
7.30 A.M.	History of Civilization, I, IV, V. Civil Engineering, II.	German, I, II, IV, V. Kinematics, III.	General Chemistry.	Physical Geography.
8.40 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.
9.35 A.M.	Stereotomy, II. (F. of T.) Sanitary Engineering, II, (L. of T.) Comparative Anatomy I, IV, V. Hydraulic Motors, III.	Farm Drainage and Mechanics, I. Physics, I, II, III, IV, V. (L. of T.) Vise work, III. (F. of T.)	French.	
10.30 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. Machine and Working Drawings, 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.

STANDARD TIME.	SENIORS.	JUNIORS.	SOPHOMORES.	FRESHMEN.
7.30 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.)
8.40 A. M.	Mental and Moral Science, I, V. Civil Engineering, and Contracts, Designs and Specifications, II. Laboratory work, IV. Valve and Link Motions, III.	German, I, II, IV, V. Machine Drawing, III.	Qualitative Analysis, I, IV, V.	Book-keeping. (F. of T.) Botany. (L. of T.)
9.35 A. M.	Cultivation of Cereals, care and feeding of animals, etc., I. Laboratory work, IV. Zoology, II. Steam Engines and Boilers, 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.
10.30 A. M.	U. S. Constitution and Political Economy, I, II, III, IV, V.	Zoology and Entomology, I, IV, V. Dynamics and Machine Design, 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. Translation 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. The labor is designed to be as much as possible educational, so that every student may become familiar with all the forms of labor upon the farm and in the garden.

The students of the three upper classes carry on their principal labor in the laboratory, the drawing rooms, the work shops, 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 batallion 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 several 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 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, Bangor Messenger, Fairfield Journal, 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, New York Witness, Official Gazette U. S. Patent Office, Bangor Daily Commercial, Farmington Chronicle, Good Templars' Record, Phillips Phonograph, Springvale Advocate, Wilford's Microcosm.

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, Missouri Republican, New York Times, New York Tribune, Scientific American, Scientific American Supplement, Sunday Herald, Eastern Argus (furnished by S. W. Gould,) American Naturalist, Blackwood's, Charleston Weekly News, Detroit Commercial Advertiser, Engineering News, Justice, 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 of 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 sureties 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.

<i>Name and Occupation.</i>	<i>Residence.</i>
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., Division Engineer, Shore Line 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	Benton
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	Red Bluffs, Wyoming Territory
David R. Hunter, B. S., Police Officer	Oakland, Cal.
Louise H. Ramsdell, B. S., (Mrs. Milton D. Noyes)	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.

<i>Name and Occupation.</i>	<i>Residence.</i>
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.
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., Book-keeper	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 Div. Engineer N. P. R. R., Bozeman, Mon.	
Fred M. Bisbee, C. E., Civil Engineer Mex. C. R. R., El Paso, Tex.	
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., Draughtsman St. P. M. & M. Ry., St. Paul, Minn.	
Vetal Cyr, B. S., Principal of Madawaska Training School, Fort Kent	
James E. Dike, C. E., U. S. Surveyor	Fargo, Dakota Ter.
*Willis O. Dike, B. S.	Gorham
Horace M. Estabrook, B. S., Teacher, Normal School	Gorham
Arthur M. Farrington, B. S., Veterinary Inspector and Supt. Quar- antine Station, Garfield, N. J.	
George O. Foss, C. E., U. S. Engineer	St. Paul, Minn.

*Deceased.

<i>Name and Occupation.</i>	<i>Residence.</i>
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.....	New Gloucester
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.....	Houlton
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., Business Manager, Flouring Mills of Leonard Day & Co., 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, B. C. E., Ass't Engineer N. P. R. R., Brainard, Minn.	
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

* Deceased.

<i>Name and Occupation.</i>	<i>Residence.</i>
*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
Charles E. Towne, B. C. E., Government Surveyor,	Helena, Montana
James W. Weeks, B. M. E., Draughtsman . . .	Cedar Rapids, Iowa
Nellie E. Weeks, B. S., (Mrs. Llewellyn Spencer)	Orono
Ivan E. Webster, B. S., Lumberman.	Orono

CLASS OF 1878.

Emma Brown, B. S., Teacher, (Mrs. Charles Gilman)	Enfield
Andrew J. Caldwell, B. M. E., Draughtsman.	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., Farmer.	Ipswich, Dak. Ter.
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 and Contractor,	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	Dexter
John D. Cutter, B. S., Physician, 336 West Washington St.,	Chicago, Ill.
Wilbur F. Decker, B. M. E., Inst'r in Vise Work and Forge Work,	State University, Minneapolis, Minn.
David A. Deerow, B. C. E., Draughtsman, Holly Man'g Company,	Lockport, New York
Willis E. Ferguson, B. S., Farmer.	San Gabriel, California

<i>Name and Occupation.</i>	<i>Residence.</i>
Charles W. Gibbs, B. C. E., Civil Engineer.....	Glenburn
Annie M. Gould, B. S., Teacher.....	Stillwater
Nellie M. Holt, B. S., Teacher	Orono
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.	Washington, D. C.
John W. Meserve, B. M. E., Mech. Engineer, Cambridgeport, Mass.	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 Manager,	Bangor and St. John, N. B.

CLASS OF 1880.

Horace W. Atwood, B. S., Veterinary Surgeon...Providence, R. I.	Providence, R. I.
James M. Bartlett, M. S., Analytical Chemist State College, Penn.	State College, Penn.
Albert H. Brown, B. S	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., Teacher	Levant
Fred W. Fickett, B. S., U. S. Signal Service.....	Sitka, Alaska
George W. Lufkin, B. C. E., Civil Engineer, N. P. R. R.,	St. Paul, Minn
Frank A. Mansfield, M. S., Theological Student . . .	Oberlin, Ohio
Annie A. Matthews, B. S., Teacher	Stillwater
Henry W. Murray, B. C. E., Teacher	Milton, California
Franklin R. Patten, B. C. E., Ass't Engineer to Col. Waring,	Newport, R. I.

<i>Name and Occupation.</i>	<i>Residence.</i>
Charles T. Pease, B. S., Civil Engineer, Mex. Nat. R. R.,	Laredo, Texas
James F. Purington, B. S., Farmer	Bowdoin

CLASS OF 1881.

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.	Arlington, Mass.
Fannie E. Colburn, B. S., Teacher	Orono
Edward H. Farrington, B. S., Chemist, Agricultural Experiment Station, New Haven, Conn.	
Oliver C. Farrington, B. S., Teacher Greely Institute, Cumberland	
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., City Engineer, Bismarck, Dak. Ter	
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., Bernard, Dak. Ter.	
Oscar L. Pease, B. S., U. S. Signal Service	Phoenix, Arizona
Harold M. Plaisted, B. M. E., with John Webber, Mill Builder, Detroit, Mich.	
Alice I. Ring, B. S.	Orono
May L. Ring, B. S., Teacher	Orono
* Roscoe L. Smith, B. S., Farmer	Lewiston
George Washington Sturtevant, B. C. E., Civil Engineer, Minneapolis, 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.

<i>Name and Occupation.</i>	<i>Residence.</i>
Charles S. Bickford, B. S., Book-Keeper	Belfast
Jacob L. Boynton, B. S.	266 Washington St., 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	Brooklyn, N. Y.
Walter Flint, B. M. E., Instructor, State College.	Orono
George R. Fuller, B. S., Teacher	Tremont
Charles C. Garland, B. S., 129 Nicollet Avenue, Minneapolis, Minn.	
Joseph F. Gould, B. S., Teacher.	Bradley
Thomas W. Hine, B. S., Teacher.	Phoenix, 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.	Ellsworth
Frederic M. Reed, B. M. E., Draughtsman	Hurricane Island
Gleason C. Snow, B. S., Farmer.	North Orrington
Avery P. Starett, 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. Wright, B. C. E., Supt. Gas Works	Trinidad, Col.
Daniel C. Woodward, B. M. E., Machinist.	Dexter

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., Houghton Farm,	Mountainville, Orange Co., N. Y.
Arthur L. Fernald, B. S.	Levant
Bartholomew P. Kelleher, B. S., Farmer	Orono
Lucius H. Merrill, B. S.	Auburn

<i>Name and Occupation.</i>	<i>Residence.</i>
Jennie C. Michaels, B. S., Teacher...	Harrington
Charles W. Mullen, B. C. E., Civil Engineer, Shore Line R. R.,	Oldtown
Truman M. Patten, B. C. E....	Hermon
Harry W. Powers, B. S....	Orono
Charles E. Putnam, B. C. E., Civil Engineer ...	Squantum, Mass.
Lewis Robinson, Jr., B. M. E....	Hampden
George A. Sutton, B. C. E., Civil Engineer, Shore Line R. R.,	Orono
Levi W. Taylor, B. S., Teacher.....	Bangor

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, New Gloucester.
- 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, New York, N. Y.
- 1883. C. E. PUTNAM, Squantum, Mass.

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.

<i>Name and Occupation.</i>	<i>Residence.</i>
John T. Bowler, Register of Deeds.....	Bangor
William H. Cary, Jr.....	Houlton
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
Wilbur F. Lovejoy, Book-Keeper.....	Winn
Thomas P. Pease	Bridgton
Clarence Pullen, Civil Engineer.....	Los Vegs, New Mexico
Frederic A. Ransom.....	Augusta

* Deceased.

CLASS OF 1874.

<i>Name and Occupation.</i>	<i>Residence.</i>
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.....	Caribou
Ora Oak.....	California
Sydney 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.....	New York City
Russell A. Carver.....	Dixfield
Frank P. Gurney, Farmer.....	Wyoming
Frank A. Hazeltine, Farmer.....	Dexter
Eugene Hopkins.....	Oldtown
James W. Linnell, Farmer.....	Exeter

<i>Name and Occupation.</i>	<i>Residence.</i>
George J. Moody, Lawyer	Augusta
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	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

<i>Name and Occupation.</i>	<i>Residence.</i>
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. Stuart, 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

<i>Name and Occupation.</i>	<i>Residence.</i>
William N. Titus, Lawyer, Judge Mun. Court	Bristol, R. I.
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. Boswell, 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, Student Ins. Tech	Boston, Mass.
Charles S. Simpson, Lumber Surveying	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	Guilford
George W. Holmes, Merchant	Norway
John F. Horne, Shoe Manufacturer	Auburn

* Deceased.

<i>Name and Occupation.</i>	<i>Residence.</i>
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.....	Springfield
Harry P. Tidd.....	Wingleton, Mich.
William R. Tilden, Workman in Shoe Factory....	Campello, Mass.
William A. Vinal, Scaler	Orono
William 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. Keniston, 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
Henry W. Longfellow, Clerk	Machias

<i>Name and Occupation.</i>	<i>Residence.</i>
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, Medical Student	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 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. Sawyer	Minneapolis, Minn.
Mertie Sawyer	Hampden
Charles F. Smith, Law Student	Belfast
* Horace G. Trueworthy ..	Orono
Jotham Whipple, Jr.	Solon

* Deceased.

CLASS OF 1885.

<i>Name and Occupation.</i>	<i>Residence.</i>
James W. Bishop, Farmer	Milo
Harry W. Davis, Clerk	Hillsboro', Dakota
Samuel W. Hill.....	Machias
William Philbrook	Bethel
Carl H. Prince, Farmer.....	Turner

CALENDAR.

- 1884—Feb. 12. Tuesday, Second Term commences.
June 19, 20. Thursday and Friday, Examinations.
“ 21. Saturday, Prize Declamations by Sophomores.
“ 22. Sunday, Baccalaureate Address.
“ 23. Monday, Prize Essays by Juniors.
“ 25. Wednesday, Commencement.
“ 26. Thursday, Examination of Candidates for Admission.
Vacation of five weeks.
Aug. 5. Tuesday, examination of Candidates for Admission.
First Term commences.
Nov. 24, 25. Monday and Tuesday, Examinations.
Vacation of eleven weeks.
1885—Feb. 10. Tuesday, Second Term commences.



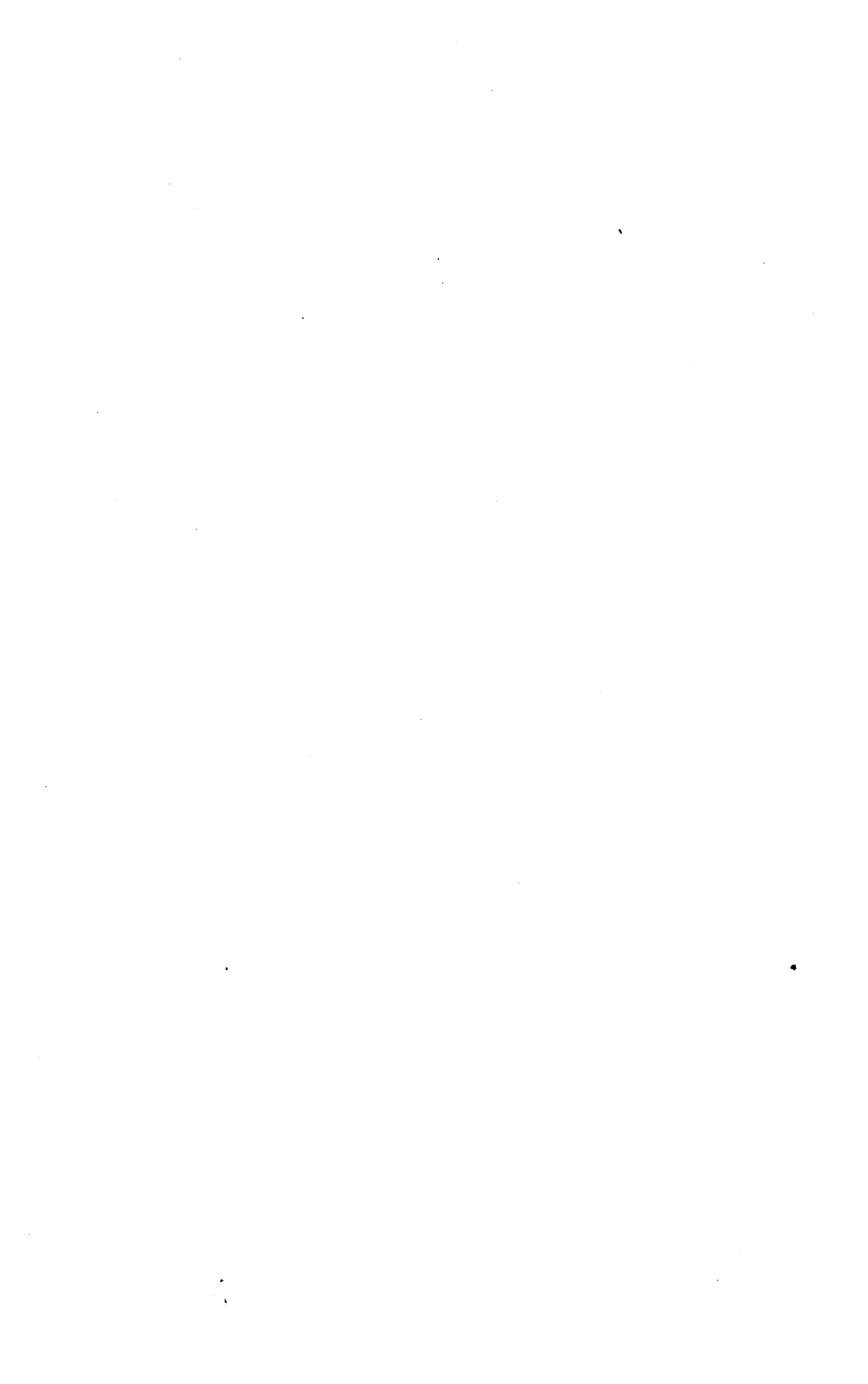
SUMMARY OF
Meteorological Observations,
TAKEN AT THE
MAINE STATE COLLEGE of AGRICULTURE and the MECHANIC ARTS,

Latitude, $44^{\circ} 54' 2''$ N. Longitude, $68^{\circ} 40' 11''$ W.

FROM JANUARY, 1869, TO JANUARY, 1884,

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 1883 was July 6th, when the mean temperature was 75°.1, and the coldest day was December 22d, when the mean temperature was 13°.9 below zero.

The highest temperature (85°.6) recorded during the year was on the 7th of July, and the lowest temperature (25° below zero) on the 6th of January.

The range of temperature between the two extremes is 110°.6, which is less by 3°.5 than the average range between the extremes for the last fifteen 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 1883, with the mean temperature of corresponding months for fifteen years, is given below:

Months.	Mean temperature from 1869 to 1883, inclusive.	Mean temperature for 1883.	
January.....	15°.45	10°.65	4°.80 colder.
February.....	19°.17	16°.36	2°.81 "
March.....	27°.30	21°.95	5°.35 "
April.....	39°.58	38°.93	0°.65 "
May.....	52°.40	51°.77	0°.63 "
June.....	62°.26	66°.47	2°.21 warmer.
July.....	67°.73	68°.04	1°.69 colder.
August.....	65°.97	64°.85	1°.12 "
September.....	57°.66	55°.97	1°.69 "
October.....	46°.28	42°.97	3°.29 "
November.....	32°.78	34°.74	1°.96 warmer.
December.....	20°.45	19°.89	0°.56 colder.

The year 1883 (mean temperature 40°.72) averaged 1°.53 colder than the mean temperature of the fifteen years under notice.

Late spring frosts occurred on May 5th and 18th, a light summer frost on the morning of August 29th, early autumnal frosts on September 4th and 6th, and a heavy frost, destructive to vegetation, on October 1st.

The principal thunder showers of 1883, were on May 29th, June 4th and 7th, July 4th, 5th, 7th, 13th, 14th and 31st, August 3d and 23d, and October 13th.

The rainfall of this year was 40.60 inches, less by 2.79 inches than the average annual rainfall for fifteen years; the amount of snow was 53 inches, less by 37.3 inches than the average annual snowfall for the same period.

The number of days in 1883 on which the sky was at least eight-tenths covered with clouds was 82, or 22 per cent. of the whole number. The number of days on which at least .01 of an inch of rain or snow fell was 139, or 38 per cent. of the whole number; the number of days, therefore, without any considerable quantity of rain or snow, was 226, or 62 per cent. of the whole number.

From May to September, inclusive, the prevailing wind was S. W. and S., and during the remaining months of the year, N. W. and W. Strong winds prevailed on March 10th and 11th, November 28th, December 3d, 15th and 22d, and rose to gales on February 28th, November 12th and December 28th. The gale of November 12th was especially destructive of forests and timber growths in several counties of the State.

The prevailing wind for the fifteen years from 1869 to 1883, 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 1883 were on the evenings of February 1st, 2d, 24th, 27th and 28th, March 8th, 9th and 29th, April 4th, July 30th, September 5th and October 5th, those of April 4th and October 5th being the most brilliant.

But few halos have been observed during the year; the principal lunar halo was on June 18th.

The zodiacal light was plainly visible on January 29th, February 7th, 8th and 26th, and on March 8th.

The deep (red) coloring of the sky south and west, extending about 10 degrees above the horizon, was noted as especially marked on the evenings of November 26th, 27th and 28th, for two hours after sunset.

The barometer indicated the greatest pressure in the month of February, and the least in December. The range between the two extremes was 1.891 inches.

The least mean pressure was during March, and the greatest during October, when the average height of the mercury in the barometer, at an elevation of 129 feet above sea level, was 30.045 inches. The mean pressure of vapor in the atmosphere was sufficient to sustain a column of mercury .259 of an inch in height. The mean humidity of the air was .78.

SUMMARY BY MONTHS—1883.

MONTHS.	THERMOMETER IN THE OPEN AIR.											RAIN AND SNOW.		Cl'rs	WINDS.				BAROMETER.			Relative humidity or fraction of saturation.												
	Mean of warmest day.		Mean of coldest day.		Highest temperature.		Lowest temperature.		Maximum temperatures.			Minimum temperatures.			Mean of three daily observations.			Amount of rain or melted snow— inches.	Amount of snow— inches.	Mean per centage of cloudiness.	Per cent. of direction and force.				Barometer height reduced to freezing point of water.			Force or pressure of vapor in inches.						
	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.	Day.	Temperature.	Mean of maximum temperatures.	Mean of minimum temperatures.	Mean of three daily observations.	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.			
																		Day.	Temperature.	Day.												Temperature.	Day.	Temperature.
January..	31	35.7	5	-6.9	31	41.4	6	25.0	20.55	0.50	10.65	2.44	15.00	.47	.60	.19	.09	.12	30.410	29.274	30.028	.267	.015	.069	100	40	82							
February..	17	41.2	10	-5.8	17	46.4	24	11.0	26.39	5.82	16.36	2.34	13.00	.45	.46	.30	.09	.15	30.641	29.289	30.036	.240	.027	.083	100	41	79							
March....	27	40.9	4	-0.6	26	47.5	6	-13.7	30.46	11.34	21.95	1.89	7.50	.44	.53	.17	.12	.18	30.458	28.846	29.746	.299	.023	.096	100	38	72							
April.....	12	47.2	7	28.6	10	60.2	1	13.2	47.32	30.43	38.93	3.80	2.50	.51	.49	.13	.23	.15	30.410	29.440	29.830	.269	.077	.167	100	29	70							
May.....	26	63.9	15	40.4	26	80.7	1	32.4	61.06	42.91	51.77	5.10	-	.59	.27	.32	.18	.27	30.343	29.478	29.867	.559	.073	.291	100	18	72							
June.....	29	73.4	1	57.0	21	83.3	17	46.0	70.53	56.52	61.47	3.66	-	.49	.21	.46	.30	.03	30.359	29.325	29.864	.757	.254	.497	100	39	73							
July.....	6	75.1	8	59.0	7	85.6	1	51.3	74.89	58.67	66.04	6.90	-	.47	.35	.39	.14	.12	30.062	29.537	29.805	.860	.293	.517	100	40	78							
August...	21	73.7	28	54.8	23	81.0	29	35.5	76.47	55.70	64.85	0.53	-	.34	.35	.36	.17	.12	30.213	29.572	29.830	.715	.235	.480	100	39	76							
September	15	66.3	30	40.1	11	80.5	11	33.2	67.65	45.37	55.97	2.23	-	.46	.28	.47	.10	.15	30.320	29.008	29.929	.663	.186	.360	100	37	77							
October...	14	62.4	22	27.8	14	75.0	23	19.0	52.45	44.35	42.99	4.9	-	.52	.38	.32	.07	.23	30.536	28.914	30.045	.705	.111	.246	100	40	82							
November	22	44.6	29	13.5	22	58.0	29	9.0	44.26	29.92	34.74	3.75	3.00	.53	.45	.53	.10	.12	30.506	29.114	29.941	.436	.062	.193	100	50	84							
December	8	45.9	23	-13.1	9	48.2	23	20.0	28.50	10.94	19.89	2.99	12.00	.52	.56	.16	.02	.26	30.449	28.750	29.921	.328	.016	.110	100	34	88							
Year...	365	75.1	23	-13.1	7	85.6	6	-25.0	50.04	31.79	40.72	40.00	53.00	.48	.41	.30	.13	.16	30.641	28.750	29.904	.860	.015	.259	100	18	78							

METEOROLOGICAL.

SUMMARY BY YEARS—FROM 1869 TO 1883, INCLUSIVE.

YEAR	THERMOMETER IN THE OPEN AIR.										RAIN AND SNOW.		CLDS Mean percentage of cloudiness.	WINDS.				BAROMETER			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 gauge — inches.		Depth of snow — inches.	Per cent. of direction.				Barometer height reduced to freezing point.					Force or pressure of vapor in inches.			
	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.
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	48.51	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 29	-23.0	48.49	30.11	39.58	41.94	93.80	.50	.44	.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	5.37	123.00	.49	.43	.30	.08	.19	30.783	28.458	29.804	.937	.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	31.64	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	33.57	43.85	33.84	69.90	.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	29.862	.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
15 yrs	Aug. 7	85.3	Jan. 8	-17.2	Aug. 6	96.7	Jan. 8	-35.6	50.83	33.75	42.25	43.39	90.30	.52	.40	.29	.11	.20	30.783	28.423	29.827	.956	.005	.259	100	13	76

APPENDIX.

THE
BUTTERFLIES

OF

MAINE.

Designed for the use of the students in the Maine State College,
and the farmers of the State.

C. H. FERNALD, A. M.

Orono, February, 1884.

INTRODUCTION.

The following paper contains an account of all the species of butterflies occurring in Maine, so far as known to me. If there are other species within our limits, they must be rare, or very local in their distribution; and if any should hereafter be found in the State, which are not here described, I shall be very glad to know of the fact, and to see specimens of them. We are still ignorant of the insect fauna of certain parts of the State, yet it is hardly probable that many species of butterflies will be added to the list herein described. *Chionobas semidea* Say, and *Argynnis montinus* Scud. occur on the White Mountains in New Hampshire, and may yet be discovered on Mt. Katahdin when that region is fully explored by entomologists.

Quite a number of the butterflies feed on plants which are of no special value to our people, but those which are destructive to our more valuable plants should be well known in all their stages, and the best means of destroying them should be understood. I have therefore given all the facts known to me, which can be of value in holding the injurious insects in check.

It should be a part of the education of a farmer, to discover his friends and enemies among the insect tribes, and to do this, there is no better way than to raise those which trouble his crops, carrying them through all their transformations, in order to enable him to recognize them in any stage of their existence, and to discover the most vulnerable stage in their lives, or the one in which they may be most easily destroyed.

CLASSIFICATION.

Insects have been divided by naturalists into the following orders :

HYMENOPTERA, which include the bees, wasps, ants, ichneumon flies, sawflies, etc.

LEPIDOPTERA, which include the butterflies and moths.

DIPTERA, which include the true flies.

COLEOPTERA, or beetles.

HEMIPTERA, or the true bugs.

ORTHOPTERA, which include the crickets, grasshoppers, locusts etc.

NEUROPTERA, which include the dragon flies, darning needles etc.

The LEPIDOPTERA are characterized by having four ample wings covered on both sides with minute overlapping scales which are easily rubbed off, and appear like a fine powder. They are naturally divided into the butterflies (*Rhopalocera*) and moths (*Heterocera*).

The butterflies have two thread-like antennæ, or feelers, on the head, each of which is enlarged, at the outer end, into a knob or club. They fly in the day time, and keep their wings elevated when at rest, at least the fore wings.

The moths have the antennæ variable in form, but never enlarged at the outer end. They fly mostly by night, and when they alight they spread their wings out more or less horizontally, or close them around their bodies.

TRANSFORMATIONS.

There are four distinct periods in the existence of butterflies: The EGG, the LARVA, the PUPA or CHRYSALIS and the IMAGO or PERFECT INSECT.

The eggs of butterflies are more or less globular, conoid or spindle shaped, with their surfaces smooth, or marked with a variety of regular sculpture in the different species, and of different colors, among which, white, green and

yellow are the prevailing tints. They are deposited here and there upon the leaves of the plants on which the young feed. A few species deposit their eggs in clusters within which they are arranged regularly.

The term *larva* or caterpillar is applied to the insect as soon as it hatches from the egg, and is the voracious period of life. In some species it is the longest period of their existence, since they pass the winter hibernating in this stage, while in others, this period is comparatively short. The larva sheds its skin (molts) several times before it reaches its full growth, and often changes its color with each molt.

EXTERNAL ANATOMY OF THE CATERPILLAR.

The body of the caterpillar is elongated, cylindrical, and composed of thirteen joints or segments. Some caterpillars are naked, others have a few scattered hairs scarcely visible, while others are more or less covered with spines. The first segment forms the head which has the mouth organs on the lower side. The second, third and fourth segments have each a pair of short legs, the rudiments of the future legs; and the seventh, eighth, ninth, tenth and thirteenth, have each a pair of soft membranaceous ones which disappear when the larva changes to a chrysalis. On each side of the body there are nine oval apertures, the spiracles or stigmata (breathing holes). These are situated in the second, fifth, sixth and following segments to the twelfth.

The head is of a rounded or oval form, and of a harder texture than the other parts of the body. On its lower side are situated the organs of the mouth, and at the sides, the rudiments of the eyes and the antennæ. The head is divided into two halves by an indented line or suture which extends down the middle of the front, from the vertex or *epicranium* to the face, the front of which is formed by a convex plate, the *clypeus*. Immediately below this is another plate, the *labrum* or upper lip which forms the upper boundary of the mouth. Beneath this is a pair of strong horny jaws or

mandibles attached one on each side of the mouth, which work laterally. Beneath these are the *maxillæ* or lesser jaws placed in a similar manner, which with the *mandibles* form the sides of the mouth. The *maxillæ* are used to hold the food rather than for chewing, and are furnished with a pair of jointed organs called the *maxillary palpi* which are used as organs of touch.

Below the *maxillæ* is situated another plate called the *labium* or lower lip which forms the lower boundary of the mouth. This is also furnished with a pair of jointed organs called the *labial palpi*. There is also a soft, conical, horny tube called the *spinneret*, on the soft membrane of the *labium*. It is the common excretory duct of those glands which secrete the silken threads by means of which the chrysalis is suspended and leaves are drawn together by those species which conceal themselves, and also the cocoons are formed by those species which transform in them. The antennæ, though but slightly developed, are situated a little above the base of the mandibles on each side of the clypeus, and are of a conical form and jointed. There are six very minute simple eyes at a little distance from each other, near the base of the mandibles.

EXTERNAL ANATOMY OF THE PUPA.

The pupa state in butterflies is a very peculiar and characteristic period of their existence. Externally a perfect standstill appears in the process of development, for the pupa is quiet and does not take the least nourishment; but internally, great changes are in progress.

Those pupæ which hang freely from one end, or are supported by a loop of silken threads, are called naked pupæ, while those which rest in cases of silk spun by the larvæ just before transforming into pupæ, are called incased pupæ, and their cases are called cocoons. The outside covering of a pupa is of a fine, horny texture, and shows the parts of a future insect more or less plainly. The pupa shows the

division of the insect into head, thorax and abdomen, much more plainly than the larva. The parts of the covering take special names according to their uses; as the head-case, eye-cases, tongue-case, leg-cases, antennæ-cases, trunk-case, wing-cases and the abdomen-case which consists of nine more or less distinctly separated segments with the future spiracles along the side, and the anal orifice indicated on the last segment. The apex of the last segment is called the cremaster which varies greatly in form in the different species, but is always armed with hooks or spines by means of which the pupa secures itself to the threads of silk spun for that purpose.

Some pupæ have spines along the abdomen or on other parts of the body, and there are other angles and protuberances, as two in front, which are the palpi-cases, several along the edges of the wing-cases, and in some species, there is a process upon the top of the thorax in the form of a long thin pyramid or resembling a man's nose. The majority of butterfly pupæ have a greenish, or yellowish grey, or brown color, and some have metallic spots on them.

EXTERNAL ANATOMY OF THE IMAGO.

The term imago is applied to the insect as soon as it emerges from the pupa case. It has three principal divisions; head, thorax and abdomen. The head is more or less globose in form, and has on each side a globular or ovate compound eye. On the top of the head, between the eyes, are two long jointed antennæ which have the outer end enlarged into what is called the club. In some species the club terminates quite abruptly, while in others (some of the *Hesperidæ*), it tapers more or less to a fine point and is curved or hooked. On the under side of the head are situated the mouth parts which consist of a pair of three-jointed palpi covered with hair-like scales, which curve up in front more or less closely against the head. Near the base of the palpi, and between them, is situated the proboscis or tongue; a long, tapering, horny

tube through which they draw up the nectar from the flowers, and which they coil up like a watch spring when not in use. The head, as well as the palpi, is densely clothed with hair-like scales, and in some species the compound eyes are clothed with minute hairs starting out from between the facet, in which case they are said to be hairy, otherwise naked.

The thorax is joined to the head by means of the neck, and bears the legs and wings. There are three pairs of legs, each of which comprises a basal joint called the coxa, at the end of which is a minute piece called the trochanter, followed by the longest joint of the leg, which is called the femur, followed by the tibia, after which comes the tarsus which is composed of five joints gradually decreasing in size to the last, which usually has a pair of curved claws. The middle and hind tibiæ usually have a pair of scaly spurs at the end, and sometimes are more or less armed with spines; and the hind tibiæ sometimes have a second pair of spurs near the middle. The fore tibiæ, in some species, have an appendage on the inside called the tibial epiphysis.

The fore legs of some of the butterflies are so small and aborted as to be of no service in walking. The scales arising from the upper side of the first segment of the thorax form the collar, and there are small scaly pieces over the bases of the fore wings called the shoulder lappets or pterygodes.

The wings, of which there are two pairs, are composed of membranes supported by a frame work of round, tapering, branching, tubular rods which are between the membranes. These membranes are quite concealed beneath the covering of minute variously colored scales which overlap one another, like shingles on the roof of a house. This covering has gained for these insects the scientific name of Lepidoptera, derived from two Greek words which signify scaly-wings.

The arrangement of these supporting rods, veins or nervures, as they are sometimes called, is of value in the classification of the insects. The part of the wings attached to the body is called the base; the edge in front, when they

are extended, is called the costa or anterior margin; the angle at the outer end of the costa is called the apex, and the side which follows, being the most remote from the body when the wings are extended, is called the outer margin (hinder margin of some authors); the angle which follows is called the anal angle, and the side of the wing extending from the anal angle to the body, is called the hinder margin (inner margin of some authors).

Those veins of the wings, usually four in number, which go out from the base may be called nervures. The one nearest the costa is called the costal nervure; the next behind this, the subcostal nervure; the next in order extending approximately through the middle of the wing, and dividing it into two more or less equal parts, is called the median nervure; the one behind this last is called the submedian nervure; and a short one, occurring in some species behind the submedian is the internal nervure.

The first and last two of these extend to the margin of the wing, but the subcostal and medium nervures extend out to near the middle of the wing where they are joined by a vein which is called the transverse nervure. The remaining veins are branches of the subcostal and median nervures, or extend out from the transverse nervure, and are called nervules. We make use of the term veins when we wish to use a word to include either or both nervures and nervules, and we call the whole veiny structure of the wing the venation.

The system of numbering the veins adopted very generally by European entomologists, and to some extent in this country, is to number them in order at their terminations along the margins of the wing, whether nervures or nervules and without regard to their length. The vein going out from the base of the wing below the median, is called number 1. If, however, there are two, as the internal nervure and the submedian, then the first is called 1 a, and the second 1 b. The first branch of the median is number 2, the second, number 3, and so on around the outer margin and costa to the costal

nervure which will be the last or highest number. The same system is observed in the hind wings, but in some moths there are three separate veins behind the median which are numbered, 1 a, 1 b, and 1 c, in order going out from the hinder border. The portion of the wing included between the subcostal, median and the transverse nervures is called the discoidal cell, and this is sometimes divided by what are called cellular nervules, and are distinguished as superior and inferior according to their position.

COMMON NAMES.

The common names of the butterflies have been omitted in the body of this paper, and it would be as well to omit them entirely since they are only local, the same insect being called by different common names in different places, while the scientific names, when established, hold everywhere without change, and I should advise all to use them in preference to the common names.

The scientific names in this paper are divided into syllables, and the syllable which should be accented in pronunciation is marked by an ' mark following it. As some may greatly desire the common names, they are given in the following list against the scientific names.

The scientific name of an insect consists of two words, the first being the generic name or the name of the genus (surname), and should always begin with a capital letter; the second is the specific name and should begin with a small letter, though writers differ on this point. The specific name is followed by the name of the entomologist who described the insect originally, and gave the name to it, though the initial letter or the abbreviation of his name is generally used.

The arrangement and nomenclature adopted is that of Mr. W. H. Edwards, soon to appear in his Catalogue of the Butterflies of North America. I have also availed myself freely of the published writings of Messrs. Edwards and

Saunders on the preparatory stages of some of our butterflies. I am under obligations to Mr. William Saunders, Editor of the Canadian Entomologist and to Henry Holt & Co. for electrotypes to illustrate this paper.

SCIENTIFIC AND COMMON NAMES OF THE
BUTTERFLIES OF MAINE.

	NO.
PAPIL'IO ASTE'RIAS, Cramer. The Black Swallow-tail.....	1
PAPIL'IO TUR'NUS, Linneus. The Tiger Swallow-tail. Turnus Swallow-tail.....	2
P'ERIS OLERA'CEA, Harris. The Gray-veined White Potherb Pontia. White Butterfly.....	3
P'ERIS RA'PÆ, Linneus. The Imported Cabbage Butterfly. Rape Butterfly.....	4
CO'LIAS PHILOD'ICE, Godart. The Clouded Sulphur Butterfly. Common Yellow Butterfly....	5
CO'LIAS INTE'RIOR, Scudder.....	6
TE'RIAS LI'SA, Boisduval and Leconte. The Little Sulphur.....	7
DA'NAIS ARCHIP'US, Fabricius. The Monarch. Milk-weed Butterfly.....	8
ARGYN'NIS IDA'LIA, Drury. The Regal Fritillary.....	9
ARGYN'NIS CYB'ELE, Fabricius. The Great Spangled Fritillary..	10
ARGYN'NIS APHROD'ITE, Fabricius. The Silver-spot Fritillary...	11
ARGYN'NIS ATLAN'TIS, W. H. Edwards. The Mountain Silver- spot.....	12
ARGYN'NIS MYRI'NA, Cramer. The Silver-bordered Fritillary....	13
ARGYN'NIS BELLO'NA, Fabricius. The Meadow Fritillary.....	14
EUPTOIE'TA CLAU'DIA, Cramer. The Variegated Fritillary	15
MELITAE'A PHA'ETON, Drury. The Baltimore. The Baltimore Fritillary.....	16
PHYCIO'DES HARRIS'II, Scudder. Harris's Butterfly.....	17
PHYCIO'DES NYC'TEIS, Doubleday. The Silver Crescent.....	18
PHYCIO'DES THA'ROS, Drury. The Pearl Crescent.....	19
GRAP'TA INTERROGATIO'NIS, Fabricius. The Violet Tip.....	20
GRAP'TA COM'MA, Harris. The Orange Comma.....	21
GRAP'TA FAU'NUS, W. H. Edwards. The Green Comma.....	22
GRAP'TA PROG'NE, Cramer. The Gray Comma.....	23

	NO.
GRAP'TA J-AL'BUM, Boisduval and Leconte. The Compton Tortoise	24
VANES'SA ANTI'OPA, Linneus. The Camberwell Beauty. Mourn- ing Cloak	25
VANES'SA MILBERTI, Godart. The Nettle Tortoise-shell. Mil- bert's Butterfly	26
PYRAME'IS ATALAN'TA, Linneus. The Red Admiral	27
PYRAME'IS HUN'TERA, Fabricius. The Painted Beauty. Hun- ter's Butterfly	28
PYRAME'IS CAR'DUI, Linneus. The Painted Lady	29
JUNO'NIA COE'NIA, Huebner. The Buckeye	30
LIMENITIS AR'THEMIS, Drury. The Banded Purple	31
LIMENITIS DISIP'PUS, Godart. The Viceroy	32
NEONYM'PHA EU'RYSIS, Fabricius. The Little Wood Satyr	33
NEONYM'PHA CAN'THUS, Linneus. The Eyed Brown	34
DE'BIS PORTLAN'DIA, Fabricius. The Pearly-eye	35
SAT'YRUS AL'OPE, Fabricius. The Blue-eyed Grayling. The Blue-eyed Ringlet	36
CHIONO'BAS JUT'A, Huebner. The Arctic Satyr	37
THEC'LA HU'MULI, Harris. The Gray Hair-streak. The Hop- vine Thecla	38
THEC'LA STRIGO'SA, Harris. The White-striped Hair-streak. The Streaked Thecla	39
THEC'LA CAL'ANUS, Huebner. The Banded Hair-streak	40
THEC'LA AUGUS'TUS, Kirby. The Brown Elfin	41
THEC'LA I'RUS, var. AR'SACE, Boisduval and Leconte. The Hoary Elfin	42
THEC'LA HEN'RICI, Grote and Robinson	43
THEC'LA NI'PHON, Huebner. The Banded Elfin	44
THEC'LA LAE'TA, W. H. Edwards. The Spring Beauty	45
THEC'LA TI'TUS, Fabricius. The Coral Hair-streak	46
FBNIS'ECA TARQUIN'IUS, Fabricius, The Wanderer. The Pie- bald	47
CHRYSOPHA'NUS EPIXAN'THE, Boisduval and Leconte. The Marsh Copper	48
CHRYSOPHA'NUS AMERICA'NA, D'Urban. The American Copper	49
LYCAE'NA PSEUDARGI'OLUS, Boisduval and Leconte. The Spring Azure	50
LYCAE'NA COMYN'TAS, Godart. The Tailed Blue	51

	NO.
CARTEROCEPH'ALUS MAN'DAN, W. H. Edwards.....	52
ANCYLOX'YPHA NU'MITOR, Fabricius. The Wee Skipper.....	53
PAM'PHILA ZAB'ULON, Boisduval and Leconte. The Mormon... 54	54
PAM'PHILA SAS'SACUS, Harris.....	56
PAM'PHILA LEONAR'DUS, Harris. Leonard's Skipper.....	55
PAM'PHILA O'THO VAR. EGER'EMET, Scudder.....	57
PAM'PHILA PECK'IUS, Kirby. Peck's Skipper, The Yellow Spot.....	58
PAM'PHILA MYS'TIC, W. H. Edwards.....	59
PAM'PHILA CER'NES, Boisduval and Leconte. Tawny-edged Skip- per.....	60
PAM'PHILA MANATA'AQUA, Scudder.....	61
PAM'PHILA METACOM'ET, Harris. The Immaculate Skipper.....	62
PAM'PHILA BIMAC'ULA, Grote and Robinson.....	63
AMBLYSCIR'TES VIA'LIS, W. H. Edwards. The Roadside Skipper.	64
AMBLYSCIR'TES SAM'OSET, Scudder.....	65
THAN'AOS BRI'ZO, Boisduval and Leconte. The Sleepy Dusky- wing.....	66
THAN'AOS IC'ELUS, Lintner.....	67
THAN'AOS PER'SIUS, Scudder. Persius' Dusky-wing.....	68
EUDA'MUS PY'LADES, Scudder.....	69

The following artificial key may be of service in determining the Maine butterflies :

- 1 { Distance between the insertion of the antennæ more than half the vertical diameter of the eye. Family HESPERIDÆ 38
- 1 { Distance between the insertion of the antennæ less than half the vertical diameter of the eye..... 2
- 2 { Fore legs small and rudimentary ; not used in walking, Family, NYMPHALIDÆ 10
- 2 { Fore legs well developed, and used in walking..... 3
- 3 { Large butterflies with wings generally expanding two inches or more. Colors, sulphur yellow, white, or black and yellow Family, PAPILIONIDÆ 4
- 3 { Small butterflies, with wings generally expanding less than two inches. Colors, dark brown, blue, copper-red or orange Family, LYCAENIDÆ 29

		NO.
4	{	Hind wings with lobes or tails . . . Sub-Family, PAPILIONINÆ, 5
		Hind wings entire; without lobes or tails, Sub-Family, PIERINÆ, 6
5	{	Wings black, with yellow and blue spots.. PAPILIO ASTERIAS.
		Wings yellow, with black markings PAPILIO TURNUS.
6	{	Upper side of the wings white; sometimes very pale yellow, PIERIS, 9
		Upper side of the wings bright lemon or sulphur yellow 7
7	{	Fore wings with a prominent black spot near the middle.. 8
		Fore wings without a prominent black spot near the middle, TERIAS LISA.
8	{	Under side of the wings with a row of dark points within the outer border COLIAS PHILODICE.
		Underside of the wing without any dark points within the outer border COLIAS INTERIOR
9	{	Under side of the fore wings with one or two dark brown spots beyond the middle PIERIS RAPÆ.
		Under side of fore wings unspotted; veins of hind wings heavily marked PIERIS OLERACEA
10	{	Ground color of the fore wings above, tawny yellow or orange. 11
		Ground color of the fore wings above, not tawny yellow or orange 13
11	{	Veins and borders of all the wings black; the outer borders with white spots on them 12
		Without these characters; at least without the white spots on the outer border. 16
12	{	Hind wing with a narrow, curved black band across it a little beyond the middle. LIMENITIS DISIPPUS.
		Hind wing without any band across the middle, DANAIS ARCHIPPUS.
13	{	Wings black or brown without eye spots 14
		Wings black or brown with eye-spots 15
14	{	A terminal row of red spots preceded by two or three rows of white spots MELITÆA PHAETON.
		A terminal yellow band preceded by a row of blue spots, VANESSA ANTIOPA.
		A tawny orange or yellow band crossing all the wings a little before the outer border VANESSA MILBERTI.
		An orange red band crossing the fore wings obliquely, and some white spots before the apex. . . PYRAMEIS ATALANTA.
		LIMENITIS ARTHEMIS.

- | | | | | |
|----|---|--|-------------------------|----|
| | { | Fore wings dark brown, with a bright yellow band enclosing two eye spots | SATYRUS ALOPE. | |
| | { | Fore wings dark brown, with a yellow band, or with only a trace of it. Eye spots as in <i>S. alope</i> | SATYRUS NEPHELE. | |
| | { | Fore wings wood brown, with five eye-spots on the notched hind wing, and three or four on the fore wing, | | |
| | | | DEBIS PORTLANDIA. | |
| 15 | { | Pale wood brown, with five eye-spots on the entire hind wing, and three or four on the fore wing, | | |
| | | | NEONYMPHA CANTHUS. | |
| | { | Wood brown with two eye-spots on each wing, | | |
| | | | NEONYMPHA EURYTRIS. | |
| | { | Wood brown with several imperfect eye-spots surrounded with yellow, on each wing | CHIONOBAS JUTTA. | |
| | { | Two large, unequal eye-spots on the hind wing, and one or two on the fore wing, with a whitish, oblique band, | | |
| | | | JUNONIA COENIA. | |
| 16 | { | Hind wings with a prominent tooth or lobe near the middle of the outer margin. | | 17 |
| | { | Hind wings entire, or with the middle tooth no larger than the others. | | 18 |
| 17 | { | Outer edge of the wings touched with lead-blue, | GRAPTA INTERROGATIONIS. | |
| | { | Hind wings with a white spot a little beyond the middle of the costa | GRAPTA J-ALBUM. | |
| | { | Under side of wings coarsely marked with olive green on the outer part | GRAPTA FAUNUS. | |
| | { | Under side of the wings coarsely marbled with light and dark brown | GRAPTA COMMA. | |
| | { | Under side of the wings dark gray, with fine, blackish cross streaks | GRAPTA PROGNE. | |
| 18 | { | Fore wings without white spots on the upper side | | 19 |
| | { | Fore wings with several white spots on the upper side near the apex | | 28 |
| 19 | { | Upper side of hind wings blue-black, with two rows of light colored spots | ARGYNNIS IDALIA. | |
| | { | Upper side of hind wings tawny or yellowish, with black spots or marks | | 20 |
| 20 | { | Under side of hind wings with numerous silvery or white spots | | 23 |
| | { | Under side of hind wings without silvery or white spots | | 21 |
| 21 | { | Basal half of hind wings beneath, much darker brown than outer half | EUPTOIETA CLAUDIA. | |
| | { | Basal half of hind wings not darker than outer half | | 22 |

22	{	All the wings bordered with black.....	PHYCIODES THAROS.	
	{	Wings not bordered with black	ARGYNNIS BELLONA.	
23	{	Spots on the under side of the hind wings, clear white, ringed with dark brown	PHYCIODES HARRISII.	
	{	Spots on the under side of the hind wings, silvery or pearly white		24
24	{	Costa and outer border of hind wings above, black,	PHYCIODES NYCTEIS.	
	{	Costa and outer border of hind wings not black above ...		25
25	{	Expanse of wings less than two inches, ARGYNNIS MYRINA.		
	{	Expanse of wings more than two inches		26
26	{	Extreme outer border of all the wings black,	ARGYNNIS ATLANTIS.	
	{	Extreme outer border of the wings not black....		27
27	{	Subterminal pale yellow band of hind wings beneath, very narrow.....	ARGYNNIS APHRODITE.	
	{	Subterminal pale yellow band of hind wings beneath, wide and clear.....	ARGYNNIS CYBELE.	
28	{	Hind wing with two large, unequal sized eye-spots beneath,	PYRAMEIS HUNTERA.	
	{	Hind wing with a row of four or five small eye-spots beneath,	PYRAMEIS CARDUI.	
29	{	Hind wings with thread-like tails on the outer margin . . .		30
	{	Hind wings without thread-like tails on the outer margin...		33
30	{	Hind wing regularly rounded, with one tail; color blue or brown.....	LYCÆNA COMYNTAS.	
	{	Hind wing triangular; a short tail outside of the thread- like one		31
31	{	Hind wing with an orange or red spot enclosing a black one near anal angle above.....	THECLA HUMULI.	
	{	Hind wing unspotted above.....		32
32	{	Under side of fore wings crossed by two whitish lines be- yond the middle.....	THECLA CALANUS.	
	{	Under side of fore wings crossed by four whitish lines be- yond the middle	THECLA STRIGOSA.	
33	{	Ground color above, dark brown.....		35
	{	Ground color above, more or less blue		34
	{	Ground color above, orange with black markings,	FENISECA TARQUINIUS.	
	{	Fore wings above, copper red with black spots and dark outer border.....	CHRYSOPHANUS AMERICANA.	
	{	Fore wings above, brown or purplish brown with small black spots.....	CHRYSOPHANUS EPIXANTHE.	

NO.

- 34 { Under side of fore wing with one or more rows of red spots,
THECLA LAETA.
Underside of fore wing without red spots,
Forms of LYCENA PSEUDARGIOLUS.
- 35 { Under side of hind wings with a row of red spots along the
outer border THECLA TITUS.
Under side of hind wings without red spots. 36
- 36 { Under side of hind wings, pale rust brown with an irregular
white line across the middle THECLA NIPHON.
Under side of hind wings, dark brown at the base, with a
lighter band on the middle shaded into a rusty border, and
with purplish reflections over the whole surface,
THECLA AUGUSTUS.
Under side of hind wings, dark brown or blackish brown
and washed with whitish beyond. 37
- 37 { The first tooth outside of the anal angle, curving outward,
THECLA IRUS var. ARSACE.
The first tooth outside of the anal angle, not curving out-
ward THECLA HENRICI.
- 38 { Dark brown, marked more or less with tawny yellow 39
Dark brown, without tawny yellow markings. 53
- 40 { Under side of hind wings with white spots ringed with
brownish. CARTEROCEPHALUS MANDAN.
Under side of hind wings not marked as above. 40
- 40 { Hind wings spotted more or less with tawny yellow above.. 41
Hind wings not spotted with tawny yellow above 47
- 41 { Under side of hind wings bright yellow, with no trace of
spots or band ANCYLOXYPHA NUMITOR.
Under side of hind wings more or less spotted or banded.. 42
- 42 { The larger part of the surface of the wings above, bright
tawny yellow 43
The larger part of the surface of the wings above, dark
brown. 45
- 43 { Outer margin of the wings beneath, brown, overlaid with
whitish scales. PAMPHILA ZABULON.
Outer margins of the wings beneath, yellowish, scarcely
darker than the middle part. 44
- 44 { A large tawny spot on the upper side of the hind wings,
PAMPHILA SASSACUS.
A small tawny spot and band beyond, on upper side of hind
wings Male of PAMPHILA MYSTIC.

	NO.	
45 {	Pale spots on the under side of the hind wings, covering half the surface or more PAMPHILA PECKIUS.	
	Pale spots on the under side of the hind wings covering much less than half the surface	46
46 {	Bright reddish brown beneath, with a row of seven small cream-colored spots across the middle of the hind wing, and one on the cell PAMPHILA LEONARDUS.	
	Reddish yellow beneath, with a row of seven large ochre spots across the middle of the hind wing, and one on the cell Female of PAMPHILA MYSTIC.	
47 {	Fringes white PAMPHILA BIMACULA.	
	Fringes brown or yellowish brown	48
48 {	Upper side of the fore wings unspotted, but with a tinge of tawny Male of PAMPHILA METACOMET.	
	Upper side of the fore wings, with whitish or tawny spots or markings	49
49 {	Under side of hind wings, purplish brown, Female of PAMPHILA METACOMET.	
	Under side of hind wings yellowish, or greenish brown	50
50 {	Under side of hind wings greenish brown, PAMPHILA CERNES.	
	Under side of hind wings yellowish brown or dusky ochre yellow	51
51 {	Upper side of fore wings, with a large brassy yellow spot along the costa Male of PAMPHILA MANATAAQUA.	
	Upper side of fore wings, without a large, brassy spot along the costa	52
52 {	Under side of the fore wings tawny yellow, dusky towards the outer margin Female of PAMPHILA MANATAAQUA.	
	Under side of the fore wings, brown with a few tawny scales overlaid PAMPHILA OTHO VAR. EGEREMET.	
53 {	Club of antennæ doubled up into a hook EUDAMUS PYLADES	
	Club of antennæ curved only	54
54 {	Under side of wings unspotted, Male of PAMPHILA METACOMET.	
	Under side of wings marked more or less with light spots	55
55 {	Hind wings with two rows of pale yellowish dots near the outer margin	58
	Hind wings without two rows of pale yellowish dots near the outer margin	56
56 {	Under side of hind wings unspotted, but with purple reflections AMBLYSIRTES VIALIS.	
	Under side of hind wings, with a row of pale spots across the middle	57

NO.

- 57 { Under side of all the wings, yellowish brown,
AMBLYSCIRTES SAMOSET.
Under side of all the wings, purplish brown,
Female of PAMPHILA METACOMET.

- 58 { Upper side of the fore wings with a row of four whitish dots
from the outer fourth of the costa downwards,
THANAOS PERSIUS.
Upper side of the fore wings without above named row of
white dots 59

- 59 { Upper side of the fore wings heavily overlaid with pale
bluish scales on the outer part. THANAOS ICELUS.
Upper side of the fore wings not overlaid with pale bluish
scales..... THANAOS BRIZO.

RHOPALOCERA.

Family—PAPILIONIDÆ.

Sub-Family—PAPILIONINÆ.

1. PAPILIO ASTERIAS, Cram.

Pa-pil'-i-o as-té'-ri-as.

Expanse of wings, from 3.5 to 4 inches.

Upper side of body and wings, black; the fore wings with two rows of yellow spots across them, eight in each row, the one near the outer margin composed of round spots, the second is within and parallel to the last and composed of wedge-shaped spots. There is also a yellow dash across the end of the cell, and a yellow spot a little above and beyond this.

The hind wings have a row of seven yellow spots across the middle, and a series of six lunules of the same color along the outer margin, and an orange or red eye-spot containing a black pupil at the anal angle with a yellow edge on the outside. Between the rows of yellow spots is a series of blue spots or shades. Nervule 4, of the hind wing extends out into a lobe or tail, and the outer margin is excavated between the veins, and edged with yellow.

The ground color on the under side of the wings is lighter than above, and the spots are repeated but touched more or less with orange.

The abdomen has two rows of small yellow spots on each side.

The females do not have the yellow spots as large, and are not as brightly colored as the males.

The larva of this insect feeds on carrot, parsnip, celery, caraway etc., of the gardens, and on various wild unbelliferous plants.

The eggs, which are deposited singly on the leaves of the plants, are smooth, nearly globular, and of a delicate light yellow color.

The larva, when first hatched, is nearly black with a broad white band across the middle and another on the tail, but when fully grown is about an inch and a half long, of a bright green color, lighter beneath, and with a transverse black band on each segment, and a row of yellow spots on it. When disturbed they thrust out from a slit in the top of the second segment, a pair of soft yellow organs joined at the bottom, somewhat like the letter Y in form. These are supposed to be scent organs which serve to drive off the insects and birds which prey upon them.

The pupa is an inch and a quarter long, of a pale green, ochre-yellow or ash-gray color, with two short ear-like projections above the head, just below which on the upper part of the back, is a little prominence. The pupa is attached by the tail to a button of silk, and is supported by a loop of silk around the middle of the body.

This butterfly has never been abundant enough to cause a very great amount of injury, but should it attack the garden plants in such numbers as to cause much damage, they can be reduced by hand picking, and the chickens, if allowed to run in the garden, will destroy them. They are generally kept down by the birds, and their insect enemies.

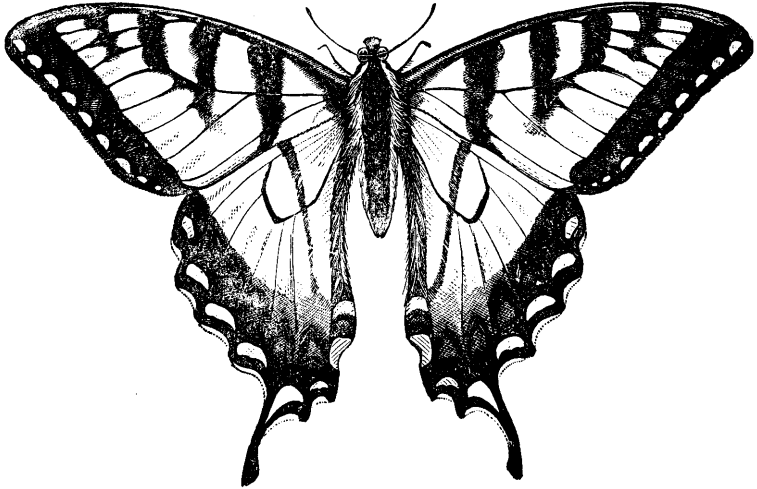


Fig. 1. *Papilio turnus* (nat. size.)

2. PAPILIO TURNUS, L.

Pa-pil'-i-o tur'-nus.

Expanse of wings, from 3.5 to 4.5 inches.

Upper side of the wings, pale lemon yellow with the outer borders of all the wings, costal borders of the fore wings, and hinder border of hind wings, black. The base of the fore wings and four bands starting at equal distances apart from the costa, the inner one extending across the wing, the others decreasing in length, all black. The black outer border of the fore wings has a row of about eight yellow spots through the middle, while that on the hind wings has six lunate spots, the first and last of which are orange, the others yellow with more or less bluish scales before them, and a more prominent orange spot occurs near the anal angle. Vein 4 of the hind wings extends into a lobe or tail; and the outer margin is excavated between the veins, and edged with yellow, while a narrow black band crosses the middle of the hind wings.

Under side of the wings marked as above, but paler in color.

Body, black, with a yellow stripe along each side.

The larva feeds on the leaves of apple, plum, wild and cultivated cherry, thorn and basswood.

The eggs are deposited singly on the leaves, and are nearly globular, smooth, dark green when first laid, but soon changing to greenish yellow, and speckled with reddish brown. In a little less than two weeks, the eggs hatch and the young are about one-tenth of an inch long, cylindrical, largest towards the head, of a brownish color, mottled with black, and with a large whitish spot on the middle of the back.

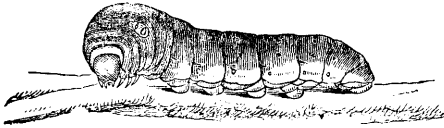


Fig. 2. Larva of *Papilio turnus* (nat. size).

The full grown larva is about one inch and a half long, of a deep green color and paler beneath.

The head is small, compared with the segments following, and of a reddish brown color. The front edge of the second segment, and also the hinder edge of the fifth, is yellow; and the front edge of the sixth is velvety black. On the side of the fourth segment is a yellow eye-spot with a black center. As the larva approaches maturity, the green color grows dull, and gradually changes to a dark reddish brown mottled with grayish on the sides. The larva then seeks some place of shelter, where it spins a button of silk in which the hind feet are secured and a loop of silk to support the forward part of the body, and after a short time casts off its skin and discloses a dull brownish pupa, in which state it passes the winter, and emerges the following June.

These insects have been quite abundant for a few years past, but their insect enemies and the birds hold them pretty well in check.

As each female lays about 200 eggs, they would soon multiply to such an alarming extent as to destroy the trees upon which they feed, were it not for these natural remedies. There is no doubt that spiders destroy the eggs and young larvæ to a much greater extent than has generally been supposed.

Sub-Family—PIERINÆ.

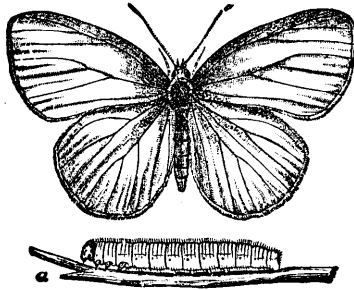


Fig. 3. *Pieris oleracea* (a, larva, nat. size).

3. PIERIS OLERACEA, Har. Fig. 3.

Pi'-e-ris ol-e-ra'-ce-a.

Expanse of wings, nearly two inches.

Upper side of the wings white, a little dusky at the base. Under side white, dusted along the veins more or less with brown scales which are prominent on the veins of the hind wings.

Body black above, and whitish beneath.

The larva feeds on the leaves of cabbage, turnip, radish, mustard and other plants of the order *Cruciferae*.

The eggs, one or two of which are deposited on the under side of a leaf, are somewhat pear-shaped, of a pale greenish white color, about one-twentieth of an inch long, and not more than a third as much in diameter. They are marked with about fifteen sharp ridges running lengthwise with cross lines between, and hatch in about ten days.

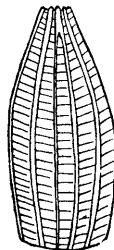


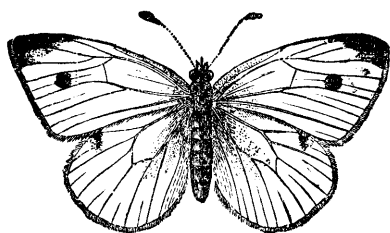
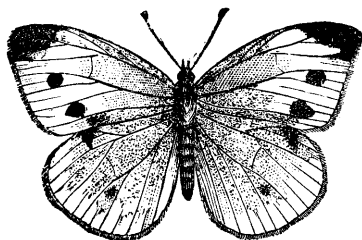
Fig. 4.
Egg of *Pieris oleracea*.
x 27.

The newly hatched larva is of a glassy, watery-white color, thinly clothed with fine shortish hairs. They first eat the egg shells from which they escaped, and then begin upon the leaf, eating round holes through it, soon changing their color to green. They feed

mostly by night and rest by day, along in the groove of the midrib on the upper side of the leaf, with their heads towards the base of the leaf. The mature larva (Fig. 3, *a*), is about an inch and a quarter long, of a pale green color, similar to that of the leaves of the cabbage, with a darker line along the middle of the back. The entire surface is covered with fine, short, white hairs. When they are done feeding they wander off in search of some protected place, as the under side of a board or fence-rail, in which to change to a pupa. Here the larva spins a button of silk, to which the anal feet are attached, and a loop in which to support the forward part of the body. In a short time the skin is shed, disclosing the pupa, which is about seven-tenths of an inch long, of a pale green or whitish color, and finely speckled with black.

In summer the insect remains in this stage about a week or ten days, but the fall brood passes the winter in the pupa state.

This species does not appear to be common in Maine, its place being taken by *Pieris rapæ*. For remedies, see under *Pieris rapæ*.

Fig. 5. *Pieris rapæ*, male (nat. size).Fig. 6. *Pieris rapæ*, female (nat. size).

4. PIERIS RAPÆ, L.

Pi-e-ris ra'-pæ.

Expanse of wings, about two inches.

Upper side of the wings white, dusky at the base and on the apex of the fore wings. A black spot rests on the costa of the hind wing a little beyond the middle. Fore wing with a black spot a little beyond the middle, and in the female there is another below it. These dark markings are sometimes quite faint.

Under side of the fore wings white, yellowish towards the apex, and with two black spots in both sexes corresponding to the two on the upper side of the female. Under side of the hind wings pale lemon yellow, without marks, but sprinkled more or less with dark atoms.

Body, black above, white beneath.

A male variety of this species, with the ground color of the wings sulphur yellow, has been described by Mr. Scudder, under the name *novangliæ*.

The larva of this insect feeds on the leaves of the cabbage, turnip, mignonette and some other plants, but is especially injurious to cabbages, boring into the interior of the head, beyond the reach of insecticides.

The eggs are scattered here and there on the under side of the leaves of the food plant, but sometimes they are found on the upper side, or even on the leaf-stalk. They are somewhat pear-shaped, flattened at the base, and the apex is cut squarely off. They are yellowish white in color, and marked with twelve longitudinal ribs with very fine cross lines between them. They measure about one-twenty-fifth of an

inch in length, and about one-fourth as much in diameter. The eggs hatch in about a week, and the young larva, which is then very pale yellow, first eats the shell from which it has escaped, and next it spins a carpet of silk upon which it remains, except when feeding. At some point outside of the mat upon which it rests, it eats a round hole through the leaf, and very soon changes its color to a pale green, or near to that of the leaf upon which it feeds. Dr. Fitch states that it sheds its skin three times before it reaches maturity. At this time they are about

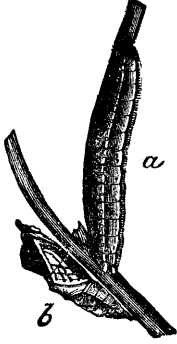


Fig. 7. *Pieris rapae*. a, larva. b, pupa. an inch long or a trifle more (Fig. 7, a), of a pale grass green color, with a pale yellow line along the back, and a row of small yellow spots along the side.

Having reached its full growth, the larva wanders off to some sheltered place, as under a board, fence-rail, or even under the edge of a clapboard on the side of a building, where it spins a button of silk in which to secure its anal legs, then the loop of silk to support the forward part of the body, after which the skin is molted and the pupa appears.

The pupa (Fig. 7, b), is about three-fourths of an inch long, quite rough and uneven, with projecting ridges and angular points on the back, and the head is prolonged into a tapering horn. In color they are very variable; some are pale green, others flesh colored or pale ashy gray and sprinkled with numerous black dots. There are two broods a year in Maine; the first butterflies are on the wing during the early part of June, and the next brood in September. The winter is passed in the pupa state.

A minute insect (*Pteromalus puparum*, L.) frequently attacks the pupa, boring through the outside and depositing its eggs within. These hatch before the time for the butterfly to emerge, and feeding on the contents, destroy the life of the pupa. I have bred over forty of these minute parasites from a single pupa.

Birds and spiders are of great service in destroying these

insects, and poultry may also be made available to lessen their numbers if allowed to run among the cabbages. Children should be encouraged to capture and destroy the butterflies, and the pupæ should also be collected and destroyed, unless they are found to be infested with parasites, which can easily be determined by observing whether the joints of the abdomen can be moved easily or not. If they are flexible, they should be destroyed, otherwise they may contain parasites and should be preserved, that the parasites may escape to attack others.

Experiments with hot water, tobacco smoke, sulphur, bisulphide of carbon, saltpetre and salt, lime, tar-water, pyrethrum and kerosene emulsion were tried by Prof. S. A. Forbes on this insect to ascertain what was the value of each respectively as an insecticide, and it was found that the last two alone would destroy the larvæ without injury to the plants, but these were of value only while the larvæ were on the exposed parts of the cabbage, or before they had made their way into the interior of the head. As these butterflies lay their eggs continuously for some time, any application, to be entirely successful, must be repeated several times.

The method of preparing the kerosene emulsion, as published by Prof. Riley, is substantially as follows. Kerosene oil is mixed with milk, either sweet or sour, and at a temperature of 75° F., they are churned together vigorously for fifteen minutes or more, when they form an emulsion, or curdle and suddenly thicken to form a white and glistening butter, perfectly homogeneous in texture. The whole amount of both ingredients solidifies together and there is no whey or other residue. The emulsion may be made of any desired strength, as the quantity of milk required to hold the oil does not exceed ten per cent. After the emulsion is made, it can be diluted with water to any extent required by adding a little at a time and stirring it up well. Prof. Forbes obtained good results with an emulsion diluted so that the kerosene was five or six per cent of the whole mixture, and sprinkled on to the plants.

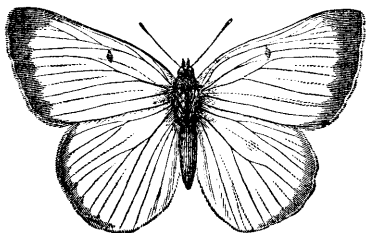


Fig. 8. *Colias philodice*, male (nat. size).

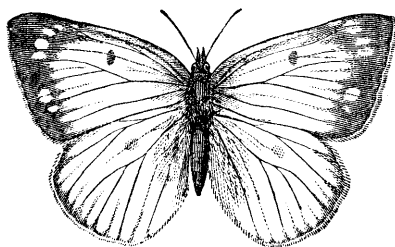


Fig. 9. *Colias philodice*, female (nat. size).

5. COLIAS PHILODICE, Godt.

Co'-li-as phil-od'-i-ce.

Expanse of wings—male, 2.25 inches; female, 2.5 inches.

Upper side of the wings sulphur yellow, with a black border on the outer margin, which, in the females, is quite broad on the fore wings, and spotted with yellow. A black discoidal spot, larger in the females than in the males, rests on the end of the cell near the middle of the fore wings, and a pale orange spot occurs in the same position on the hind wings.

Antennæ, head, collar, costal edge of the fore wings and all the fringes, light purplish red.

Under side of the fore wings are the same color as above, with the costal and outer margins and the whole under side of the hind wings sprinkled with brown scales. Discal spot on the under side of the fore wings, black with a white center, while on the hind wings it consists of two small silvery

spots near together, one smaller than the other, surrounded by a rust-colored ring. There is a row of dark points more or less evident, within, and parallel to the outer margin, on the under side of all the wings.

A female variety is sometimes found with wings nearly white.

The larva of this insect feeds on clover, *medicago*, lucerne, buffalo pea, and sometimes on the leaves of peas.

The eggs are deposited on the upper side of the leaves, one only on each plant, and are pale yellow when first deposited, but change in a few hours to a dark crimson color. They are spindle-shaped, .06 of an inch long, attached by one end, ribbed lengthwise and crossed by numerous striæ. The eggs hatch in six or seven days, and the brownish green larvæ at first eat round holes through the leaf, but later eat the entire leaf from the outside.



Fig. 10.
Egg of
Colias philodice
x 10.

The larvæ molt their skins four times before they reach maturity, when they are a little over an inch long, cylindrical, slightly tapering towards the last segment, downy, of a dark green color, somewhat lighter underneath, with a creamy white stripe on each side, through the middle of which runs a broken crimson line, below which there is sometimes a series of black spots. After they are done feeding, they seek some protected place where they spin a button of silk, to which the anal feet are attached, and a loop in which the body is supported; and after a little time the old skin is cast off, and the pupa appears, which is one inch long, of a yellowish green color, with a yellow line along each side.

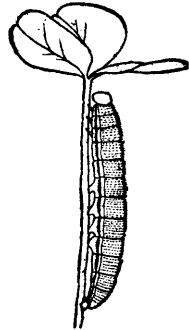


Fig. 11 *Colias philodice*.
Larva (nat. size).

From the laying of the egg to the emergence of the butterfly in the warmest part of the season is about forty days, and as they are to be seen on the wing from the last of May till the last of September, it is probable that we have three broods in Maine. This insect is extremely abundant in this

State, and does a vast amount of damage, feeding as it does on clover, one of our prominent and valuable forage plants. A few years ago I made as careful an estimate as I could of the number on the college farm, their progeny and the amount they would eat, and was led to conclude that they destroyed not less than twenty-five per cent of all the clover growing in the field. The opinion prevails that they do little or no harm, but this is a very grave error.

Parasites play an important part in holding them in check, and our insect-feeding birds, as the robins and sparrows, are extremely useful in destroying them, and should be fully protected from men, boys, cats, shrikes, kingbirds and all other tyrants.

6. COLIAS INTERIOR, Scud.

Co'-li-as in-té-ri-or.

Expanse of wings, 2.25 inches.

This species was described from specimens taken at Cape Breton island, and one from Waterville, as *Colias philodice*, var. *laurentina*, but Mr. W. H. Edwards considers it to be identical with *Colias interior*.

The males closely resemble those of *C. philodice*, except that the sub-marginal row of dots on the under side of the wings is entirely wanting in both sexes, and the terminal black band of the fore wings does not reach the hinder margin, and is almost wholly wanting on the hind wings of the females.

7. TERIAS LISA, Bd-Lec.

Té-ri-as lí-sa.

Expanse of wings, about one inch and a quarter.

Upper surface of the wings sulphur yellow, the fore wings sprinkled with black atoms at the base and along the costa, and a small black discal point rests on the end of the cell. There is also a large dark brown apical patch on the fore

wings, and a smaller one on the hind wings, followed by about four small brown spots, decreasing in size, on the ends of the veins.

Under side of the wings inclining more to orange yellow, and sprinkled with dark atoms except on the middle of the fore wings. A small discal point occurs at the end of the cell on all the wings. Costal edge of the fore wings, all the fringes, a small spot towards the apex of the fore wings, and a patch on the apex of the hind wings, all reddish.

This is a southern butterfly and must be extremely rare in Maine. One example was taken at the Isles of Shoals by Mr. Roland Thaxter.

The larva, which is green with four longitudinal whitish lines, is said to feed on clover and some other leguminous plants.

Family—NYMPHALIDÆ.

Sub-Family—DANAINÆ.

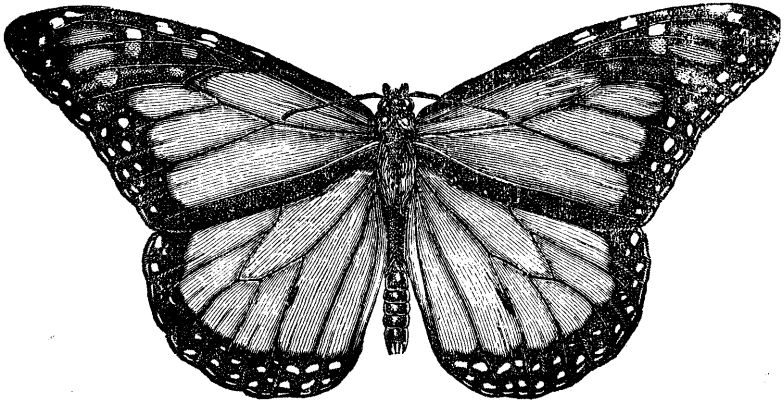


Fig. 12. *Danais archippus* (nat. size).

8. DANAIS ARCHIPPUS, F.

Dan'-a-is ar-chip'-pus.

Expanse of wings, from three and three-fourths to four and a half inches.

Upper side of the wings tawny orange red, with the veins heavily marked with black, and the borders black spotted with white. Under side somewhat paler, but the white spots are more prominent.

Body black, more or less spotted and marked with white.

The males have a black spot by the side of vein 2, near the middle of the hind wing.

The larva of this insect feeds on the different species of milk-weed (*Asclepias*), and bitter root (*Apocynum androsæmifolium*).

The eggs are deposited singly on the under side of the leaves. When first laid they are white, but in two or three days they turn yellow, and just before hatching they change to dull gray. They are somewhat conical in form, one twenty-fifth of an inch long, and marked with about twenty-five longi-

tudinal ribs, and between each of these are about the same number of cross lines, giving the surface a reticulated appearance. These eggs hatch in about a week, and the young larva, which is about one-tenth of an inch long, with a yellowish white body and a large black head, first eats the egg shell, after which it attacks the leaves. They molt three times before reaching maturity, after which they are about one inch and three-fourths long and have a yellowish head marked

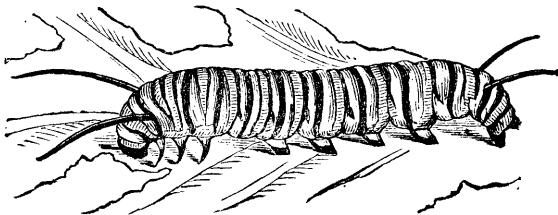


Fig. 13. Larva of *Danais archippus* (nat. size).

with two triangular black stripes. the upper surface of the body is ornamented with transverse stripes of black, yellow and white, this last color covering the greater part of each segment. On the third segment are two long black fleshy horns, and on the twelfth there are two similar but smaller ones. The under side is black, with greenish between the segments.

The larva spins a button of silk on some convenient object, attaching the hind feet to it, and in this suspended position, with no supporting loop of silk, it changes to the pupa.

The pupa is about an inch long, of a bright green color dotted with gold, and with a band of golden dots extending more than half way round the body above the middle. This band is shaded with black, and the part by which it is suspended is black also.

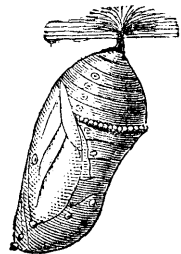


Fig. 14. Pupa of *Danais archippus*.
(nat. size.)

The insect remains in the pupa state from ten to twelve days, when it emerges and remains quietly hanging to some object to give time for its wings to develop and harden, after which it flies away. They are said to hibernate in the butterfly state, and to deposit their eggs the next spring.

As their food plants are of little or no value, we pay but little attention to them save as objects of scientific interest or curiosity.

Sub-Family—NYMPHALINÆ.

9. ARGYNNIS IDALIA, Drury.

Ar-gyn'-nis i-da'-li-a.

Expanse of wings, from three and a half to four inches.

Upper side of the wings, tawny orange red, with a series of four sinuous black bars across the cell, the outer one being double; an irregular black line composed of curved bars crosses the middle of the wing beyond which is a row of small round spots parallel to the outer border. The costal edge and outer border are black, and in the female there is a row of white spots in the black outer border, and a few white dashes towards the apex.

The hind wings are bluish black with a rusty tinge on the base, and a row of cream colored spots across the middle, and another along the outer border, which is cream colored in the female, but orange red in the male.

Under side of the fore wings marked as above, but slightly paler. Under side of the hind wings, dull brown with three rows of pearly white spots across them, one along the outer border, the second just outside of the middle, and the third, inside of the middle of the wing. There are also four spots near the base, and the inner edges are marked with the same color.

Body black, with yellowish hairs on the thorax.

The larva of this insect feeds on violets and pansies.

The egg is in the form of an irregular truncated cone with the top slightly depressed, marked with 18 vertical, wavy

ribs, half of which reach the top, while the rest extend not more than three-fourths of the way up. Between these ribs are numerous cross striæ.

The eggs hatch in about twenty-five days, and the young larva is about one-twelfth of an inch long, of a pale yellowish brown color, with a brown head. All the segments except the first two and the last have a row of eight dark spots, from each of which arises one or two long, black, curved hairs. These insects, as soon as hatched, crawl under some protecting object, as a stick or stone, where they hibernate during the winter. In the spring they revive from this state of lethargy, crawl to the growing violets and at once begin to feed. They molt five times before reaching maturity, changing their appearance at each molt.

The mature larva is one and three-fourths inches long, velvety black, banded and striped with ochrey yellow, changing to dull orange or red, and furnished with six rows of tapering fleshy spines each of which has several small black bristles. The two rows along the back are silvery white with black tips, those at each end of the rows somewhat smaller. The spines of the rows along the sides are smaller and yellowish or orange at the base. The head is reddish above and black beneath. They now seek some suitable place and change to a pupa about an inch long, suspended by the end. In this stage they remain about seventeen days.

This is not a common insect in Maine and is confined to the western part. I have not heard of its occurrence east of the Kennebec river. It has been taken at Waterville, Brunswick, Norway and Portland.

10. ARGYNNIS CYBELE, F.

Ar-gyn'-nis cyb'-e-le.

Expanse of wings, from three to three and a half inches.

Upper side of the wings, fulvous or reddish yellow, brownish at the base; the whole surface marked and spotted with black. The cell is crossed by three sinuous black bars followed by one resembling an inverted P. A heavy zigzag black band crosses the wing a little beyond the middle, beyond which is a row of round black spots between the veins, followed by a series of black lunules, which is followed by two parallel black lines, heaviest on the veins, one on the outer margin, and the other a little within. The veins are black, and in the females the lunules towards the apex are expanded so as to join the sub-terminal black line, leaving the ground color of the wing as a series of round spots.

The hind wings have the subterminal line only, heaviest in the females, the terminal line being almost entirely obliterated, preceded by a series of crescents before which is a row of black, circular spots; while across the middle of the wing is a band of irregular spots not reaching to the abdominal margin, but expanding near the costa, and extending in a broad band toward the base of the wing. Under side of the fore wings pale yellowish marked with yellowish brown on the apical portion; while the rest of the wing is marked with black like the upper side. Under side of hind wings reddish brown, more or less mottled with yellow; the space between the two outer rows of silvery white spots, bright yellow, forming a conspicuous band characteristic of this species. There are about ten silvery white spots on the basal part of the wing, while the two outer rows have seven each.

This species feeds on the different species of wild violet, and also on pansies.

11. ARGYNNIS APHRODITE, F.

Ar-gyn'-nis aph-ro-di'-te.

Expanse of wings, from two and a half to three inches.

Upper surface of the wings, bright reddish fulvous, paler in the female, cinnamon brown on the base. The black markings are similar to those of *Argynnis cybele*, but not quite as heavy. The irregular spots of the median band on the hind wings are smaller, and are not expanded on the costa towards the base as in *cybele*.

Under side of fore wings reddish except on the costa and apex, which are buff with pale brown markings. The black markings of the upper side are re-produced except on the costa and outer margin. Under side of hind wings cinnamon brown with silvery white spots much as in *cybele*, but smaller. The band between the two outer rows of silver spots is buff colored, and very narrow, especially at the extremities.

This species may be distinguished from *cybele* by the band between the two outer rows of silver spots on the under side of the hind wings, which is very narrow and much encroached upon by the ground color of the basal part of the wing; and also by the absence of the broad black patch near the middle of the costa of the hind wings, which is present in *cybele*.

The early stages of this species closely resemble those of *Argynnis cybele*, and like that species it feeds upon wild violet.

The butterfly is on the wing in Orono during the month of July.

12. ARGYNNIS ATLANTIS, Edw.

Ar-gyn'-nis at-lan'-tis.

Expanse of wings, about two and one-half inches.

Upper side of wings fulvous, obscure at the base. All the wings have black outer margins with only a trace of the ground color on them towards the anal angles. In other respects the fore wings are marked as in *aphrodite*, and the hind wings like *cybele*.

Under side of the wings much as in *aphrodite*.

This species is easily distinguished from *cybele* and *aphrodite* by its smaller size, and black outer borders of the upper side of the wings, and its general darker color.

The larva of *Argynnis atlantis* feeds on wild violets, and the early stages are similar to those of *cybele* and *aphrodite*.

This is a common species in Maine, and is on the wing from the middle of June to the early part of July.

13. ARGYNNIS MYRINA, Cram.

Ar-gyn'-nis my-ri'-na.

Expanse of wings, one inch and three-fourths.

Upper side of the wings fulvous or reddish yellow with black markings arranged somewhat like *A. atlantis*. Outer borders of the wings black enclosing a row of fulvous spots nearly obliterated. Under side of the fore wings paler, except on the apex, which has an irregular patch of reddish brown, with a row of silvery white spots along the outer border, and one or two others on the apical patch. The black markings of the upper side are repeated on the rest of the wing. Under side of the hind wings reddish brown, marked in places with pale yellow and with several rows of silvery white spots. Between the two outer rows is one of small, round, black spots. Across the middle of the

wing is a row of about four large silvery white spots; and on the base of the wing are about five more of the same color.

This species feeds on wild violets, and is common in Maine.

The eggs are pale green, somewhat acorn-shaped, with the top cut off, and marked with about fourteen vertical ridges with fine cross lines between them. The young larvæ are about one-twelfth of an inch long, of a pale green color with brownish black head. Brown patches nearly

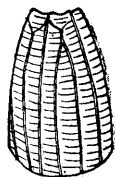


Fig. 15. Egg of *Argynnis myrina*.
x 24.

cover the fifth, seventh, ninth and eleventh segments. Black hairs arise from tubercles on all the segments, and curve forward. They molt four times before reaching maturity, when they are one inch long, ash-brown, mottled with velvety black, with six rows of fleshy spines beset with black bristles; those on the second segment three and one-half times as long as any others, and projected forward. Legs and feet, black; head, bronze colored. Pupa, three-fifths of an inch long, suspended by the tail; light brown streaked with darker, and armed with two rows of sharp, conical tubercles on the back. The perfect insect flies from the last of June to the middle of July.

14. ARGYNNIS BELLONA, F.

Ar-gyn'-nis bel-lo'-na.

Expanse of wings, about one and seven-eighths of an inch.

Upper surface of the wings fulvous or reddish yellow, marked with black, after the general pattern of the other species of this genus. Two rows of black spots on the outer margin preceded by another a little distance within, while the basal half of the wings is marked with black dashes running together, more or less.

Under side of the fore wings marked like the upper side, except the outer part, which, like the under side of the hind wings, is brownish, and glossed with purplish white, with darker spots and irregular lines.

This species may be distinguished from *Argynnis myrina* by the absence of black outer borders to the wings, and of silvery white spots on the under side of the hind wings.

This species feeds upon violets, and is not uncommon in Maine. The eggs are similar to those of the *myrina* in form, size, color and markings; and it closely resembles that species in all the early stages. The mature larva, however, does not have the spines of the second segment lengthened. The perfect insect flies in Orono from the middle of May to the first of June, and again in the early part of September.

15. EUPTOIETA CLAUDIA, Cram.

Eup-toi-e'-ta clau'-di-a.

Expanse of wings, nearly three inches.

Upper side of the wings, bright fulvous, paler in the females, and somewhat dusky on the base and along the costa. The veins, terminal, and sub-terminal lines, are blackish brown. The lines are slightly enlarged where they cross the veins. Within these, in the interspaces, is a row of irregular round spots, followed by two zigzag lines, the inner one heavier and more strongly angulated, its angles extending out to the other line. These two lines also cross the hind wings, but are not as heavy nor as angular as on the fore wings. There is a circle on the end of the cell of the fore wing, and a half-circle near the middle. Below these is a sinuous mark extending from the origin of nervule 2, down to nervure 1. The hind wing also has a curved line across the end of the cell. Fringes, whitish, and marked with blackish brown at the end of the veins.

Under side of fore wings, bright reddish fulvous, from the base to the heavy zigzag line which is repeated from above. The marks on the cell, and the three black spots above the anal angle, are also the same as on the upper side. The outer half of the wing is pale with a reddish wash on the lower part; a pale ashy triangle on the costa; the apex and the outer margin marked with light brownish.

Under side of the hind wings, pale brown on the basal half, beyond which is a whitish band shaded off into a pale brown, followed by a terminal pale band. The veins are whitish, and the round spots of the upper side are faintly re-produced with greenish pupils.

Mr. Lyman wrote me that he "saw and took several specimens of this insect; beginning of August, 1882, near Portland." I am not aware that it has been taken anywhere else in the State.

Mr. W. H. Edwards states that the mature larva is an inch and a half long, of a yellowish brown color, and glossy, with six rows of steel blue, fleshy spines. Between these spines, in the dorsal rows are white tuberculated spots; the head is furnished with two long black jointed spurs, like antennae, and clubbed at the end.

The pupa much resembles that of *Melitaea phæton* in shape; the surface clear pearly color, partly iridescent, and covered with metallic bronze tubercles.

The food plants of this species are violets, mandrake (*Podophyllum peltatum*), passion-flower (*Passiflora incarnata*), *Sedum*, *Desmodium* and *Portulacca*.

16. MELITÆA PHAETON, Drury.

Mel-i-tæ'-a pha'-e-ton.

Expanse of wings, from two to two and one-fourth inches.

Upper surface of the wings, black with a row of red spots along the outer margin, and two red spots on the cell of the fore wing, the outer one being double. One red spot occurs on the cell of the hind wings. These cellular red spots are sometimes wanting. There are two or three rows of cream-colored spots within the outer row of red. Under surface of wings, black, and marked like the upper side, except that the spots are enlarged; and there are several red and also yellow spots on the basal half of the under side of the hind wings, not represented above.

This species is rare, at least, in the vicinity of Orono.

The larvæ feed on *Chelone glabra*, L., Fly Honeysuckle, (*Lonicera ciliata*), and Arrow-wood, (*Viburnum dentatum*). The eggs are laid in large clusters of from two hundred to four hundred, upon the under side of the leaves. They are



Fig. 16. Egg of
Melitaea phaeton.
x 10.

somewhat in the form of a truncated cone, ribbed on the upper half, yellow when laid, but soon turn to crimson, and just before hatching they change to black. Duration of this stage, nine-teen or twenty days. The young larvæ at once begin to construct a web, drawing together the upper leaves of the stem, and feeding upon those which are enclosed, extending the web as more food is required. The first molt takes place in six days, and the second about six days later; while the third occurs in nine or ten days after the second. Before the third molt, they construct a substantial web, in which, after molting, they become lethargic, and hibernate till the following spring, when they revive and crawl about in search of other plants to feed upon. After molting twice more, they reach maturity, and are a little over an inch in length, with the first three and last two segments black; the others red with transverse black lines, and seven rows of long, tapering, fleshy, black spines, bristling with stout, black hairs. These spines arise from round, shining, blue tubercles.

The pupa is four-fifths of an inch long, suspended by the tail, whitish, with red and black dots over the surface.

Duration of this stage, from fourteen to eighteen days.

The imago is on the wing from the first to the middle of July.

17. PHYCIODES HARRISII, Scud.

Phy-ci-o'-des har-ris'-i-i.

Expanse of wings, one inch and three-fourths.

Upper surface of the wings, orange red with black markings; the black so extended as to leave only a sinuous red band across the wing outside of the cell, beyond which is a row of small red spots; also about three on the cell and two below. The sinuous band is so extended, as to fuse, more or less, with the red spots beyond, and is divided by the black veins of the wing.

The hind wings have a broad orange band, also cut by the black veins, and sometimes divided by a black line across the wing. Along the outer edge of this band, is a row of small black spots, two of which sometimes have pale yellow centers.

Under side of the fore wings, with very much less black than the upper side, and with two rows of white spots inside of the outer margin.

Under side of hind wings, dull orange, with the base edged with white, and with about five white spots ringed with black. Across the middle is a band composed of three rows of irregular white spots, on a ground of black; and near the outer border, is a series of pearly white lunules also on a ground of black, within which is a row of small black spots, some of which have white centers.

Body, above, black with reddish hairs; whitish beneath, with red legs. The eggs, and larvæ in their different molts, much resemble those of *Melitæa phæton*; and they hibernate, some before the second, and others after the third molt. They make no web over their food-plant.

This common insect feeds on Aster and *Diplopappus umbellatus*, and has but one generation in a year.

The imago flies in Orono, through the middle of June.

18. PHYCIODES NYCTEIS, Doub.

Phy-ci-o'-des nyc'-te-is.

Expanse of wings, one and three-fourths inches.

Upper side of the wings very much like those of *Phyciodes harrisii*. Under side of fore wings, pale orange, faintly showing the black markings of the upper side. A pale yellow line runs along the outer margin, bordered on each side by a fine brown line, and preceded on the apex, and near the middle of the outer border, by a few white lunules. Under side of hind wings, dark brown, broken somewhat by whitish and pale yellow. A row of large, silvery white spots across the wing near the base, a similarly colored band across the middle of the wing, broken by the brown veins, and edged on the outside by a scalloped brown line. Between this and the outer border, on the brown shade, is a row of round black spots, re-produced from the upper side. A terminal yellow line, with brown edges similar to those of the fore wings, is continued along the outer border of the hind wings, within which is a series of unequal, silvery white lunules, the middle one being much the largest.

Body, above, blackish; beneath, white.

The larvæ feed on *Diplopappus umbellatus*, *Aster*, *Helianthus* and *Actinomeris*. As these wild plants are of no value, the insect has but little economic importance.

The eggs are laid in clusters of about a hundred, on the under side of the leaves. The eggs are whitish green, somewhat in the form of a truncated cone, the lower third of the outside smooth; the middle part marked with hexagonal, irregular, very shallow cells, and the remainder, by vertical ribs, terminating at the rim of the top. Duration of this stage, nine to thirteen days.

The larva passes four molts before reaching maturity, when it is an inch in length, of a blackish brown color above, and greenish brown beneath. Head, shining black, heart-shaped, with the sides high and rounded, and clothed with numerous

black hairs arising from black papillæ. A broad black band along the base, usually of a dull green color, with a yellow stripe in the line of the lower lateral spines, and a broken yellow line running with the spiracles; in some cases, this band is ochre yellow or reddish yellow. The back and sides are much dotted with white. The body is furnished with seven rows of long, tapering, black spines armed with short black hairs, one along the middle of the back, and three on each side, each arising from shining, black tubercles, except those of the lowest row, which has greenish or yellow tubercles. The pupa is .6 of an inch long, similar in shape, to *M. phaeton*, variously colored from greenish yellow to grayish brown. Abdomen armed with five rows of conical tubercles.

This butterfly is on the wing at Orono, about the middle of June.

19. PHYCIODES THAROS, Drury.

Phy-ci-o'-des tha'-ros.

Expanse of wings, one inch and a half to one and seven-eighths.

Upper side of the wings, reddish fulvous, banded and reticulated with black. Borders of the wings black. Three or four spots of the ground color on the cell of the fore wing, with as many more beyond it. A sinuous band across the wing beyond the cell, followed by a series of spots, the lower one of which has a black center, and a lunule beyond this near the middle of the wing, all reddish fulvous. These run into each other more or less in the males.

Hind wings, with a pale, crenate line in the black border, sometimes scarcely perceptible, within which is a row of seven fulvous spots with black centers, the upper ones nearly or quite lost on the black ground. The basal part of the wing is marked by irregular, curved, black lines. Under side of fore wings, fulvous, pale yellow or buff along the costa and outer margin, with a brownish spot near the middle

of the outer margin, and another on the anal angle, preceded by a black spot. Another black spot rests on the middle of the hinder margin; one on the middle of the costa, and another between this last and the end of the wing. Under side of hind wings, pale yellow or buff, with a brown blotch on the outer margin, and a scarcely visible, dull, silvery lunule near the middle. Inside of this is a row of brownish points, corresponding to the black spots above. Across the middle and basal parts of the wings are several irregular, rusty lines. Body blackish above, white underneath.

This species feeds on different species of Asters, both wild and cultivated. There are two broods in a year; the one described above is known as the form *morpheus*, and the one appearing in the early part of the season is the form *marcia*, and scarcely differs on the upper side, but has the under side of the hind wings more or less silvery on the basal part, and the terminal lunules silvery, with a pale, lilac tint.

The eggs are laid in clusters of two hundred or more, sometimes in three tiers, usually on the under side of the leaves. They are pale green, conoidal, depressed at the top, and rounded at the base; the lower half indented like the surface of a thimble, the upper half with about fifteen vertical ribs or flutings. Duration of this stage, four to seven days. The young larva is .06 of an inch long, with a dark brown head, and a yellowish green body clouded with brown, with scattered black hairs, those on the forward segments directed forward.

The first brood passes four molts before reaching maturity, when it is .85 of an inch long, with a heart-shaped, shining, bronze-colored head, with two oblique white stripes on each side, and a spot of the same color above the mouth. The body is dark brown dotted with yellow, and has seven rows of tapering, fleshy spines armed with blackish bristles.

The larvæ of the second brood feed, and pass three molts, when they become lethargic, and hibernate during the winter; and in the spring they revive, go to feeding, and molt twice more, after which, they change to pupæ; and in from one to

two weeks, the butterfly emerges. This is the form *marcia*; while those arising from the first brood mentioned above, are the form *morpheus*.

20. GRAPTA INTERROGATIONIS, F.

Grap'-ta in-ter-ro-ga-ti-o'-nis.

Expanse of wings, two and three-fourths inches.

Upper side of the wings, tawny orange, with brown spots running together on the outer part, and with an oblique black spot extending from the middle of the costa across the end of the cell. Two more small ones in the cell, and three or four somewhat larger, resting on the interspaces below. Hind wings, above, of the same color as the fore wings, with two small black spots near the middle, and one on the costa, which is double in the female. The outer borders of all the wings, including the angles and tails, are lilac. Under side of the wings, pale brown, more or less clouded with darker brown, with an irregular, sharply angulated band across the middle of both wings; the surface more or less washed with lilac. At the end of the cell, near the middle of the under side of the hind wings, is an interrupted C, usually silvery, but sometimes golden-colored.

There are two forms of this insect; the one described above is known as the form *fabricii*; and the other, which is known as the form *umbrosa*, differs from the above in having the outer half of the hind wings quite black, and the under side of the fore wings of the males, lighter, and coarsely marbled.

The larvæ of this species live on the leaves of the hop, elm, nettle, false nettle and basswood. The eggs are pale green, conoidal in form, with the base flattened; the sides are rounded, and marked by eight or nine vertical ribs, which are low near the base, but higher above, and terminate abruptly around a small, flat space at the top. Duration of this stage, from three to ten days. The caterpillars pass four

molts before they reach maturity, when they are about an inch and a half long, pale yellow, variegated with brown, with a yellowish line on each side of the body. The head is rust red, with two blackish, branched spines at the top. The spines of the body are arranged in seven rows, one along the middle of the back, from the fourth to the eleventh segment, inclusive, and three rows on each side arranged as in *Grapta comma*.

The pupa is one inch long, variable in color from light yellowish to dark brown, with the head deeply notched; a thin prominence on the thorax, and eight silvery spots on the back.

21. GRAPTA COMMA, Harr.

Grap'-ta com'-ma.

Expanse of wings, from two and one-fourth to two and one-half inches.

Upper side of wings, tawny orange. Outer border of fore wings, black, edged within by a series of pale yellow spots. A rusty brown patch rests on the hind margin against the black border, and an oblique patch of the same color, on the costa before the apex. An oblique patch from the middle of the costa across the end of the cell; two spots, one above the other, on the middle of the cell; and three spots, the first one below these, the other two beyond, in the interspaces, all black. Upper side of the hind wings, more or less washed with brown; the outer borders, dark brown, with a row of yellowish red spots before it; and three black spots, one on the costa, one on the cell, and one below.

Under side of the wings, marbled with light and dark brown; the hind wings, with a silvery C on the middle. The males have the under side more or less washed with pink.

The eggs are green, similar in form to those of *interrogationis*, and marked by ten vertical ribs, with fine cross striæ

between them. Duration of this stage, four or five days. The larva passes four molts before maturity, and is then one inch long, armed with seven rows of long, tapering spines; one along the middle of the back, from the third to the twelfth segment, inclusive, and three along each side; the upper row on each side running from the third to the twelfth segment; the next row from the third to the thirteenth, but the spine on the fourth, is below the row and in line with the spiracles; the lower row extends from the fifth to the twelfth segment. A little below the summit of each spine, from three to five branches start out, each branch and spine ending in a bristle. The color varies greatly; some are black with yellow bases to the spines and a yellow lateral line; others are nearly white, with red spots along the sides.

The pupa is about four-fifths of an inch long, of various shades of gray or brown, with golden protuberances on the abdomen, and a flattened prominence on the back.

The larva of this species feeds on hop, nettle, false nettle and elm; and after the second molt, they conceal themselves among the leaves drawn together with silk. There are two broods in a year; the last one hibernates in the perfect state, and the females revive in the spring and lay their eggs for the next brood. The form which appears in the fall, and hibernates during the winter is called *harrisii*, and is the one described above. The next generation is the form called *dryas*, and differs from the above in having the upper side of the hind wings nearly black.

This species has been taken in Orono, on the tenth of August.



Fig. 17. *Grapta faunus* (nat. size; under surface on left).

22. GRAPTA FAUNUS, Edw.

Grap'-ta fau'-nus.

Expanse of wings, from two and one-fourth to two and three-fourths inches.

Upper side of wings, deep orange fulvous, marked with brown and black, as in *G. comma*, only the markings are clearer and heavier.

Under side of both wings, dark brown on the base, with an irregular, common, blackish band across the middle, darkest on its outer edge, and within the abdominal margin, where its outline is obliquely serrated; beyond this band, the color is pale brown, mottled with grayish white, which is clearest on the costa of the fore wings; the whole surface clouded with wine color, and more or less crossed by fine abbreviated streaks of dark brown; apex of fore wings, yellowish brown, with three small, lanceolate, rusty spots, the lower one enclosing a blue or green point; the outer margin of both wings below these, bordered by a series of confluent blue-black, sometimes olive-green spots, following the outline of the wing; a little before this, another series of rounded spots of the same color, those on the hind wings largest and sometimes having black centers. A white G, varying in form, in the middle of the under side of the hind wing.

This species feeds on wild gooseberry, cultivated currant, willow and *Betula lenta*.

The mature larva is an inch and one-fourth long, head black, furnished with two branching horns, and a few scattered white hairs. Upper side of second to sixth segments, brick red, striped transversely with blue, yellow and black lines; a few white hairs on the second segment; four branching, yellow spines, with black tips, on the third and fourth segments; six on the fifth and sixth. Segments seven to twelve are white, with a faintly-marked black stripe along the back, each with three transverse yellow bands and two oblique black spots. These segments have each seven branching spines, all white except the one next to the lowest, which is brown. Last two segments black, twelfth, with seven spines like the eleventh, and the thirteenth has four white spines. Sides red, with two black bands, the lower spotted with blue.

Under side gray, striped transversely with black. Feet and prolegs black.

The pupa is well represented in Fig. 18.

The perfect insect flies in Orono about the middle of August.



Fig. 18. Pupa of
Grapta faunus.
(nat. size.)

23. GRAPTA PROGNE, Cram.

Grap'-ta prog'-ne.

Expanse of wings, about two and one-half inches.

Upper side of wings, tawny orange, marked and bordered with black as in *G. comma*. Under side of wings, brown, crossed with fine black streaks, and a paler band on the outer part, leaving the darker basal part strongly angulated on the middle.

Hind wings with a silvery mark, somewhat in the form of the letter L, on the middle of the under side.

The larva of this insect feeds on currant and gooseberry,

both wild and cultivated, and also on the leaves of elm, hibernating in the perfect state.

The eggs are similar to those of *G. interrogationis*, and the mature larva is about one inch long, buff-colored, and armed with branching spines as in *G. comma*. Head, subcordate, with a large, compound, spinous process on each vertex, the main stem black, the branches black and yellow, the face and sides of the head thickly covered with simple, conical, yellowish spines of various sizes. The surface of the body varies greatly in color and markings.

The pupa is .7 of an inch long, suspended by the tail; the head-case, high, with a short, stout, conical projection at each vertex, the space between being rounded, the back with a thin prominence. There are several rows of tubercles on the abdomen, mostly small, some of which are gilded; colors, dull green, brown and pinkish white.

The butterfly is on the wing in Orono, about the middle of August, and hibernated specimens, early in the spring.

24. GRAPTA J ALBUM, Bd-Lec.

Grap'-ta j al'-bum.

Expanse of wings, about three inches.

Upper side of the wings, dull yellowish, washed more or less with dull, rusty brown, which is darker and more dense on the base of the wings. The outer margin of the fore wings is black, with a double crenate line, more or less obscured by black atoms along the edge; two oblique black bars on the costa, one on the middle, the other between this and the apex, and separated from the black border by a white costal spot. There is also a black spot on the middle of the cell, with another below, and three beyond, between the veins. The upper side of the hind wings has a heavy, angulated brown line a little within the outer margin, and a black costa broken by a white spot. Under side of wings brown from the base to the middle, with light and dark waves, then

grayish-white with fine reticulations, and a scarcely perceptible row of dark points; and near the outer margin, is a wavy, dark line, followed by a narrow, ashy-blue shade.

The larva is two inches long, light green; head with black markings on the sides, thickly set with bristles and short spines, of which the lateral ones are each tipped with a long bristle, and armed with two shining, black, thick spines, whorled near the tip. The three upper rows of spines on the body are shining black, except at the base, which is reddish, with long branches, those of the forward segments more numerous branched than the others, and having each point tipped with a bristle. The remaining spines are reddish, tipped with black.

The pupa is one inch long, of a beautiful green color, delicately reticulated, with six golden spots on the back; spines and projections similar to those in *G. comma*.

The food-plant is not known, but it may be willow. The above description of the larva and pupa was taken from Prof. Lintner's account of one which he found crawling on the ground in a dense grove of varied timber. The butterfly hibernates and appears on the wing early in the spring, and again about the middle of August.

25. VANESSA ANTIOPA, L.

Va-nes'-sa an-ti'-o-pa.

Expanse of wings, two and one-half to three inches.

Upper side of wings, purplish or dark reddish brown, with the outer edge of the wings pale yellow, somewhat sprinkled with black, and preceded by a black band, on which is a row of violet-blue spots. The costa of the fore wings is black, with cross streaks of yellowish, and two oblique yellow dashes beyond the middle. Under side of the wings, very dark brown, with numerous wavy cross lines of black, and the outer margins and discal points, dull white, sprinkled with brown.

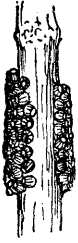


Fig. 19. Clusters
of Eggs of
Vanessa antiopa,
encircling the
twig of an elm.
x 2.

This species hibernates in the perfect state during the winter, and appears in the spring with the wings much worn and faded. The females deposit a dozen or more pale yellow, ribbed eggs in a girde around the twigs of willow, elm, or poplar, near the petiole of a springing leaf, upon which the young larvæ may feed. The mature larvæ are two inches long, black, minutely dotted with white, which gives them a grayish look. There is a row of bright, brick-red spots along the top of the back. Head black, and roughened with small, black tubercles. The spines on the body are black, rather long, and slightly branching; four each on the second and third segments, six on the fourth and fifth, and seven on each, from the sixth to the twelfth, inclusive. The last segment has two pairs of short spines, one behind the other.

The pupa is dark brown or gray, with two rows of conical spines along the back of the abdomen, two on the head in front, three on the edge of the wing-covers on each side, and a thin prominence on the middle of the thorax.

Hibernated specimens of this butterfly are on the wing in the spring, and fresh specimens of the next brood are out about the middle of August.

26. VANESSA MILBERTI, Godt.

Va-nes'-sa mil-ber'-ti.

Expanse of wings, two and-one-fourth inches.

Upper side of wings, blackish brown, with a wide, fulvous band across both wings, between the middle and the outer margin, slightly wavy, and of a paler tint on its inner edge, followed on the outer border of the hind wings, with a row of violet crescents. The fore wings have two fulvous spots on the cell, a black spot in the band on the costa, with a white

spot on each side of it. Under side, dark brown, with wavy cross lines of darker color, and a band of a paler tint corresponding to that above.

This species feeds on nettle, and is rather rare at this place.

It hibernates in the perfect stage, emerging in the spring.

The mature larva is a little more than an inch long, with a black head sprinkled with minute, whitish dots, from which spring pale hairs. The body is nearly black above, with small, white dots and pale hairs, which give it a grayish color. The spines are arranged as in *V. antiopa*, and are black and branching. A greenish yellow, lateral line low on the side, above which is a broken line of a brighter orange yellow shade.

Hibernated specimens of this butterfly are on the wing in the spring, and fresh specimens of the next brood are out in the last of July.

27. PYRAMEIS ATALANTA, L.

Py-ra-me'-is at-a-lan'-ta.

Expanse of wings, two and a half to three inches.

Upper side of wings, black, with an oblique, orange red band across the middle, and marked with six white spots towards the apex, the inner one of which is a broad, oblique dash on the costa. Hind wings, with an orange red band on the outer margin, on which is a row of black dots, the two nearest the anal angle having blue centers. Under side of fore wings, paler, especially so on the apex.

Under side of hind wings, slightly marbled with gray, a whitish spot resting upon the middle of the costa.

This species feeds on the nettle and hop.

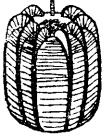


Fig. 20 Egg of
Pyrameis atalanta.
x 20.

The eggs are green, barrel-shaped, with nine vertical ribs, highest at the top. Duration of this stage, five days.

The larva draws together the edges of a leaf, within which it remains and feeds until forced to leave for another, which it draws together in the same manner. The mature larva is nearly an inch and half long, of various tints, from yellowish green to violet, powdered with gray, and armed with spines arranged as in *Vanessa*.

28. PYRAMEIS HUNTERA, F.

Py-ra-me'-is hun'-te-ra.

Expanse of wings, from two and one-fourth to two and one-half inches.

Upper side of wings, tawny, variegated and spotted with black and white. Hind wings, marbled and streaked, with two large eye-like spots near the outer margins. The spots on the under side corresponding to these are black, with violet centers.

This insect feeds on *Gnaphalium polycephalum*, drawing the leaves together into a rude case, within which it lives, feeding on the inner surface of the leaves, especially near the summit. The mature larva is one inch and a fifth long, with a black head. The body above is alternately banded with rich blackish purple and yellowish green. The purple bands occupy the middle portion of each segment, and on these arise transverse rows of black, branching spines, as follows:—four each on the third, fourth and last, and seven on each of those between.

On each side of the back, from the sixth to the twelfth segments, inclusive, is a round, silvery white spot.

29. PYRAMEIS CARDUI, L.

Py-ra-mé-is car'-du-i.

Expanse of wings, two and three-fourths inches.

Upper side of wings, with color and markings very much like *P. huntera*. Under side of hind wings, marbled, a white spot on the middle of the wing, and a row of four or five eye-like spots near the outer margin.

This insect is double-brooded, and hibernates in the perfect state, reviving in May, and depositing its eggs on the leaves of thistles, burdock and sunflower, hatching in six or eight days, when the young conceals itself in a curled leaf. The mature larva is an inch and one-fourth long, with a black head, or reddish in some examples, sprinkled with fine whitish hairs, and a few small black tubercles. The body is grayish brown, variegated with yellow and black. The second, third, fourth, fifth, and last segments are black, with many whitish dots. A broken stripe along the back, white in front, yellow behind. The second segment is without spines, but is covered with fine, whitish hairs. The third and fourth segments have four spines each; the others have seven each, except the last, which has two pairs, placed one behind the other. The spines are much branched, and vary in color from yellowish to brownish white, tipped with black; base of spines along the sides of the body, from fifth to twelfth segments, of a reddish orange color. Body thickly sprinkled with fine whitish hairs, arising from minute white or yellow dots; a pale yellowish broken stripe on each side close to the under surface.

30. JUNONIA COENIA, Hub.

Ju-no'-ni-a coe'-ni-a.

Expanse of wings, from two to two and a half inches.

Upper side of wings, dark brown, each with a large and a small eye-like spot on both sides. The fore wings have two orange red bars, edged with black, in the cell, and a large whitish oblique band across the outer part of the wing, enclosing the hinder eye-like spots. This band is broken by the brown veins which cross it, and is stained with reddish in the females, with a branch extending up towards the apex. Hind wings, with a narrow reddish band between the eye spots and the outer margin.

This butterfly, though common in the Southern States, is exceedingly rare in Maine; one specimen was taken in the summer of 1883, near Bangor.

The caterpillars feed on plantain, snapdragon and Gerardia. They are blackish, pointed with white, and reddish underneath; and have two lateral white lines, of which the upper is marked with a row of fulvous spots.

Pupa, like those of *P. cardui* and *huntera*, but blackish, varied with whitish, without any metallic spot.

31. LIMENITIS ARTEMIS, Drury.

Li-men-i'-tis ar'-the-mis.

Expanse of wings, two and one-half to three inches.

Upper side of wings, brownish black, with a common white band a little beyond the middle, and a double series of blue crescents along the outer margin of the hind wings, and only a single row on the fore wings, inside of which, there is sometimes a short row of fulvous spots. Two or three white spots before the apex of the fore wings. The males have a row of seven round reddish spots between the band and the blue crescents on the hind wings.

Under side of wings lighter than above, and washed more or less with rust red. Two red spots surrounded with black, and some bluish atoms are on the cell of the fore wing, and three spots of the same color on the basal part of the hind wing.

There are two forms of this butterfly, which were originally thought to be distinct species, but Mr. W. H. Edwards has raised both from eggs laid by one individual. The description given above is of the form *lamina*, F, and is the most common one in this State. The other form is called *proserpina*, Edw., and was taken by Mr. Lyman, near Portland, in July. He states that there is sometimes a second brood of this form towards the end of August or beginning of September.

The form *proserpina* is of the same size and form as *lamina*, but the white band across the middle of the wings is wanting, or at most, there is only a whitish stripe occupying some part of the position of the band. Intermediate examples connecting the two forms have occasionally been taken.

This species is very common in Maine, and feeds on the leaves of willow, aspen, basswood, and probably thorn. The eggs, which are laid one on each leaf, near the tip, are grayish green, dome-shaped with the whole surface covered with six-sided reticulations, from each angle of which arises a short, tapering, white spine. The egg hatches in from seven to nine days, and the young larva is about one-tenth of an inch long, yellowish brown, covered with fine tubercles, each giving out a fine, club-shaped hair. The newly hatched larva eats away the end of the leaf on both sides of the mid-rib. When at rest it is found on the stripped portion of the rib, and is easily discovered by this habit. The end of the rib is no sooner laid bare than it is coated and wound with silk, and to the extremity are fixed pellets of excrement, two or three at first placed in line. These are bound together and to the rib. As the larva grows and consumes the sides of the leaf, this perch is increased considerably in size. The larva molts in eight days, after which it is about one-fifth of

an inch long, and blackish brown. On the top of the eighth segment is a light brown patch extending down on each side. The tubercles of the back are larger than the others. The head is now somewhat warty and depressed in the middle above. In six days more it molts again, after which it is one-fourth of an inch long, and much the same in form and markings as before. Five days after this molt, the larva is four-tenths of an inch long, and begins to construct a winter residence. This is accomplished by cutting away the sides and outer end of the leaf, leaving a fiddle-shaped piece with the midrib through the center. It next draws up the edges by silken threads until the two edges are brought together, and the seam woven together with a close mat of silk, and the entire inside of the domicile lined with silk. The stem of the leaf is also firmly secured to the branch from which it grows so as to prevent its falling to the ground, as it otherwise would do. In this silk-lined house or *hibernaculum* it now retires, closing the door, and hibernates for the winter. In the spring it revives, and emerges after the new leaves are put forth, and feeds a little, and then molts its skin for the third time. It is now nearly half an inch long, of a reddish brown color, somewhat speckled and mottled with black, segments two to four yellowish. On the third segment is a pair of irregular, knobbed appendages of a red color. The yellow patch on the eighth and ninth segments is extended down the sides. In six days more it passes the fourth and last molt, being three-fifths of an inch long, and much as in the last molt. Two days later the colors begin to change somewhat, and at maturity the larva is one inch and one-fifth long. In about ten days from the last molt it spins a button of silk on the under side of a branch to which it attaches itself and changes to a pupa nearly an inch in length, silvery gray, with a prominent, rounded appendage near the middle of the back. Duration of this stage, about ten days.

The butterfly emerges and is on the wing at this place during the last of June and the first of July.

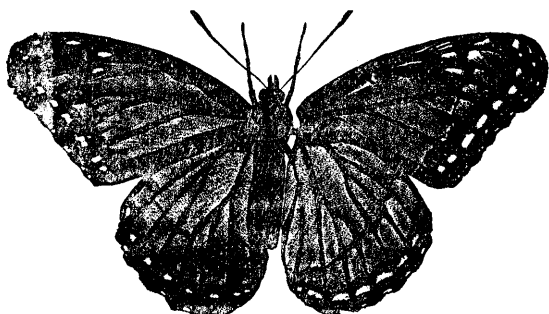


Fig. 21. *Limenitis disippus* (nat. size; under surface on the right).

32. LIMENITIS DISIPPUS, Godt.

Li-men-i'tis di-sip'-pus.

Expanse of wings, two and a half to three inches.

Upper side of wings, reddish fulvous, with black edges and veins. The outer borders of both wings have a row of white spots, and the fringes are white and black alternately. An oblique, triangular, black band extends nearly across the outer part of the fore wing, with a row of three white spots on it. A narrow black band across the hind wings a little beyond the middle.

Under side paler but marked like the upper side, except that there are two rows of white spots on the terminal band.

The larva of this common species feeds on the leaves of apple, plum, willow, poplar and oak.

The eggs (Fig. 22, *a*, greatly enlarged), of this insect, are similar in size and form to those of *L. arthemis*, pale yellow at first, but changing to gray. They are generally deposited singly, near the end

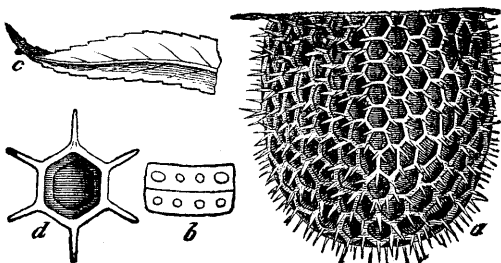


Fig. 22. *Limenitis disippus*; *a*, egg, greatly enlarged; *b*, one segment of the larva; *c*, egg on the leaf of a willow; *d*, one of the facets of the surface of the egg, very much enlarged.

of a leaf, on the under side, (Fig. 22, *c*.) Prof. Riley has described the early stages so admirably, that I give it in nearly his own language. The newly hatched larva is .9 of an inch in length, with a yellowish brown head, twice as large as the second segment, and distinctly bi-lobed. The second segment is also larger than the others. Each segment is divided by a transverse impressed line, and upon the top of each fold thus made, are four elevated spots, the forward ones being larger than the rest, (Fig. 22, *b*, enlarged.) There is a sub-dorsal and also a sub-stigmatal row of similar, rounded warts, and they all give rise to little pale bristles or spines. The general color is pale yellowish-brown, mottled with dark streaks, especially below the stigmata. The second period scarcely differs from the first, except in the somewhat greater length of the horns. In the third period, the horns acquire their mature proportions, and the whole surface of the larva becomes more granulated. In the fourth or last, the blue points appear and the lateral rows of tubercles lose their conspicuousness, to a great extent.

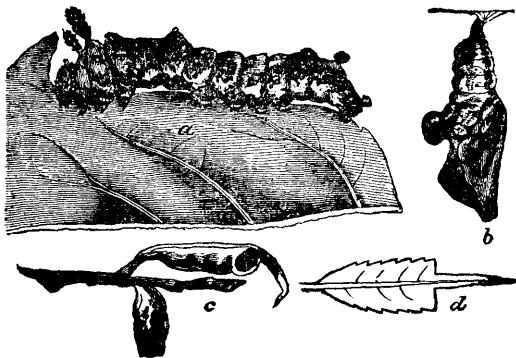


Fig. 23. *Limenitis disippus*; *a*, larva; *b*, pupa; *c*, hibernaculum; *d*, leaf of willow as cut by the larva.

The mature larva, (Fig. 23, *a*,) is one inch and one-fifth long. General color, either whitish or olive green. Body thickly granulated. Head, dull olive, with dense, minute prickles; its vertex, bifid, and terminating in

a pair of prickly, cylindrical horns, transversely arranged, and each about .3 of an inch long. Back, speckled and mottled with olive of different shades above the line of spiracles, except segments three and nine, and the upper parts of eight and ten, but with a continuous, pure white line below the spiracles, beneath which line, on segments five to eleven,

is a large olive patch, extending on segments seven to ten to the external tip of the prolegs. A pair of black transversely arranged dorsal dots in the suture behind segment three, and a more or less obvious lateral one just above and behind the sixth and eighth pair of stigmata surrounding the lateral white line. Segments four to eight and ten to twelve, with more or less shining, elevated, blue dots. On segment three, a pair of prickly, cylindrical, black horns, transversely arranged, and .16 of an inch long. On segments four, eleven and twelve, a pair of large dorsal tubercles transversely arranged, each crowned by a little bunch of from eight to twelve robust prickles. On segment six, a pair of similar tubercles, but still larger, of a yellowish color. On segments five, seven, eight and ten, tubercles similar to those on segments four, eleven and twelve, but smaller. On segment thirteen, four black, prickly, dorsal horns, quadrangularly arranged, and each about .03 of an inch long. Stigmata and legs, blackish. Different examples vary greatly in the general depth of coloring, and in the proportion of the lighter and darker shades.

The pupa, (Fig. 23, *b*,) is similar in form to that of *L. arthemis*, and is marked with burnt-umber brown, ashy-gray, flesh-color and silvery white.

The winter is passed in a *hibernaculum* (Fig. 23, *c* and *d*), composed of a leaf, similar to *L. arthemis*.

The eggs of this species are destroyed by spiders, ants and a minute egg parasite belonging to the Hymenopterous family, *Chalcididae*, and the larvæ, while small, are destroyed by spiders, a *Tachina* fly, a species of *Microgaster* and birds.

This species flies in Orono, from the middle of July to the middle of August.

Sub-Family—SATYRINÆ.

33. NEONYMPHA EURYTRIS, F.

Ne-o-nym'-pha eu'-ry-tris.

Expanse of wings, from one inch and a half to two inches.

Upper side of wings, dark wood-brown, with a slightly paler band across the ends, on which rest two eye-spots on each wing. These spots are black, with yellow rings, and a double metallic spot in the center. A triple line runs along the outer margin of the wings.

Under side of wings, lighter with a triple line along the outer margins and two wavy lines across the wings, one before, the other beyond the middle. The eye-spots of the upper side are repeated with two double silvery spots between. There are four eye-spots on the upper side of the hind wings, the upper and lower being the smallest.

This species has never been taken in this vicinity, but occurs in the western part of the State. The larva feeds on grass and hibernates in the winter, after which it completes its development, giving rise to the butterfly in June or July, thus having but one generation in a year. The eggs are pale yellowish green, nearly globular, flattened at the place of attachment, the surface covered by a fine net-work of slightly raised lines. They are deposited singly on the blades of grass, and hatch in about ten days. The young larva is .08 of an inch long, cylindrical, thickest in the middle, tapering each way, the last segment ending in two short tails; body covered with fine white hairs, slightly re-curved; color pinkish white, marked lengthwise by seven crimson lines, one of which is along the middle of the back and three on each side.

The head is dark brown, very large, and with a small conical process on each side above. They make their first molt in about seven days, after which they are .16 of an inch long, with a yellowish head, finely mottled with red, and with a small, rounded, red process on each vertex. The body is drab, with either a green or a red tint, and striped lengthwise with dull red, one stripe along the middle of the back and two more on each side. The whole surface is covered with fine tubercles of irregular size and shape, each of which gives rise to a short hair. In six days they molt their skins the second time, and are then one-fourth of an inch long; head shaped as before, yellow, with two arched rows of rounded brown patches across the upper part of the front. Body dull ochery yellow striped with brown, one broad dark stripe along the middle of the back and a similar one on the lower part of each side; two narrow stripes on the middle of each side, paler colored; tails reddish at the tips.

The larva passes the third molt in fourteen days from the last, and is .44 of an inch long, the middle segments stouter, the base broader than before; color, pale ochre yellow, somewhat mottled with reddish on the back, but variable; the lateral stripes sometimes nearly if not quite obsolete, and in place of the upper one is a dark point or spot on the hinder part of each segment from four to ten; basal ridge, buff; surface more roughened than before; head nearly as before, the spots on the face darker.

These larvæ are at all times very sluggish, and frequently pass days without eating. It is probable that they hibernate in this latitude after the third molt, and make the fourth and last in the spring, after their winter sleep.

The mature larva is one inch long, flat on the base, the back rounded, much arched on the middle segments, the sides flat and sloping, and there is a fleshy ridge along the sides over the feet; the second segment is much constricted, and the last is forked. Color above, yellowish brown, darker on the sides, a dark brown band running along the back, and on

each side of this on each segment from four to eleven is an indistinct patch. The basal ridge is yellowish, and the tails are tipped with red. The whole surface is covered with sharp tubercles of irregular size, from each of which arises a short brown hair. Head yellowish brown, finely tuberculated, the vertices a little produced, the face crossed by three rows of rounded brown patches.

The pupa is half an inch long, suspended by the tail only, cylindrical, the abdomen stout and larger than the remaining part. Color, pale yellowish brown. Duration of this stage, eleven days.

34. NEONYMPHA CANTHUS, L.

Ne-o-nym'-pha can'-thus.

Expanse of wings, two inches.

Upper side of wings, pale yellowish brown or wood brown; a scarcely perceptible pale band across the outer part of the wings, leaving an angle of the darker ground color apparent beyond the end of the cell. The outer margins of the wings have a pale narrow border, through the middle of which runs a dark line. The fore wings have four small black eye-spots on the pale band, and the hind wings have six.

Under side of wings lighter than above, and crossed by two irregular wavy lines, and the outer borders the same as above. Five eye-spots on the fore wings and six on the hind wings. These spots have a silvery white center on a black spot, which is ringed with pale yellow, followed by a ring of the general ground color, outside of which is a paler ring.

This is a common insect in Maine, feeding on grass, and passing the winter in the larval state.

The eggs are laid singly on the stems of grass, are greenish white, nearly globular, and with the surface slightly rough, but without definite markings. They hatch in about seven days, the young larva being .09 of an inch long, yellowish

white, but changing in a few hours to pale green. The head is light brown, nearly twice as broad as the second segment, and has on each vertex a small rounded prominence indented at the top, and from the middle of the hollow rises a little tubercle with a bristle. The last segment of the body ends in two tails. In eight days the larva molts, after which it is .26 of an inch long, slender, slightly thickest in the middle segments; the tails longer in proportion than at first, slender, somewhat conical, pink-tipped; rough, with white, pointed tubercles, and short bristles. Color, at first greenish yellow, afterwards changing to pale green. Along the middle of the back is a dark green stripe free from tubercles, and on either edge of this, is a line of white tubercles, another along the side, and a third along the base; between the last two, are two other white lines. The head is yellowish green, with the surface finely tuberculated. On each vertex is a long, tapering, rough horn, tipped with brown, and marked in front by a reddish stripe, which is extended down the side of the face. In about nine days it molts a second time, is .4 of an inch long, of the same form as before, and yellowish green, with the same tuberculated lines. The horns on the head are longer than before, nearer together, and the upper part pink. In about fifteen days it molts for the third time, after which it is .55 of an inch long, of the same form and color as before, but changes very soon to brown and buff. Along the middle of the back is a brown stripe, on either side of which is a reddish buff band, which changes to greenish on the outer side. Another buff band on the side, through the middle of which runs a brown line. The basal ridge is buff. In a few days the larvæ become lethargic, in which state they pass the winter. Soon after their revival in the spring, they molt for the fourth time, being .62 of an inch long, pale green, with a dark stripe along the back, and a yellowish white one just below; the two lines on the side and the basal stripe of the same color. Tails, green; head, emerald green, the horns reddish, the stripe down the face,

dark brown. In thirty days they pass the fifth and last molt. The mature larva is 1.2 inches in length, slender, the back arched, the last segment ending in two long, slender, rough, conical tails. The whole surface is finely tuberculated, each tubercle giving off a fine short hair. Color of body, green, a darker stripe along the back, and on either side of this, a pale green band, on the outer edge of which is a yellowish green stripe. On the side below the above, is a pale green band, through which runs a yellow line, and there is a yellow stripe along the base. Head, yellowish green, and the horns red with a brown stripe down the front, which extends down the side of the face. Pupa unknown.

The butterfly appears on the wing in Orono, about the middle of July.

35. DEBIS PORTLANDIA, F.

De'-bis Port-lan'-di-a.

Expanse of wings, two and one-fourth inches.

Upper side of wings, dark wood-brown, with three large black eye-spots on the fore wings, and five on the hind wings. These eye-spots have no pupils, but are surrounded by a yellow iris or ring. There is sometimes an intermediate small eye-spot on the fore wings between one and two, and the hind wings occasionally have a small eye-spot near the anal angle.

The fore wings have a paler shade beginning on the costa beyond the middle and extending across the wing so as to include the eye-spots, and having the inner side angulated and curved.

Under side of the wings lighter than above, and with violet reflections. Two brown lines cross the wings, one before the middle, nearly straight, the other beyond the middle, sinuous. The eye-spots are brighter and blacker than above, those on the fore wings enclosed in a pale, oblong ring; the first and last are usually pupilled with white, as are all the

spots on the hind wings which are preceded and followed by a pale sinuous line, and there is another of the same color just within the outer margins.

This species is not common in Maine, and is quite local, being a forest species, and not found in the open fields.

The larvae feed on grass, probably some of the wild grasses of the forest in a state of nature. The eggs are obovoid, greenish white, with a smooth surface. They hatch in about six days and the young larva is .13 of an inch long, cylindrical, head twice as wide as any other segment, body tapering from the second segment to the end. Color of the body, whitish yellow, changing in a few hours to pale green. Head yellow, somewhat tinted with brown. In eight days the larva molts the first time, after which it is .26 of an inch long, tapering as before, the last segment ending in two long, slender, blunt-tipped tails; color of body, bright green, much covered with whitish tubercles, mostly arranged in longitudinal rows, one being on either side of the middle line of the back, and two more on each side, with many separate tubercles in the intervening spaces; each tubercle bears a short, stiff, white hair. Head, dark green, with a rough horn on each vertex, the horns being green with a red tip.

In about eight days the larvæ molt the second time, after which they are .44 of an inch long, of the same form as before. Color, light green. The next molt is made in from nine to fifteen days, after which the larva is .52 of an inch long, and of the same form and color as before. At this time they go into the lethargic state, and hibernate during the winter. Soon after they revive in the spring they molt the fourth time, and are .6 of an inch long, of a yellowish green color. In from eleven to twenty days they molt the fifth time, and reach maturity in about ten days more.

The mature larva is 1.2 inches long, the middle of the back much arched, and sloping each way; the last segment ending in two small, short, slender tails, and the whole body is covered with fine whitish tubercles, mostly arranged in

longitudinal rows, each having a short stiff hair. Head, yellowish green, with many rather large, white, conical tubercles, and with a rough, red-tipped horn on each vertex. Body, also yellowish green, with a dark green band along the middle of the back, and on each side of this a yellow line, with a dark green line above it and another along the side, with a narrow yellow stripe along the base. Tails tipped with pink.

A few days later the larva attaches itself to some object and changes to a pupa, which is .6 of an inch long, cylindrical, the abdomen conical, the wing-covers raised considerably along the back side. The color is delicate green, sometimes bluish green, and the surface smooth and glossy.

The butterfly emerges from the pupa in about fourteen days, and appears on the wing in Orono, about the middle of July.

36. SATYRUS ALOPE, F.

Sat'-y-rus al'-o-pe.

Expanse of wings, from two and one-fourth to two and one-half inches.

Upper surface of wings, blackish brown, darkest on the basal portions; outer margins bordered by two fine, parallel lines, a little within which is a black stripe. The fore wings have a transverse yellow band beyond the disk; sometimes a little ochraceous, and often more or less encroached on by the brown ground; on this are two round black eye-spots of variable size, and with or without a white central point with blue scales.

The hind wings have a similar eye-spot near the anal angle.

Under side of the wings, yellowish brown; the band enlarged, and of a paler color; the eye-spots repeated and enlarged. The brown area is marked by numerous darker cross streaks. Under side of hind wings, marked like the

base of the fore wings; and the eye-spots are in two groups of three each, the middle one of each group being the largest; all black, rounded, in narrow yellow rings, and having white dots edged by blue scales.

This species is rare in Maine, at least in this part of the State, but the other form, *nephele*, is common. These two forms were originally described as two distinct species, and have been so considered until quite recently, when both forms were bred from eggs laid by a single female.

Form, *NEPHELE*, neph'-e-le, Kirby.

This form is of the same size and color as the form *alope*, but the yellow band on the fore wings is wholly wanting, or in some of the intergrades, with a little yellow shade around the eye-spots.

This species feeds on grass, the eggs being laid singly on the stems.

The eggs are lemon yellow, somewhat in the form of a truncated cone; about eighteen vertical ridges with rounded excavations between, crossed by fine striæ, spring from near the base, and extend to the edge of the top; this last is rounded, and covered with shallow cells. They hatch in from fourteen to twenty-eight days, according to the temperature.

The young larvæ are .1 of an inch long, with a head considerably larger than the other segments; light yellowish brown, speckled with brown, and with a few scattered hairs.

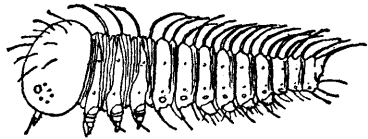


Fig. 24. Young larva of *Satyrus alope*.
x 20.

The body is carnation with a crimson line along the middle of the back, and three of the same color near together along the sides. There are three rows of long, white bristles along each side. These all curve backward, except those of the middle row which curve forward. The larvæ hibernate at this stage. Soon after beginning to feed in the spring, they molt their skins for the first time, when they are .16 of

an inch long, cylindrical, thickest in front, the last segment terminating in two round, tapering sharp tails which are green with red tips.

Body, pale green with seven dark green longitudinal stripes, one along the middle of the back, and three on each side. Head nearly as before, light green with white papillæ, each sending out a blunt white hair. This occurs also on the surface of the body. After twenty-three days they molt a second time, being .3 of an inch long, and much as before.

The whole surface is one shade of yellowish green, with a dark stripe along the back, and a yellow ridge over the feet. In fourteen days they molt the third time, after which they are .44 of an inch long, and nearly as before. Head emerald green. In fourteen days more they molt the fourth time, and in twenty-eight days change to a pupa. The mature larvæ are a little over an inch long, largest in the middle, and tapering each way, of a dull yellowish green color, with a darker shade on the sides, a dark green stripe along the middle of the back, and a yellow stripe or line over the feet, and some have a yellow line along the middle of the side. The last segment ends in two sharp, conical reddish tails. Head larger than the second segment, emerald green, and both head and body are covered with pale, conical papillæ from each of which arises a fine white hair.



Fig. 25. Pupa of
Satyrus alope.
(nat. size.)

The pupa is .6 of an inch long, cylindrical, pale green, the abdomen evenly tapering; the wing-cases a little raised at the margins; a thin dorsal prominence with a depression behind it. Suspended by the tail only.

The butterflies emerge in fourteen days.

37. CHIONOBAS JUTTA, Hueb.

Chi-on-o'-bas jul'-ta.

Expanse of wings, two and one-fourth inches.

Upper side of wings, dark brown with four small black spots ringed with yellowish, nearly parallel with the outer margin of the fore wings. The two middle ones are scarcely visible. An irregular black band along the lower side of the median nervure in the males. The hind wings have a series of yellowish spots inside of the outer border, the first of which has a small black eye-spot on it, with a whitish pupil.

Under side of hind wings costal and apical parts of fore wings marbled with grayish, dark brown and black. The rest of fore wings as above with the eye-spots reproduced.

All the fringes pure white interrupted with black at the ends of the nervules. Head, thorax and abdomen, black with brownish hairs.

This northern butterfly, which has never been taken elsewhere within the limits of the United States, has been taken for several years early in the month of June on a large bog in Orono. It occurs in the northern parts of both Europe and America, but its food plant has not yet been discovered.

Its near relative *Chionobas semidea*, Say, on the White Mountains of New Hampshire, feeds on *Carex rigida*, and, as there are many species of *Carex* on the above named bog, it is possible that the larva of our species feeds on some of them.

Family—LYCÆNIDÆ.*Sub-Family*—THECLINÆ.

38. THECLA HUMULI, Har.

Thec'-la hu'-mu-li.

Expanse of wings, from one inch to one inch and a quarter.

Upper side of the wings, dusky brown with a bluish gray tint. The males have a dark oval spot a little above the middle. The hind wings have two short thread-like tails, the inner one longer than the outer, and tipped with white. The anal angle is touched with orange, and there is a large orange crescent resting on a black spot between the bases of the tails. Along the outer margin is an interrupted line of pale blue.

Under side of the wings, pale ashy gray with bluish reflections. A brown line, edged with white on the outside, starts from the outer fourth of the costa of the fore wings, and extends about two-thirds of the way across the wing. Another, similar but less prominent, scarcely touched with white on the inside, a little within and parallel to the outer border, extends from near the anal angle up near the costa.

The hind wings have two lines similar to those of the fore wings; the first, edged on the inside towards the costa with orange, runs across the wing to a point near the orange spot of the upper side repeated, where it forms a sharp angle and continues with one angle after another to the inner margin, something like the letter W. The outer line follows a little within the outer margin. Anal angle, black, preceded by an orange spot. The line at the base of the fringes is black.

The young of this species are "green, downy caterpillars," feeding on the heads of the common hop vine. This butterfly is on the wing during the middle of May.

39. THECLA STRIGOSA, Har.

Thec'-la stri-go'-sa.

Expanse of wings, one inch and one-tenth.

Upper side of the wings, dark brown and unspotted in the males, but the females sometimes have a fulvous spot near the anal angle of the hind wing, and are paler in color. The under side of the wings is pale reddish brown. The outer part of both wings is crossed by four irregular, rather wavy, white lines, varying a little in individuals, but the two inner ones on the fore wings, approach each other towards the hinder margin. The third is shorter than the second, and the fourth or outer one, reaches only to the middle of the wing. The inner line on the hind wings extends nearly across, then bending, runs some way up the hinder margin, preceded in the last part of its course by another line nearly parallel to it. Above the termination of these two, there is a circlet of white on the margin. The outer line is short, and limited to the middle of the wing. The fore wings have a sub-marginal row of indistinct brown lunules edged on the inside with white, and the hind wings have a similar series which are bright red towards the anal angle, and edged on the inner side with black followed by white, and enclosing next to the anal angle, a large black space which is nearly covered with blue scales. Beyond this is a small black spot, and there is another at the angle surmounted by a red stripe edged like the lunules, and extending up the margin. The lunules next the apex usually exhibit a few scales of red. The margins of both wings are edged with a fine whitish line.

Body fuscous, beneath grayish white. Legs, white, annulated with brown. Palpi, white, the outer joint black tipped with white. Antennæ, annulated with black and white. Club, fuscous tipped with white.

The larva was taken by Mr. Saunders on a species of thorn (*Cratægus*), and his description is as follows: Length, half

an inch. Head, greenish brown. Body flattened, sloping abruptly at the sides. Color, velvet-green, with a darker colored dorsal stripe. The anterior edge of second segment, yellowish brown with a few darker dots; the middle segment laterally striped with two or three faint yellow oblique lines, and the last two segments have each a lateral yellow patch, and there is a faint yellow basal line from the fifth to the terminal segments. Under surface, bluish-green.

The larva is .37 of an inch long, nearly oval, and with the head case rounded. The body is dark reddish brown, with black markings, and thickly covered with fine hairs. The anterior segments have many black patches on them, and there is a dark ventral line from the sixth to the twelfth segments.

Prof. S. I. Smith, who very kindly sent me a list of the butterflies which he has taken at, or in the vicinity of Norway, Me., informs me that he captured a single specimen of this rare species in Norway.

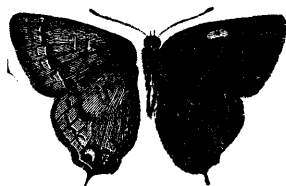


Fig. 26. *Thecla calanus* (nat. size; under surface on left).

40. THECLA CALANUS, Hueb.

Thec'-la cal'-a-nus.

Expanse of wings, one inch and a quarter.

Upper side of the wings, dark brown with brassy green reflections. Hind wings with two very unequal, thread-like tails, the lower one being longest and edged with white. Base of fringes, from anal angle to the lower tail, white, and

at this place there is also a narrow, white terminal line. Under side of the wings, somewhat paler than above. Two short, whitish, parallel lines occur on the disk of the fore wings, and a whitish crenate line crosses the wing about half way between the last and the outer border, shaded within by blackish; and there is another broken whitish line, shaded on the outside with blackish, between the last line and the outer border.

The hind wings have two short, whitish discal lines with a blackish shade between them. A series of blackish spots, edged on either side with whitish, crosses the wing beyond the disk; and outside of this is a series of lunate whitish spots shaded on the outside with blackish and faintly edged on the outside, below, with bluish white. Along the anal angle the black streak is followed with orange. At the very apex of the anal angle there is a black spot with white on its upper side. On the next interspace is a patch of powdery blue scales and in the next interspace to this is an orange crescent enclosing a black spot. The orange scales are also faintly visible in the next interspace.

The larva is said to feed on the leaves of oak.

This species is reported from Norway, Maine.

41. THECLA AUGUSTUS, Kirby.

Thec'la Au-gus'-tus.

Expanse of wings, one inch.

Upper side of the wings dark brown tinted with rusty brown on the disk and along the margin of the hind wing near the anal angle. The wings sometimes show greenish reflections.

Under side of the fore wings, lighter than above, with a scarcely perceptible line crossing the outer fourth, beyond which is a row of dark dots continued across the hind wings. The basal half of the hind wings underneath is nearly black

and overlaid with numerous purplish scales. The outer half is lighter, especially inside of the row of points.

This butterfly has been taken in Orono from the middle of May till the middle of June.

The early stages and food plant are unknown.

42. *THECLA IRUS*; variety, *ARSACE*, Bd-Lec.

Thec'la i'-rus, ar'-sa-ce.

Expanse of wings, from an inch to an inch and a quarter.

Upper side of the wings, dark brown with greenish reflections. Under side of the wings blackish brown on the basal half and lighter beyond. The outer part of the wing is overlaid more or less with white scales. The tooth of the hind wing, next outside of the anal angle, curves outward, and there is a more or less prominent black spot within the margin between the base of the tooth mentioned and the one next outside.

The stigma on the fore wings of the males is three times as long as wide.

43. *THECLA HENRICI*, Gr-Rob.

Thec'la hen'-ri-ci.

Expanse of wings, from seven-eighths of an inch to one inch and an eighth.

This species very closely resembles *Thecla irus* var. *arsace* in form and color as well as markings but differs in having the outer part of the hind wings somewhat rust colored, the teeth of the hind wing shorter and the first one beyond the anal angle, not curving outward, and in wanting the black spot on the under side of the hind wings between the bases of the first two teeth. The stigma on the fore wings of the males is shorter and wider than in *arsace*, being only twice

as long as wide. This species averages smaller than *arsace*.

This is a common species in Maine and is on the wing during the middle of May.

According to Mr. Edwards, the larva feeds on wild plum, resting on the side and eating into the fruit. The eggs are whitish green, rounded and flattened, with a reticulated surface. They are laid on the flower stem and hatch in five or six days, just at the right time for the young caterpillars to take the newly-formed plums.

When first hatched they are .04 of an inch long, brownish yellow, of an oval form, flattened on the base, the back high and sloping towards the hinder part, and on each side there is a row of long, re-curved, white hairs, with a similar one along the edge of the base. In five days they molt their skins, when they are .08 of an inch long, of the same shape as before. There is a reddish brown stripe along the middle of the back, on each side of this, dull yellowish green with a macular brown line next the outer edge and limiting the dorsal area. Sides sloping, with a broken yellowish line; a similar but continuous line along the basal ridge. Whole under side, yellowish green. Body much covered on the upper side with short, stiff hairs. Head, heart-shaped, smooth, yellowish green.

In three or four days they molt a second time, when they are .12 of an inch long and of the same shape as before. The back is considerably elevated and a tuberculous ridge crosses each segment from the fourth to the eleventh. Color, reddish brown and dull yellowish green. A red band runs along the back tapering to a point behind. A green line runs through the middle of the band. Outside of this band there is a green line containing a little reddish brown space on each segment. The sides are reddish brown with a green longitudinal line in the middle and the basal ridge is green.

In five days more they molt a third time when they are .3 of an inch long. The back from the fourth to the eleventh segments presents a series of elevated ridges, one to each segment, narrow in front and broad behind. The summit of

the back is flattened and a little concave and covered by a broad band which is cut by a paler line. The rest of the elevated ridges are yellowish green making two sub-dorsal macular bands. The sides are sloping, nearly flat, reddish brown, with an indistinct green line. The second segment is a broad, elevated rolled collar in which the head is concealed. The basal ridge is green and the head yellowish green. One day later the length is .4 of an inch, the color changed to port-wine red, the sub-dorsal area remains yellowish green but with a tint of red on the posterior part of each segment. The sides are the same color as before, and there is a pale red line along the basal ridge. Body covered with short brown hairs.

Two days later the length is .56 of an inch, when they stop feeding and in eight days from the third and last molt they pupate.

The pupa is .3 of an inch long, black or blackish brown with obscure red bands, there being on either side a narrow, black stripe in the middle of the abdomen. The winter is passed in this stage.

44. THECLA NIPHON, Hueb.

Thec'-la ni'-phon.

Expanse of wings, one inch and one fifth.

Upper side of the wings, dark brown with a rusty space on each in the females. The notches on the hind wings are white, and the teeth are blackish. Under side of the wings, light brown. Two black streaks cross the cell of the fore wing, one at the end and the other near the middle. A wavy black line, edged on the outer side with white, starts from the outer third of the costa, and extends two-thirds the way across the wing; and between this and the outer border, there is a row of more or less wedge-shaped, black spots. The hind wings have two tortuous black lines crossing them, one near the base with the inner edge white, the other a little

beyond the middle, and edged with white on the outside. Between this last and the outer border, is a row of black spots, which are more or less wedge-shaped. The outer space is somewhat sprinkled with whitish scales.

The larva of this species feeds on various kinds of pine, and is described as being green and pubescent, with three longitudinal stripes on the back, the middle one pale yellow, the other two white. Near the feet there is usually a small marginal white line. The head is brown.

The pupa is grayish, with four rows of small spots, of which the two middle ones are blackish and indistinct, and the others ferruginous.

The butterfly is on the wing in Orono during the middle of May.

45. THECLA LAETA, Edw.

Thec'-la lae'-ta.

Expanse of wings, one inch.

Upper side of the wings in the males, black with a few metallic blue scales near the base of the fore wings, and a band of the same color on the hind wings, extending from the anal angle half way along the outer margin. Under side of the hind wings, apex and costal margin of the under side of the fore wings, slate blue with greenish reflections. Costal edge of the fore wings, red. Disk of the same, smoke color. A series of five small red spots, edged on the outside with white, starts from the outer fourth of the costa, on the under side, and extends a little more than half way across the wing.

The under side of the hind wings have two series of red spots parallel to the outer margin, those of the outer series being small, and more or less surrounded by a delicate white border in which are a few black scales. The inner series crosses the middle of the wing, and is somewhat sinuous, the spots larger, brighter red, and crescent shaped, bordered on the outside with white in which are a few black scales.

The upper side of the females is black, with the base of the fore wings and hind margin for two-thirds of its length, and the hind wings, except the costa, dark metallic blue. Under side, greenish gray. In addition to the five spots on the under side of the fore wings in the males, the females have two blackish, rather indistinct spots below the others, nearer the base. Thorax and abdomen, black above and white beneath. Legs and antennæ, black, with white rings. Palpi white. Club of antennæ, black, red at tip.

The early stages and food plant of this very rare species are unknown.

The perfect insect has been taken in Orono on the 18th of May.

46. THECLA TITUS, F.

Thec'-la ti'-tus.

Expanse of wings, from an inch and a quarter to an inch and a half.

Hind wings without tails or teeth, but the anal angle projects slightly.

Upper side of the wings, dark brown, with a row of seven or eight orange colored spots along the outer margin from the anal angle. These are sometimes wanting. Under side of the wings, grayish brown, with a row of small black spots touched on the outer side with vermilion, along the outer margin, within which is another row of larger black spots encircled with white. Corresponding rows cross the hind wings, but the terminal row has the vermilion spots increased in size; and there are two white edged black dashes placed end to end across the end of the cell. Body above, dark brown; beneath, clothed with whitish hairs.

This species is said to feed on the plum, cherry and oak.

The mature larva is .7 of an inch long, elliptical, and flat on the lower side, of a dull green color with a yellowish tint, especially on the forward segments, and it is thickly covered with very short, brown hairs.

There is a patch of rose color on the forward segments, and another larger one on the hinder extremity. Head very small, black and shining.

The pupa is .45 of an inch long, pale brown and glossy, with many small dark brown or blackish dots over the whole surface, thicker along the middle above, appearing as a faint imperfect stripe from the seventh to the eleventh segments.

Surface thickly covered with very short, brown hairs.

This insect has not been taken in Orono, but is reported from Portland and Norway, Maine.

Sub-Family—LYCÆNINÆ.

47. FENISECA TARQUINIUS, F.

Fen-is'e-ca tar-quin'i-us.

Expanse of wings, one inch and a fourth.

Upper side of the wings, bright orange yellow. The fore wings have a dark brown outer border with an irregular inner edge, which extends narrowly along the hinder margin. A black stripe extends along the upper part of the cell, which widens into a tooth-like process at the end, below which is a round spot. A black dash runs along in the inter-space below the cell from the base of the wing, out to a small spot nearly half the length of the hinder border.

The hind wings have about half their surface, on the costal side, dark brown with an irregular edge, and there are a few brown spots near the anal angle. Under side of the fore wings paler than above; the dark markings and the whole under surface of the hind wings, reddish yellow, washed more or less with white, with numerous white circles on the hind wings. This species is subject to much variation in the extent of the brown markings.

The larva is said to feed on alder, wild currant, *viburnum* and *vaccinium*.

This butterfly has been taken in Aroostook and at Orono in the early part of June, and also on the 12th and 13th of August. Prof. S. J. Smith took it at Norway in June, and also July 20th and 28th.

48. CHRYSOPHANUS, EPIXANTHE, Bd-Lec.

Chrys-o-pha'-nus ep-ix-an'-the.

Expanse of wings, about one inch.

Upper side of the wings, dark brown, somewhat purplish in the males. The fore wings have a black spot at the end of the cell, a smaller one before it on the middle of the cell, and one below this last. The hind wings have a black mark at the end of the cell, and a row of spots beyond, scarcely visible, and one or two red spots at the anal angle. Under side of the wings, whitish, with a scalloped red line on the outer margin of the hind wing, from the anal angle upward. On the under side of the fore wing are three black spots on the cell, one near the base, one in the middle and one at the end, with one under each of the first two named. There is also a row of seven black spots across the wing beyond the cell, forming a somewhat sinuous line. There are also three spots just within the outer margin, from the anal angle upwards. Those on the hind wings are reduced to mere points, forming about two irregular rows across the wing. Body, blackish above and white beneath.

This pretty little species is quite common on certain bogs during the last of June and the early part of July. The food plant is not known, but Mr. Scudder suggests that it may be swamp dock (*Rumex verticillatus*.)

49. CHRYSOPHANUS AMERICANA, D'Urban.

Chrys-o-pha'nus a-mer-i-ca-na.

Expanse of wings, from one inch to one inch and a quarter.

Upper side of fore wings, coppery red, with the costa and outer margin bordered with dusky brown; and there are eight black spots, one on the middle and one on the end of the cell, with a somewhat irregular row across the wing, between the end of the cell and the outer border.

Hind wings, above, dusky brown, with a few small black spots, one on the disk and the others beyond. There is also a terminal, coppery red band not reaching the costa, with four black spots on it.

The under side of the fore wings are paler than above, and the outer border and under side of the hind wings are pale ash. The black spots of the upper side of the fore wings are re-produced beneath, circled with white, and there is an additional spot in the cell near the base, and three in the edge of the outer margin above the anal angle, not surrounded with white.

The hind wings have a crenated red line within the outer border, from the anal angle nearly to the costa; and two rows of small black spots of unequal size across the wing, with two or three on the cell.

This extremely common species may be taken on the wing during all the summer months.

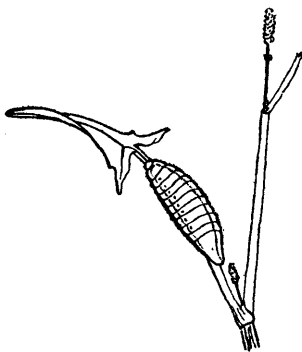


Fig. 27.

Larva of *Chrysophanus americana*
(nat. size.)

The larva, which feeds on sorrel (*Rumex acetosella*), is elliptical, flattened on the under side, dull rosy red with a diffused, yellowish tint on the sides, most distinct along the middle segments, and a line along the middle of the back of a deeper shade of red. The body is downy with minute yellowish hairs. This description of the larva was taken by Mr. Wil-

liam Saunders, from one that had probably hibernated in this stage and was not fully grown. Dr. Harris states that the larva is of a greenish color.

The young larva, according to Mr. S. H. Scudder, "is provided with long hairs sweeping backward behind their bodies, most of them arranged in longitudinal series."



Fig. 28. Pupa of
Chrysophanus americana
(nat. size).

The pupa is attached by the end of the abdomen and is closely girt to the object to which it is attached.



Fig. 29. *Lycæna pseudargiolus* (nat. size; under surface).

50. *LYCÆNA PSEUDARGIOLUS*, Bd-Lec.

Ly-cæ'-na pseu-dar-gi'-o-lus.



Fig. 30. *Lycæna violacea* (nat. size; under surface).

Form *VIOLACEA*, *vi-o-la'-ce-a.*

Form *MARGINATA*, *mar-gi-na'-ta.*

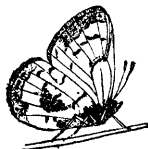


Fig. 31. *Lycaena lucia* (nat. size; under surface).

Form LUCIA, *lu'-ci-a*.

Form NEGLECTA, *neg-lec'-ta*.

This remarkable species is very common in Maine, at least the forms *violacea*, *marginata* and *lucia*, while the form *neglecta* is less common, and *pseudargiolus* is confined to more southern latitudes. These little blue butterflies are found in abundance flitting along the roads and borders of the woods, from the middle of May to the middle of June.

Expanse of wings, about one inch.

Upper side of wings, deep azure blue with a delicate terminal black line. Fringes, black on the apical part of the fore wings, but white, barred with black, on the rest of the fore wings and all the hind wings.

The fore wings of the females have a broad blackish outer margin, sometimes extending along the costa; and the hind wings have a blackish costa, and a row of dark spots along the costal margin.

The under side of the wings is very pale silvery gray, with a silky lustre, and there are the following pale brown markings: a row of spots along the outer margin, each preceded by a crescent; a curved row of elongated spots across the fore wing between the end of the cell and the outer border; and several small spots on the base of the hind wing.

The form *lucia* has the terminal spots so enlarged and run together as to form a terminal band, and the spots on the basal part of the under side of the hind wing, enlarged and run together so as to form a more or less complete triangular discal patch.

The form *violacea* has dark points on the disk of the under side of the hind wings, and pale dusky spots and crescents along the outer margin, but not run together as in *lucia*.

The form *marginata* has the terminal band on the under side of the hind wing as in *lucia*, but has the disk as in *violacea*.

The form *neglecta* has the upper side of the hind wings paler than the fore wings; and the under side paler, and the the markings less distinct than in *violacea*.

From the studies of Mr. W. H. Edwards on this species, it seems probable that there are two generations in Maine, at least in the southern part, that the spring brood has three forms, *lucia*, *marginata* and *violacea* — while the summer brood consists only of the form *neglecta*. It is quite possible that there is only one generation in northern Maine and that *neglecta* does not occur there.

Mr. Edwards states that eggs laid by *violacea* on the flowers of dogwood (*Cornus*), in West Virginia, in April or early in May produce *neglecta* in June, but most of the pupæ hibernate.

The egg stage was five days, the larva twenty-four, and the pupa stage twenty-four. Mr. Edwards has strong reasons for believing that the hibernating pupæ produce *violacea* again in the spring. He also states that the form *pseudargiolus*, in West Virginia, lays eggs which produce the same form, but sometimes of a smaller size — the true *neglecta*; but most of the larvæ hibernate and produce *pseudargiolus* again the next spring, as he believes. The fall brood of *pseudargiolus* lays eggs which after hatching and passing to the pupa stage, hibernate and yield *violacea* the next spring. *Lucia* has been observed laying its eggs on *Cornus*, in the spring, but its transformations are unknown, as are those of *marginata* also.

The following food plants have been reported for the different forms:

Actinomeris squarrosa, *Actinomeris helianthoides*, *Apios tuberosa*, *Erythrina herbacea*, *Spiræa salicifolia*, *Ceanothus americanus*, *Cornus* and *Ilex*.

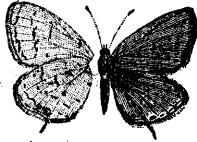


Fig. 32. *Lycaena comyntas* (nat. size; under surface on the left).

51. LYCÆNA COMYNTAS, Godt.

Ly-cæ'-na co-myn'-tas.

Expanse of wings, one inch.

The hind wing is regularly rounded, with one fine, thread-like tail. The males are dark violet blue on the upper side, with blackish outer borders, while the females are blackish brown, sometimes dusted with bluish near the base, and the fringes are whitish. Along the outer margin of the hind wings are several black spots, and one or two orange crescents.

Under side of the wings, light gray with brownish spots encircled with white, and arranged as follows: a dash across the end of each cell, a row of spots between this and the outer margin, quite regular on the fore wing, but irregular on the hind wing; a double row of paler spots along the outer margins of both wings; the black spots and orange colored crescents of the upper side repeated below; the black spots encircled with metallic scales; a spot near the middle of the cell, and one near the basal third of the costa of the hind wing.

Body, black above, whitish beneath.

The larva of this species feeds on red clover and other species of the *Leguminosæ*.

The eggs are of a delicate green color, round, flattened, depressed at the top, and covered with a frost work of interlaced points. In three or four days, the eggs hatch and the young larvæ are .05 of an inch long, cylindrical, of a yellowish color except two rows of white points along:

the back, and one near the base on each side. A long, curved, white hair arises from each of these points. Head, black and shining, nearly as large as the second segment. In three days they molt their skins, when they are .08 of an inch long, flat on the lower side, of an elliptical outline, the back flat at the top and sloping towards the base. The color is russet with the whole surface irregularly dotted with black, from which arise white hairs. Head black, long and narrow, smaller in proportion to the second segment than in the last stage, and partly concealed in the second segment. In three days more they molt the second time, after which they are .12 of an inch long, broader and flatter than before, russet, varying towards vinous, interspersed with green. On each side of the narrow ridge along the middle of the back, there is a slightly raised edge caused by the tubercles, and there is a fold along the side of the base of the body, and the hairs from this and the ridge are longer than elsewhere.

In three days more the third molt is made, when they are .20 of an inch long, pale green along the back with vinous on the sides, but varying in color. In five days they molt the fourth time, when they are .36 of an inch long and the greatest breadth is about one-fourth as much as the length. They are of the same general form as before, but highest in front and sloping backwards. Both ends are equally rounded when the head is drawn into the second segment, each segment rounded on the back, and the whole upper surface is covered with fine white hairs. Color, greenish with darker green lines, and oblique vinous lines on the sides. Head black. In about five days from the fourth molt, they attach themselves and change to the pupa stage. The pupa is .26 of an inch long by .10 wide, shaped much like the mature larva, of a greenish, brownish or sordid white color, with three rows of black dots, and sparingly clothed with whitish hairs.

In from nine to eleven days the butterflies emerge. This history of the early stages of this butterfly is from the

magnificent and very reliable work of Mr. W. H. Edwards of West Virginia; but in this latitude there may be some variation from the account given above.

This species has not been taken in this region, but I have a specimen taken at Auburn, and Mr. Lyman reports it from Portland, so it will doubtless be taken elsewhere in the western part of the State.

Family—HESPERIDÆ.

52. CARTEROCEPHALUS MANDAN, Edw.

Car-ter-o-ceph'-a-lus man'-dan.

Expanse of wings, one inch and an eighth.

Upper side of the wings dark brown, overlaid with a few yellowish scales, and marked with dull orange colored spots as follows: one row extends along the outer margin, often nearly obliterated, another across the wing between the outer border and the end of the cell, two of which are out of line and nearer the outer border. The cell is more or less filled with the orange yellow, and there is a small spot of the same color resting on the lower side of the cell near the middle.

The hind wings have a row of small orange yellow spots along the outer margin, a row of larger ones within this, and one near the base of the wing.

Under side of the fore wings much paler than above, the light marks much larger and running together. Under side of the hind wings are of the same yellowish as the fore wings, and the spots of the upper side are re-produced, but larger and of a white color, and ringed with brownish. The veins are also brownish.

The food plant of this rare species is unknown. It is on the wing through the middle of June.

53. *ANCYLOXYPHA NUMITOR*, F.*An-cy-lox'-y-pha nu'-mi-tor.*

Expanse of wings, one inch.

Upper side of fore wings, dark brown, glossed more or less with tawny yellow. Hind wings, tawny yellow, with the costa and outer border dark brown. Under side of fore wings, dark brown, with tawny yellow costa and outer margin. Under side of hind wings, paler yellow than above, and without any brown.

Body, dark brown above with yellowish hairs, whitish beneath.

The early stages and food-plant of this rare butterfly are not known. It is taken on the wing in the early part of July.

54. *PAMPHILA ZABULON*, Bd-Lec.*Pam'-phi-la zab'-u-lon.*

Expanse of wings, from an inch and a quarter to an inch and a half.

Upper side of the wings, dark brown, with a large, tawny yellow spot covering the greater part of the fore wing, leaving the base, outer and hinder margins, brown. The veins are brown, and there is a heavy oblique brown line at the end of the cell beyond which the yellow is overlaid for a short distance with brown scales, leaving two square, tawny yellow spots in the edge of the outer border. The hind wings have a large, tawny yellow spot on the middle, crossed by the brown veins.

Under side of the wings as above, but paler. The outer borders are washed with purplish white scales in the females.

Body, dark brown, with greenish hairs above, paler beneath.

This common species feeds on grass.

The eggs are pale green, nearly globular, somewhat flattened, and under a strong lens they appear reticulated over the surface with fine six-sided markings.



Fig. 33. Egg of *Pamphila zabulon*, x 12.

They hatch in about ten days, and the young larva is one tenth of an inch long, with a large, prominent, shining black head and a creamy white body with a yellowish tinge towards the tail. The second segment is half encircled with a transverse line of black. Fig. 34, mature larva (Scudder).



Fig. 34. Larva of *Pamphila zabulon*, (nat. size).

They station themselves on the inside of the leaves, near the joints, drawing portions of the leaves together with silken threads, forming a rude case in which they secrete themselves.

This species is taken in Orono during the middle of June.

55. PAMPHILA LEONARDUS, Har.

Pam'-phi-la le-o-nar'-dus.

Expanse of wings, nearly an inch and a half.

Upper side of the wings, dark brown, and, in the males, thickly overlaid with tawny scales from the base to the outer third of the fore wings, and terminating with a row of lighter, tawny spots, three below the costa, two beyond the end of the cell, a little out of line and separated from the cell by a broad dark brown dash, and two or three below, the lower ones of which shade off into the color of the base of the wing. There is an oblique, velvety black stripe on the middle of the fore wing, below the cell, in the males.

The hind wings have a curved, central, tawny band, not reaching either margin, but broken into about five spots by the dark brown veins. The part of the wing towards the abdomen, and the upper side of the body, more or less covered with dull tawny hairs.

Under side of the wings, bright reddish brown; the fore wings, blackish from the cell to the hinder margin, and

spotted as above, with the addition of a yellowish spot at the end of the cell, which shows very faintly on the upper side. The hind wings have a small yellow spot near the middle on the cell, and a curved row of six or seven pale yellow spots beyond it. Under side of the body, covered with pale yellowish hairs. The club of the antennæ is large, and has a minute, curved apex.

The females are without the tawny scales on the basal part of the fore wings above, and the oblique stripe below the cell.

Mr. H. H. Lyman, of Montreal, has kindly informed me that he found this species "common, end of August and first of September," on Cape Elizabeth, three miles from Portland. I have not heard of its being taken elsewhere in Maine. Mr. Scudder states that it feeds on grasses.

56. PAMPHILA SASSACUS, Har.

Pam'-phi-la sas'-sa-cus.

Expanse of wings, one inch and a quarter.

Upper side of the wings, dark brown, with a large, tawny yellow spot occupying a large part of the middle of each. A brown patch, more or less distinct, extends from the end of the cell of the fore wing, nearly out to the brown border, but leaving two small, square, tawny spots beyond it. The base of the wing is somewhat obscure, and in the females this covers the hinder margin; and a band of the same color extends from the base along the lower side of the cell, half its length or more. The males have an oblique, velvety black dash from near the base of the wing up to the end of the cell.

Under side of the wings, ochre-yellow, with small paler spots towards the apex corresponding to those above, while the basal portion, hinder border and the oblique stripe are brownish. The under side of the hind wings, in the female, has several square, paler spots, corresponding to the outer part of the tawny color above. Body, above, brown, with greenish hairs, lighter beneath.

The larva is said to feed on grass (*Panicum sanguinale.*)
The butterfly is on the wing in the middle of June.

57. PAMPHILA OTHO; variety, EGEREMET, Scud.

Pam'-phi-la o'-tho. e-ger'-e-met.

Expanse of wings, one inch and a fourth.

Upper side of the wings, dark brown, with a dull tint on the hinder border of the fore wings, and the middle of the hind wings, caused by the presence of yellowish hairs. The fore wings have a small yellow spot below the end of the cell, and a smaller, divided one, of the same color, half way between this and the apex. The males have a velvety black spot below the middle of the cell, and another along the side of the cell towards the end, and a patch of large brown scales between them.

Under side of the wings, dark brown, dusted with yellow scales, and with the yellow marks of the upper side reproduced. The hind wings have a faint yellowish band a little beyond the middle, not reaching either border. Body, above, dark brown, with greenish hairs; lighter beneath.

This is a rare species in Maine.

58. PAMPHILA PECKIUS, Kirby.

Pam'-phi-la peck'-i-us.

Expanse of wings, about one inch.

Upper side of the wings, dark brown, with tawny yellow markings. The males have the costa of the fore wing, from the base to a point two-thirds of the way to the apex, and extending across to the lower side of the cell; the hinder border; three spots separated by the veins, half way between the end of the cell and the apex; two minute spots beyond the end of the cell, nearer the outer margin than the last; a larger spot a little below the end of the cell, all tawny yellow. The hind wing has a spot of tawny yellow near the base, and a wide one a little beyond the middle, divided into five or six by the veins. The males have a somewhat sinu-

ous, velvety black stripe near the middle, below the cell.

Under side of the wings, light brown, with the yellow spots larger and lighter than above. The hind wings have the larger part of the middle covered by a large, irregular, pale yellow spot, nearly divided in the middle.

The females differ in having only a tinge of yellow on the costa; and the spots beyond the cell are larger and clearer than in the males; and the oblique velvety stripe is of course wanting.

This very common species feeds on grass. The eggs are pale greenish yellow, strongly convex above, and flattened at the base; and the surface is faintly reticulated. They hatch in fourteen days, and the young larva is one-tenth of an inch long, with a large, shining black head. The body is dull brownish yellow, dotted with black. The second segment has a ring of brownish black on it. Under side, paler than above, and the whole surface is clothed with fine hairs.

This butterfly is on the wing in Orono from the middle of June to the last of July.

59. PAMPHILA MYSTIC, Edw.

Pam'-phi-la mys'-tic.

Expanse of wings, one inch and a quarter.

Upper side of the wings, tawny yellow, with a wide, dark brown outer border; and a dark brown patch nearly covers the space between the end of the cell and the brown border. The males have an oblique, velvety black stripe on the middle of the fore wing. Hind wings, with a large tawny yellow patch on the middle, which is divided by the brown veins, and a brown shade across the end of the cell.

Under side of the wings, paler than above. Body, dark brown, with greenish hairs above, and lighter beneath, with grayish yellow hairs.

The females have the upper side of the fore wings dark brown, with a sinuous row of square, tawny spots across the wing beyond the cell, and more or less of the same color on the cell.

The eggs of this grass-feeding species are of a pale yellowish green color, strongly convex above, and with the base flattened. The surface appears smooth under a lens, but faintly reticulated under a power of eighty diameters. They hatch in eight or ten days, and the young larva is one tenth of an inch long, with a large, shining black head, and a white body tinged with yellowish brown which is more apparent towards the hinder part.

The full grown larva is one inch long, of an oval outline something like a "wood louse" or "sow bug" in form. The head is not large in proportion to the size of the body, but prominent and much larger than the second segment; of a dull reddish brown color, edged with black on the hinder part, and clothed with minute whitish hairs. The body is dull brownish green, with hairs similar to those on the head, and a line along the middle of the back, and numerous dots over the surface of the body of a darker shade. The second segment is pale whitish, with a line of brownish black across the top. The last segments are paler than the rest, and the under side is paler than above.

This butterfly is on the wing in Orono from the middle of June to the last of July.

60. PAMPHILA CERNESE, Bd-Lec.

Pam'-phi-la cer'-nes.

Expanse of wings, one inch.

Upper side of the wings dark brown. Fore wings in the male tawny yellow on the costa, extending across the cell and out more than three-fourths of the distance to the apex, and ending in three small, wedge-shape spots. On the middle of the wing is an oblique, velvety black stripe; and at the outer end of this is a tawny spot.

Under side of the wings, lighter but spotted as above. The females have a tawny stripe along the middle of the costa of the fore wing above, and the oblique black stripe is wanting, but the other spots are larger and more distinct than in the males.

Body, dark brown above, with greenish hairs; a little lighter beneath.

The early stages are unknown to me. The perfect insect is on the wing in Orono from the middle of June to the middle of July.

61. PAMPHILA MANATAAQUA, Scud.

Pam'-phi-la man-a-ta'-a-qua.

Expanse of wings, one inch and three-tenths.

Upper side of the wings, dark brown. The fore wings of the male have a large, brassy yellow spot, extending from the costa beyond the middle, and an oblique black dash near the middle. Hind wings with a brassy gloss.

Under side of the fore wings tawny yellow, dusky towards the outer margin, with a pale yellow oblique spot near the middle, and two or three minute ones of the same color near the costa.

Hind wings dusky ochre yellow beneath, with a transverse row of four small, paler yellow, almost obsolete spots. Head and body glossed with green above, yellowish white beneath.

The female differs from the male only in wanting the oblique black dash on the middle of the fore wings, and in the presence of two rather large, squarish yellow spots at the outer extremity of where the oblique dash would be if present, between the nervules, the lowest one largest, and not so near the outer margin as the other.

Mr. H. H. Lyman informed me that he took one specimen of this rare insect near Portland, July 20, 1874. I have not heard of its occurrence elsewhere in the State.

62. PAMPHILA METACOMET, Har.

Pam'-phi-la met-a-com'-et.

Expanse of wings, one inch and a quarter.

Upper side of the body and wings, dark greenish brown. The males have an oblique, black velvety stripe near the middle of the fore wing.

The females have a few small pale yellowish spots in a sinuous line across the fore wing beyond the end of the cell.

The under side of the wings are slightly paler but marked as above.

The larva feeds on grass. The butterfly is on the wing in the middle of July.

63. PAMPHILA BIMACULA, Gr-Rob.

Pam'-phi-la bi-mac'-u-la.

Expanse of wings, from an inch and a quarter to an inch and a half.

Upper side of the wings, dark brown, overlaid somewhat with tawny scales. The males have an oblique, velvety black stripe near the middle of the wing, on each side of which, and on the cell, the wing is marked with tawny yellow. Between the end of the cell and the apex, there are a few small, tawny streaks between the veins. The females have two pale yellowish spots below the end of the cell, and a trace of one or two between the end of the cell and the apex. Fringes of all the wings, white.

Under side of the wings, pale tawny brown. The marks of the upper side are repeated. Body, above, of the color of the wings; clothed with whitish hairs beneath.

The early stages of this rare species are unknown.

The butterfly is on the wing in Orono early in July.

64. AMBLYSCIRTES VIALIS, Edw.

Am-bly-scir'-tes vi-a'-lis.

Expanse of wings, one inch.

Upper side of the wings, dark brown with a line of three small whitish spots extending downwards from the outer fourth of the costa. There is sometimes a similar spot half way across the wing, and at an equal distance from the outer margin as those above.

Under side of the wings, dark brown with purple reflections.

This species feeds on grasses but is rare in Maine. The perfect insect is on the wing in Orono from the first to the middle of July.

65. *AMBLYSCIRTES SAMOSET*, Scud.

Am-bly-scir'-tes sam'-o-set.

Expanse of wings, one inch and an eighth.

Upper side of the wings, dark brown with greenish scales and hairs which give a greenish shade to the whole surface of the wings. A line of small pale yellowish spots crosses the wing beyond the end of the cell, consisting of three, near together below the costa; and three more somewhat larger and more distinct ones below the middle of the wing.

Hind wings with a faint trace of a pale line beyond the middle.

Under side of the wings lighter than above, and heavily overlaid with greenish scales. The markings are plainer than above. Fringes white, cut with dark brown at the ends of the veins.

The larva is said by Mr. Herman Strecker to feed on grass (*Andropogon*).

This is a rare species in Maine. The butterfly is on the wing through the middle of June.

66. *THANAOS BRIZO*, Bd-Lec.

Than'-a-os bri'-zo.

Expanse of wings, one inch and a half.

Upper side of the wings, dark brown. Fore wings almost black, and variegated with gray on the outer part; near the outer margin is a row of gray dots, within which is a transverse band composed of another row of oval gray spots, between two slender, black, zigzag lines; and across the middle, is another band of the same kind.

On the hind wings are two wavy rows of ochre yellow dots near the outer margin. All the wings have two rows of dots of the same color across the outer part.

This species is reported from Waterville. The larva is said to feed on oak, and beggar's lice (*Cynoglossum morisoni*.)

67. *THANAOS ICELUS*, Lintn.

Than'-a-os ic'-e-lus.

Expanse of wings, one inch and a quarter.

Upper side of the wings, blackish brown, sprinkled with pale bluish scales. A band, somewhat lighter than the basal part of the wing, crosses a little beyond the middle, heavily overlaid with the bluish scales, especially on the costal half. This is followed by a darker band with serrate edges, beyond which a paler shade extends to the outer margin; while through the middle of this pale space there is a series of dark spots. All these shades and bands run from the costa nearly to the hinder margin.

The hind wings are dark umber brown, with a terminal row of pale spots, and another similar row a little inside. Under side of the wings, lighter than above; and the spots of the upper side are repeated on the hind wings. The fore wings have a terminal row, and one preceding it, of lengthened dots, with two or three inside of this last.

The early stages of this common species are not known.

The perfect insect is on the wing during the middle of June.

68. *THANAOS PERSIUS*, Scud.

Than'-a-os per'-si-us.

Expanse of wings, one inch and a half.

Upper side of the wings, blackish brown, sprinkled with pale bluish scales on the outer part of the fore wings. There are four whitish dots extending in a line downwards from the costa, half way between the end of the cell and the apex. There is a similar one half way between these and the hinder margin, and another, near the end of the cell. A row of black points crosses the wing just within the outer margin,

and another of triangular spots, half way between the outer margin and the end of the cell.

The hind wings are colored and marked as in *Thanaos icelus*. Under side, paler, and with the white spots showing more plainly.

This species is reported to be common in the western part of the State, during the middle of June, but it has not been observed in the region about Orono.

The larva, according to Mr. S. H. Scudder, feeds on willow, poplar, and *Lespedeza capitata*.

69. EUDAMUS PYLADES, Scud.

Eu-da'-mus pyl'-a-des.

Expanse of wings, one inch and a half.

Upper side of the wings, dark brown, with three small white spots on the middle of the costa, separated only by the veins; three or four similar ones on the outer fourth of the costa, and three arranged in the form of a triangle between the end of the cell and the anal angle. Fringes, gray, barred with dark brown at the ends of the veins. Under side of the fore wings the same as above, but shaded with darker brown at the base, and sprinkled with pale blue scales on the outer part.

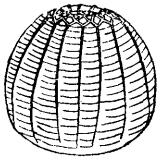


Fig. 35. Egg of *Eudamus pylades*.
x 28.

Under side of the hind wings, colored as above, but with two irregular bands across them, limited by wavy, black lines, and sprinkled on the outer part with pale blue lines. Body, above and beneath, dark brown. Fig. 35, the egg greatly enlarged (Scudder). This is a very common species in Maine, and the larva feeds on clover. The perfect insect is on the wing during the month of June.