Public Documents of Maine:

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

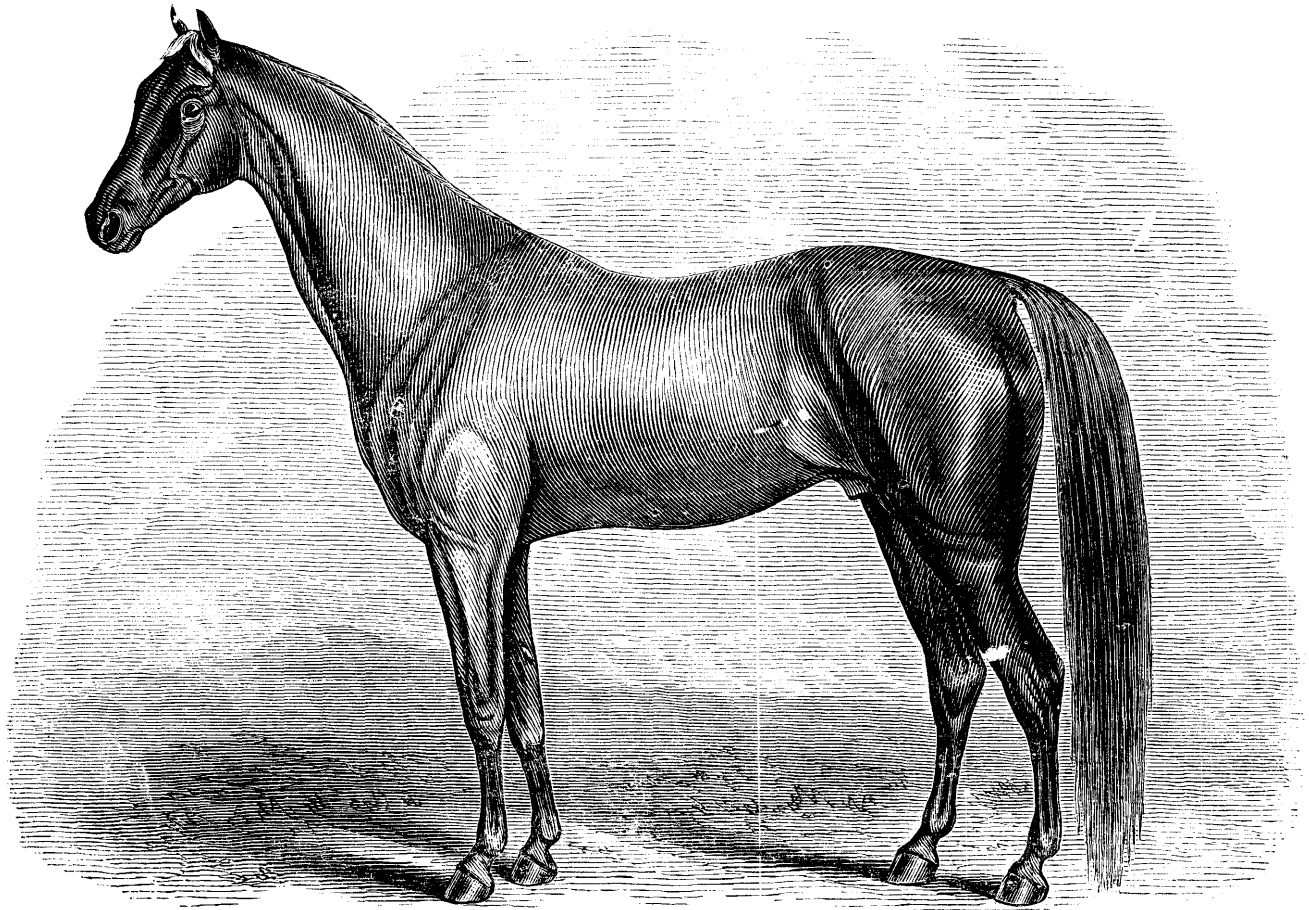
PUBLIC OFFICERS AND INSTITUTIONS

FOR THE YEAR

1876.

VOLUME II.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1876.



THE TROTTING STALLION KING WILLIAM,

Owned by J. W. McDuffee, Lewiston. Public record to harness, 2.31 1-4; to wagon, 2.35.

TWENTIETH ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE,

FOR THE YEAR

1875.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1875.

MAINE BOARD OF AGRICULTURE.

Z. A. GILBERT, PRESIDENT.
J. E. SHAW, VICE PRESIDENT.
S. L. BOARDMAN, SECRETARY.

MEMBERS AT LARGE APPOINTED BY GOVERNOR AND COUNCIL.

Name.	P. O. Address.	Term expires Dec 31.
C. F. Allen	Orono	1876
George E. Brackett	Belfast	1876
D. M. Dunham	Bangor	1877
M. C. Fernald	Orono	1877
Henry Carmichael	Brunswick	1877

MEMBER CHOSEN BY STATE AGRICULTURAL SOCIETY.

B. M. Hight	Skowhegan	1877

MEMBER CHOSEN BY STATE POMOLOGICAL SOCIETY.

Hannibal Belcher	Farmington	1875

MEMBER CHOSEN BY MAINE POULTRY ASSOCIATION.

W. W. Harris	Portland	1877

MEMBERS CHOSEN BY COUNTY SOCIETIES.

Ira C. Doe	York	Saco	1875
George B. Barrows	Oxford	Fryeburg	1875
Edward Payson	Cumberland	Portland	1875
William D. Hayden	Somerset	Madison Centre,	1875
Isaac E. Mallett	Sagadahoc	Topsham	1875
Samuel Wasson	Hancock	East Surry	1876
Joel E. Shaw	Penobscot	West Hampden.	1876
A. L. Bradbury	Franklin	Phillips	1876
Lyman Lee	Piscataquis	Foxcroft	1876
Timothy Williams	Knox	Rockland	1876
Isaac Barker	Aroostook	Houlton	1876
Ira E. Getchell	Kennebec	N. Vassalboro'.	1877
Z. A. Gilbert	Androscoggin	East Turner	1877
Lyman H. Winslow	Lincoln	Nobleboro'	1877
C. W. Hersey	Washington	Pembroke	1877
Peter W. Ayer	Waldo	Freedom	1877

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INTRODUCTION.

To the Honorable Senate
and House of Representatives:

I have the honor to transmit herewith, the Annual Report of the Maine Board of Agriculture for the year 1875.

The annual meeting was held in the Town Hall, Waterville, in connection with the Maine Dairymen's Association, on the 16th, 17th and 18th of February. Z. A. Gilbert of Greene, was elected President; J. E. Shaw of Hampden, Vice President; and Samuel L. Boardman of Augusta, Secretary. The new members were qualified and took their seats, and the various committees appointed after the usual custom. Mr. Lyman Lee of Foxcroft, member of the Board from Piscataquis county, read the opening paper on the subject of raising horses in Maine—a matter of great importance to our State, and one which was discussed with much spirit and understanding by the farmers present. Mr. Lee took the position that our farmers and horse breeders generally have been producing a class of horses altogether too light for the heavy work of the farm, and in fact, too light for general road purposes. While oxen have been going out of use, and horses have been gradually taking their places, the right kind of horses needed for heavy farm and road work have not been raised in sufficient numbers, and we have been obliged to import them from the Provinces and from the Western States. Mr Lee said: "The fatal fascination of raising fast horses has seized upon too many farmers—and attention to the breeding of this class of horses has driven out all attempts in the direction above indicated. A showy little stallion of 800 or 900 lbs., is too often patronized in the vain hope of securing a *speedy* colt, when the services of a well made up horse of 1100 or 1400 lbs., which should be secured, are not used. Farmers seek for speed in raising horses, and obtain it only in very rare instances. Now if these animals chance to become a little lame, or slightly blemished, they are of

little or no value; while heavy horses, although they may not be perfect, are still useful and command good prices. The breeding of fast horses should be left to the professional horse-men and trainers; as farmers seldom make it profitable. One trouble must be encountered at first, and that is, many of our mares are not large enough to breed from. This however, may in a measure be overcome, by selecting the largest and best mares for stock-raising, and even by importation at first, if need be. But in case of the stock horse from which to breed, there will be no difficulty, for as soon as the owners and keepers of such horses learn that a large, firm and compact breed of horses is desired, they will find it for their interest to patronize the same. Then again, would it not be better to arouse the ambition of our young men, and some older ones too, to raise and keep a team of splendid, sturdy horses for valuable use, instead of engaging in racing and pool selling with their attendant influences, which in fact more or less affect the whole community? Of course no word is to be said against breeding lighter horses for light carriage use and for driving; but experience will show that there will always be a sufficient supply of small horses." The discussion following the reading of Mr. Lee's paper was engaged in by several prominent Maine farmers, and although there were differences on minor points, the general conclusion of the same was that the raising of light speedy horses by our farmers should not on any account lead them to lose sight of the importance of other lines of breeding, or other branches of farming—for while there could be no question as to the high value of the road horses produced in Maine, yet our sheep, young cattle and dairy stock, certainly needed encouragement, and beef growing, dairying, orcharding, market gardening and other important branches of farming for which certain sections of our State were especially adapted, should not be overlooked. Hundreds of men in our State have been anxious to raise a horse that would trot in "twenty," and they have bred for this purpose, somewhat indiscriminately, forgetting that such results are only the work of years of careful breeding by those who have made it a study. The horse is a valuable animal, and speed is a valuable quality—but there are other valuable qualities possessed by this noble beast which it is equally as necessary to develop as that of speed—and it was a question if the best horse was not that one possessing the most complete development of all these qualities, such as would best fit him for all useful and desirable purposes. The

afternoon of the first day was devoted to a paper on Creameries by Dr. J. W. North of Augusta, which was published in full in the Abstract to the Report of 1874; and in the evening, Rev. Dr. Allen, President of the State College, gave a lecture on Agricultural Education, which will be found in full in the present Report, pages 94–105.

At the commencement of the proceedings on the second day, Mr. A. L. Bradbury of Phillips, member from Franklin county, presented a practical paper giving the results of his own experiments as to the value of whey and skimmed milk for feeding to pigs and calves. He stated that some years ago he took two calves from the cows at two weeks old, and put them on skimmed milk and potatoes, and fed two others on the cows until thirteen weeks old. The result was that the hand fed calves so far outgrew the others, that he had hard work to keep them from the butcher, while the others he did not want. The hand fed ones kept constantly ahead of the others, and at two years old the smallest one came in as a cow and measured more than six feet, while the best one fed on the cow was only five feet—both having had the same treatment after having been weaned. Similar results followed other experiments of a similar character, and proved beyond question the value of whey and skimmed milk for feeding to calves. Whey alone fed to pigs, had proved that it was worth saving for this purpose. To show what could be done from one cow, Mr. Bradbury narrated the following: "Samuel G. Stone, a shoemaker, having become tired of working on the bench, purchased a small farm adjoining mine three years ago, and took upon it only one cow. She dropped her first calf the 13th day of May, 1872. When this calf was three weeks old, he purchased another about the same age and made them steers, and raised them on the skimmed milk of one cow, with a few boiled potatoes. Now the steers, two years old last May, measure six feet ten inches, and six feet five inches, respectively. The next year this cow dropped a heifer calf in June. I let him have another to match it, and the two were reared in nearly the same manner, except oats were given instead of potatoes. They now girth five feet three inches, and are both coming in next season, not two years old until June. Last season his cow dropped twins, one a bull, and the other a heifer. He vealed the bull, and raised the heifer. After selling the veal calf he bought a pig, and gave one-half of the milk to that; thus having raised five good calves

and vealed one in three seasons upon one cow. The cow also furnished the milk and butter for the family, consisting of three persons, and made a surplus to sell of 174 lbs., during the three years. This shows that a man with small means can stock a farm if he has the will." Following the paper by Mr. Bradbury, the day was taken up by papers and lectures on dairying and orcharding, by Prof. L. B. Arnold, George E. Brackett and Z. A. Gilbert, all of which will be found in full in subsequent pages. The lectures by Prof. Arnold on "Needs of the Dairy," and on "Cheese Making," given in full in this Report, form most valuable contributions to a profitable and correct understanding of the great interest represented by dairying; and their careful study by our farmers generally, especially by such as are particularly interested in dairy farming, will prove of great practical value. Had our meeting been productive of no other result than the giving of these lectures to the dairymen of our State, they would alone be ample compensation for all the expense involved. Prof. Arnold is the leading authority on dairy matters in our country, and his advice and suggestions may be followed with safety and profit. A brief paper on the management of a private butter dairy, written by Mr. S. G. Foster of Wilton, formed the subject of a useful discussion. Mr. Foster stated that there was no royal road to success in this matter of butter making. While first-class butter sells for 45 cents per pound, fancy make at from 50 cents to $1.25 per pound, the great mass made sells for an average of only about 20 cents. Care must be exercised from the time the milk is drawn till it is ready in the finished article for market, if a choice article would be realized. The causes of poor butter are numerous. Dairying has seldom been made a specialty in Maine, and this has given our dairy products a poor reputation abroad. There are many points upon which we need more light, and these can be eliminated only by careful experiments conducted with nice and accurate instruments. Nothing should be done without careful weights and measures, and careful thought. We only make good butter by taking the necessary measures. Good butter is not produced in ignorance; it is the result of skill and common sense. The quantity of milk given is made the test of the value of the cow by too many, rather than the quality of the milk. There is no breed but produces good cows; no breed but produces some poor ones. He next spoke of the necessity of cleanliness in everything pertaining to the stable, the milking, the

care and keeping. The manipulating, the packing and the storing of the butter, all require good common sense, skill and cleanliness. In a discussion which followed, Prof. Arnold said the experience all over the country was, that the best cows for producing milk were grades. One-half, three-fourths and seven-eights grades make the best milkers dairymen can get; and so far as his experience and observation went, it was not true that extraordinary milkers re-produced their own qualities in their offspring.

The lectures and papers presented on the third day, including one on Cheese Making by Prof. Arnold, one on the Influence of Education upon Labor by Prof. M. C. Fernald of the State College, and one of the Members at Large, and a paper by Mr. B. M. Hight on Capital and Labor, or the necessity of capital in carrying on the farm, are given in their complete form in another part of this Report. These valuable papers and lectures so fully occupied the time that little space was left for discussion. It should be mentioned, perhaps, that the answers to the numerous questions to which Prof. Arnold replied at the close of his lectures, have been incorporated by him into the body of the several lectures in their proper place, so that all the fragments of his knowledge and experience there imparted have been gathered up and preserved for the benefit of all who will read.

It can but be regarded as a judicious measure, that to the Board of Agriculture has been given the power of directing for what purposes one-half of the State bounty given to agricultural societies shall be expended. The members of the Board representing every county in the State, and being, (if not connected with the management of some of the local societies as is generally the case) at least well acquainted with their workings, influence and needs—meeting together and looking over the whole ground, are better prepared to recommend for what purposes this portion shall be given to accomplish the best and most permanent results, than are officers of societies who are likely to have ideas somewhat limited by their own peculiar wants, and the favorable or unfavorable condition of their own society—and at the same time the disposition of the remaining half gives to the local managers of societies an opportunity to exercise their own judgment as to the choice of objects for which it should be awarded. By virtue of this provision the Board had heretofore directed that this sum should be expended for the encouragement of wheat culture, the formation and assistance of Farmers' Clubs, the permanent

improvement of farms, and other objects which have been productive of real benefit to our agriculture. Indeed, the prime object of placing a portion of the State bounty under the direction of the Board, was to prevent its being spent in small and somewhat aimless premiums, which leave little of permanent benefit—and turning the same into channels which would be likely to show some substantial improvement that would last for many years. Carrying out the plan of previous years in this particular, the Board at its last annual meeting directed that one-half of that portion under its control (or one-fourth of the bounty received from the State) be offered by the several agricultural societies for the planting of orchards from native trees or the growing of native nursery stock. The other portion was to be offered for some one or more of the following objects, from which each society was allowed to select that which its officers deemed most needful of encouragement in their several localities, and to offer and award the same in such manner as they thought best, viz: The encouragement of the introduction of thoroughbred stock, the encouragement of Farmers' Clubs through the establishment of libraries of standard and useful agricultural books, or the giving of lectures ; and the encouragement of thorough drainage. The reports to be given by the societies this winter on the above matters, will show what they have done thus far in the offering of these prizes, with the results, and will determine in a measure the future action of the Board upon the same.

In accordance with a vote of the Board the Secretary was instructed to present the following to the Committee on Agriculture of the last Legislature, which was accordingly done :

" WHEREAS, The too great multiplicity of agricultural societies tends to weakness rather than strength—it having been demonstrated from many years' experience that one strong, united society, is better than two weak ones ; AND WHEREAS, we believe the tendency to the multiplicity of incorporated local societies is largely increasing, therefore

" *Resolved*, That the Maine Board of Agriculture having a leading purpose for the real good of agriculture and agricultural societies, looks with disfavor upon the incorporation by the Legislature of societies embracing small local areas, believing that such societies only need for their own effectual working a simple, self-organized plan of association ; and that the act of legal incorporation is a questionable precedent, liable to lead to local prejudices

and a useless division of effort, and possibly of State aid to agricultural societies."

The adoption of the above resolution grew out of the fact that numerous Farmers' Clubs and small local societies in places where they drew away quite seriously from the interest in already existing county societies, were being incorporated by the Legislature, and that there was danger this course would lead to a rivalry which might not in all cases be harmonious and honorable. The encouragement of district and town clubs and societies could hardly be too great, but it was questionable if they needed the act of legal incorporation for their effectual working, as thereby they would seem to become rivals to other incorporated societies, infringing upon or curtailing the limits of such societies—when in fact they should be auxiliary or tributary to them, and a direct aid and assistance, instead of a cause of division and weakness. The resolution was placed before the Legislature at too late a day in its session for any action to be taken upon the same, but in accordance with a subsequent vote, it will be again presented the present winter.

Last winter, in accordance with a suggestion made at the semi-annual meeting, a county or local meeting of the Board was held at Etna in Penobscot county. This meeting was attended by three members of the Board and the Secretary, at which papers were read and discussions had on the management of grass lands, the raising of the wheat crop, the winter feeding of cattle, and other subjects. The meeting occupied the entire day and evening, was very well attended, and productive of much good. A second meeting was arranged for Wilton in Franklin county, but owing to the prevalence of a severe storm, the programme arranged for the same was not fully carried out. The idea of these meetings was to have them held in different parts of the State, at places remote from points at which such meetings were usually held, and holding the same under the auspices of the Board acting through the member for the county where held. The plan was cordially commended by the Board, and there can be no doubt such meetings would be instrumental in accomplishing great good.

The semi-annual meeting of the Board was held at Calais, Washington county, on the 2d, 3d and 4th of November. It is true that Washington county is not especially devoted to agriculture—in fact lumbering, shipbuilding and commercial pursuits, have heretofore occupied the attention of a large majority of the

people. Still there are in the county many progressive farmers, who claim they belong to Maine, (although living in a border county) and who expressed an earnest wish to have the session held at some point within the limits of Washington. The farmers there have been completely beyond the range of such meetings; and it was decided by the business committee of the Board, that the county had claims for a session which could not well be got over or set aside. It was deemed better to hold a fall than a winter session at that extreme point, and although the students of the State College could not attend, yet the Faculty of the College consented to change the order, (to accommodate the farmers of Washington county to have the meeting) while they are to have the students attend the coming winter meeting, and thus meet the requirements of the statute. The meeting was fully attended, twenty-one members being present. The first session was taken up with a report on the yield of the crops in the several counties the past season, being reported upon by the members from the different counties, as follows:

Androscoggin—Z. A. Gilbert. Crops on the whole very satisfactory. Hay crop bountiful, above the average; secured in excellent condition, in consequence of early cutting. Corn crop, growth heavy, but late and rather immature, not up to the average. Potatoes injured by rust, two-thirds of average crop; very little rot. Grain very good; wheat not as good as last year, oats heavy, barley good, beans good. Fruit, nearly a total failure; a few orchards escaped ravages of caterpillars, and yielded a fair crop. Pasturage excellent, stock of all kinds has done exceedingly well; prices fair and stock husbandry satisfactory. *Aroostook*—Isaac Barker. Hay crop average, but from late cutting was injured by bad weather; corn, little cultivated, not a good piece in the county; potatoes more grown but the crop below the average; oats average; barley below the average; buckwheat larger crop than ever, and secured in excellent order; wheat very good, injured some by midge but fully up to the average. Pasturage as good as average, and stock generally has done well. There has been a fair demand for stock, but prices have not been high. Fruit average better than in years past, and fully up to some other counties. Dairying successful, and cheese factories doing well. *Franklin*—A. L. Bradbury. Crops not an average. Hay on some farms greater, and on others smaller than average. Wheat not up to last year in quantity or quality; oats above average, barley and

rye but little is raised; potatoes not up to average, early kinds did well, later sorts rusted bad; corn not up to yield of former years; fruit crop almost a failure. Stock and milk productions good. Associated dairying succeeding well. *Hancock*—S. Wasson. Hay the best for many years, the bad weather at the close of the season damaging it greatly; oats, failure; potatoes about 75 per cent. of average crop; beans, a very good crop, especially the improved yellow eye; corn none; barley a general failure; cranberries, the cherry variety destroyed by frost; apple crop good; caterpillars none; pasturage very good, and stock in fair condition; cheese factories, none. *Kennebec*—I. E. Getchell. Hay crop excellent, of first quality, and farmers are becoming convinced of the necessity of early cutting. Farms that have been well taken care of have yielded well; corn better than average, corn cut up early and cured in shock; potatoes, Early Rose, better than average, late ones rusted and gave a poor crop, rotting some; wheat, Lost Nation has yielded well in past, but this year is not more than one-fourth what it has been heretofore; oats and barley average; fruit, light; pasturing good and stock is looking well; market gardening is receiving increased attention. *Knox*—T. Williams. Hay crop better than the average, and got in good order, although late cut hay was damaged; potatoes light, not two-thirds of an average crop; not much grain sown in the county, wheat light; oats and barley an average; fruit light, but better than in some parts of the State. *Lincoln*—L. H. Winslow. Hay crop better than average, and secured in better condition; grain of all kinds light, wheat not half of an average crop; oats light; potatoes not more than half of average crop; corn crop very good, more than an average crop; fruit very light. The Lost Nation wheat did better than any other variety. It makes excellent flour if the crop is cured or ripened well at harvest. The Jefferson cheese factory—the only one in the county—is giving excellent satisfaction, and is proving a good investment. *Oxford*—G. B. Barrows. Hay crop in West Oxford very good, and is being cut earlier, which gives a second crop that is cut off in preference to being fed; corn very good; pasturage good; grain—oats very good; wheat not up to average; rye &c., but little raised; potatoes, a fair crop, but hardly up to the average, Early Rose good; cheese factories are generally giving increased satisfaction, and people are well pleased with them; apple crop a general failure, winter fruit $4 per bbl. *Penobscot*—J. E. Shaw. Hay crop good,

and where cut early got in good condition, yield fully the average of past ten years; wheat fully the average, the Lost Nation variety much esteemed; oats, average; corn, a fair crop; fruit very good, but light compared with last year; stock has done as well as usual, fall feed not abundant. Penobscot county has now thirteen cheese factories, and all have given general satisfaction; potatoes about two-thirds of average crop, the rust injuring late planted ones; the Early Rose and Peerless yielded best; Orono rusted badly; one hundred and thirty-five bushels per acre he regarded an average crop. *Piscataquis*—L. Lee. Farmers feeling well satisfied with crops. Hay crop good, and well secured, except in northern sections; corn the best for several years past, although some late pieces injured by early frost; wheat more than an average, those who sowed as late as June 1st, got a better yield than those who sowed in May; fruit fair; oats and other grain, average; cheese factories meeting with success; fall feed abundant and cattle doing well, very little fodder fed from the barn up to the first of November. *Somerset*—W. D. Hayden. Crops on the whole satisfactory; hay crop better than average and secured in good condition; wheat not much below the average; oats better than in former years on land in good condition; corn, one-half a crop; potatoes, two-thirds of crop; fruit, half a crop. *Sagadahoc*—I. E. Mallett. Hay excellent in quality and quantity, and well secured where cut early; grain crop better than for years; quality (wheat, barley and oats) very heavy and good, wheat 25 bushels per acre in many cases; threshers say one-third heavier than average; potatoes fair, early varieties best; corn not much grown, farmers have got accustomed to purchasing their corn from the West; pastures good, stock in excellent condition, except lambs, which are light, owing to moist weather; fruit almost a failure. *Waldo*—P. W. Ayer. Not had a full crop of hay since drougth of 1871, the last crop however was better than any year since that time; grain—wheat very uneven, generally light, owing to ravages of wire worm, oats heavy and good; potatoes about three-fourths of a crop; fruit crop below an average, although we have considerable fruit; pasturage better than average, and stock of all kinds looking well; corn remarkably good; cheese factories are numerous, and all giving universal satisfaction. *Washington*—C. W. Hersey. Hay good, although damaged by wet weather; early potatoes good, late planted not more than three-fourths of average crop; corn good; grain light; feed good through the

season; fruit a fair crop in this section; turnips light, being too wet for them; in this county within a few years great improvement has been made in farm stock.

At the request of the farmers of Washington county, as expressed through the member of the Board for that county, Mr. C. W. Hersey, fruit growing, dairy farming and sheep husbandry, formed the leading topics of the papers, read and the discussions that were carried on at the meeting. On the second day of the meeting, Mr. Dunham and Mr. Hight presented papers, which are given in full in this Report; Mr. Brackett read a paper on associated dairying as adapted to Washington county, and lectures were also given in the evening by Mr. Payson, member from Cumberland county, and Dr. Allen one of the members at large. Mr. Brackett's paper, while giving a general account of what had been done by associated dairying in other portions of the State, was prepared with special reference to Washington county, which, like Waldo, had been something of a commercial and maritime county, but which just now was unlike that county, as it was passing through a sort of transition state from that to farming, which Waldo had successfully accomplished.

In Washington the people had lumbered some, built some ships and done some farming; doing the latter mainly for want of something better to engage in. Now, at a time when lumber is dull, shipping dull, and business generally dull, the question is, shall we go on in the old ruts or try and reach out for something better? If the latter, what shall it be? Better farming, and more of it surely; farming which demands zeal, industry, judgment, ability and brains—and which gives a good return for all this outlay. Of all the branches of farming which stand open for energetic, live men to enter—none presents so much encouragement as dairying by the associated system. To insure success in this business several requirements are absolutely necessary; among them, good pasturage, good water in abundance, a good stock of cows, and a disposition to improve. It is safe at the commencement to be sure of the requisite number of cows, as the expense of building a factory for 300 cows is little more than that of building one for 150 cows. It is not a formidable job to start a cheese factory, and when once you get about it, it may be completed in a short time. Among the advantages of cheese factories are the improvement to the real value of the town by the erection of buildings; the increase in the number and value of cows; the

saving of labor to farmers' wives during the heated season of the year; the convenience and decreased cost of marketing; the direct return in dollars and cents, and the gradual but sure improvement to our farms. These were dwelt upon at some length, and then the objections to associated dairying taken up. The chief one was the over-production of cheese; but this the speaker thought a mistaken idea. Cheese is just as much a staple article of food as flour, and must always be in demand, the price of course somewhat variable—the same as for any other article of consumption. Another was, that the production of so much cheese would lessen the butter product; but this loses its force when it is borne in mind that cheese factories mean more cows on our farms—that the factories run only about five months in the year, leaving all the rest of the milk season in which to make butter from an increased amount of milk, and a greater number of cows. No locality will be likely to support and operate a factory three or more years without doubling the number of cows kept. The paper closed with an earnest appeal to the farmers of Washington county to make a beginning in the manner of associated dairying, as a thing that would never be regretted, and on which no back tracks would ever be taken. A general discussion followed the reading of Mr. Brackett's essay, in which were brought out reports from several cheese factories in different parts of the State; the unanimous testimony being that factories had everywhere given complete satisfaction, the number of cows had increased, the profits had been larger, and the system was regarded as one of the best ever adopted by the farmers of Maine for the improvement of our agriculture. Dr. Allen's lecture on the Aims and Methods of the State College is presented in full. The lecture given by Mr. Payson was entitled, "A Plea for the Human Body." It was ingenious and ably written, though somewhat speculative in statement. His opening proposition was that it should be within the province of the Board to which was assigned the care of horses, cattle, sheep and swine, also to have some regard to the physical man. He argued that this life belonged to body, and the next to the soul; that if a little of the attention which the latter had received had been given to the body we should see better results than we do now. In the good time coming more regard must be, and would be, paid to the food upon which the body feeds, in order that it might rightly grow and become properly developed. His views were ably pre-

sented, and however much some might differ from him, all accorded to his treatment of the subject originality, force and independence.

Of the papers which formed the third day's programme, those presented by Mr. Brackett, Mr. Wasson and Mr. Ayer, are given in full. At the request of the convention, Mr. Gilbert, President of the Board, gave an off-hand lecture on fruit growing, which with the answers to the enquiries which it suggested, consumed the greater part of the forenoon. The points taken up, were, in the main, those which Mr. Gilbert has so well presented in his paper on a similar subject given in full on page 65 of this Report, and it is therefore not necessary to repeat them here. The brief discussion which followed the lecture brought out two facts of much interest in this connection :—one being that at Meddybemps in Washington county, the Concord grape ripens out of doors three years out of four, and the Clinton has not failed for twelve years to ripen every season; the other, that the apple known as the Naked Limbed Greening, has been shipped to England by parties in Winterport, and it has been pronounced the best shipping and keeping of all the American varieties that have been sent abroad.

During a discussion in the afternoon, Mr. C. F. Todd of St. Stephens, gave an account of the efforts made by the Province of New Brunswick in the introduction of blooded stock, undertaken mainly as an aid to the local agricultural societies. This past year (1865) the Province had expended $25,000 in the purchase of blooded stock, mostly imported; consisting of Ayrshire cows and bulls, which formed one-third of the whole purchase, a few Jerseys, some Shorthorns, one Hereford, one Holstein; Leicester and Cotswold sheep; Berkshire, Yorkshire and Chester swine, and Percheron horses. These animals were brought to Fredericton and sold at auction, the societies being the chief purchasers, as by so doing they could get the benefit of the Government grant to them. Purchasers were required to give a bond to keep the animals in the Province for a term of five years. The enterprise was regarded as one which would result in great good to the agriculture of the Province. Mr. F. W. Shepherd of Belfast, who had used menhaden as a fertilizer for many years with varying results, gave an account of the manner in which he had used them the past season with which he was highly satisfied. He had received the best results by making them into a compost in connection with yard manure, loam, ashes and plaster—in the

proportion of one cord loam, one cord manure, ten barrels menhaden scrap, (11 barrels to the ton) one bushel plaster, eight to twelve bushels ashes. This is put up in layers, sods being placed on the outside to hold the mass. In a few days it will heat, when it is worked over, and in a few weeks the entire mass will be about the consistency of leached ashes. This is applied to the land for grain, and also to grass land. Put on to grass land in October, it had given a yield of two loads of hay this year on land that last year gave but one; and on a field that had not been plowed for ten years, and had yielded two to three loads, applied as above, it gave this season seven loads. This manure is good for grain, potatoes or grass. The heap will compost more readily if built up high than if spread out broad, and will take about ten days or two weeks to become fit for use. The scrap costs at the factory $10 per ton from the press, or $12 per ton if packed in barrels. It may be added here, as a sort of after statement to the remark made on page 63, "there is some danger that this scrap will be sent abroad in bulk by the cargo"—that this fear has indeed become actual, and that two or three cargoes have been sent the present fall (1865) from Boothbay to Holland. Are our farmers to allow this wonderful means of fertilizing our own soils to be sent across the Atlantic to enrich the fields of the Old World, or will they see if something cannot be done whereby it may not only be kept in our own country, but in our own State, and be obtained by interior farmers at a reasonable cost?

The meeting was quite well attended, considering the extreme point in the county at which it was held, and the unpleasant state of the weather during the meeting, and already good results have been heard from it, as calls have been issued for the organization of two cheese factories, the inception of which date from the Calais meeting. It is yet too early to judge of the results of the session, but it cannot be doubted that good seed was sown in abundance, and years hence will hear good fruit for the cause of improved agriculture in the extreme eastern section of our State.

Reports from the cheese factories throughout the State for the past season are generally very satisfactory. In a few instances the returns show that from local causes which will be overcome another year—mainly the result of inexperience—factories have not proved quite so successful as was anticipated; but upon the whole the returns give a most satisfactory and cheering outlook for associated dairying in this State. In behalf of the Maine

Dairymen's Association, the Board has issued circulars of enquiry to all the factories known to have been in operation during 1875 and already returns have been received from about forty companies. These blanks cover a great many points of interest, and the reports from the factories embrace many matters which it will be interesting to have brought to the attention of dairymen, the results of which will be elaborated for the annual report of the Association. By permission of the Secretary of that Association, a few of the leading results are presented below :—

Name of Company.	lbs. cheese made.	price—cents.	No. cows.
East Sangerville	41,000	14	150
Corinth	52,000	12½ to 13	300
Wilton	18,824	13	100
South Paris	40,000	12 to 15	240
North Turner	40,336	12½ to 18	200
Andover	11,416	–	75
West Minot	28,342	12½	150
North Pownal	11,749	13	100
South Pittsfield and Burnham	14,625	13	80
Winterport	15,121	13	85
Sandy River (Strong)	39,092	13½	200
Morrill	22,230	14	–
East Jefferson	20,000	14	–
Aroostook Valley (Presque Isle)	36,950	13	180
Dixmont	22,440	13	170
Houlton	34,845	15	160
Centre Montville	23,953	14	80
Freedom	18,127	13½ to 14	100
St. Albans	31,664	13	140
Stetson	51,000	12½	240
Newport	8,995	12½	55
Six Mile Falls (Glenburn)	17,180	13	200
Dixfield	34,000	13	–
Milo	22,000	–	–
Exeter	50,000	12½ to 13	230
Mexico and East Rumford	20,112	12	150
Dixmont Mountain	26,000	13	150
Carmel	26,000	13	170
Fryeburg	21,390	14	150
South Newburg	55,927	12	225
Livermore	27,702	–	125

Name of Company.	lbs. cheese made.	price—cents.	No. cows.
Winthrop	47,000	12	200
North Jay	24,367	12½	–
Phillips and Avon	35,000	13	175
Enterprise (Industry)	7,626	12½ to 15	60
North and West Auburn	22,907	13	–
Carmel, Hermon and Newburg	44,157	12 to 14	200
North Livermore	24,605	–	150
Kenduskeag	66,480	12 to 13½	350
Etna	18,051	13 to 14	–
Union	4,462	14 to 15	–

The returns from the local agricultural societies have been received and show a good degree of interest and success in their special fields of labor during the past year. An abstract from these returns will as usual be given in the second part of this Report. While the number of Farmers' Clubs is believed to be less than at some time in the past, another organization of a private nature, known as the "Patrons of Husbandry," has largely extended itself over the State during the year, and is believed to be productive of much good—indeed, whatever unites farmers together, contributes to the social amenities of life, and promotes a spirit of mutual co-operation and aid among them—cannot but produce good results, if well and wisely managed. It is to be hoped the expectations of this Order will be fully realized by those who constitute its membership.

The State College of Agriculture and the Mechanic Arts has graduated its fourth class, numbering eighteen, and has had a year of marked prosperity. The Freshman class of 1875 was the largest ever admitted into the Institution, and it may be safely predicted that as it becomes better known throughout the State, and draws to its support a larger number of influential friends its usefulness will steadily increase. With an efficient faculty, and the liberal aid of the State, it will go on in a course of sure prosperity, giving to the young men of our State who desire it, at a moderate cost, the advantages of a thorough, liberal, scientific and practical education. This it does by means of the most approved methods of instruction, by giving to every young man who pursues the course of study an opportunity practically to apply the lesson he learns in the class-room, and by furnishing him facilities for defraying a part of his expenses by his own labor. While the course of study fully meets the requirements of the

national grant, and is especially adapted to prepare the student for agricultural and mechanical pursuits, it is designed that it 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.

The year has been one of fully average returns, and the farmer may well be satisfied with the results of his labors. Our flocks and herds have been free from plague and disease, our staple crops generally spared from blight and the ravages of insects, and on the whole contentment and comfort have waited on industry, crowning it with satisfaction and plenty. No one has lost faith in farming, but on the contrary faith in intelligent, systematic and well directed farming has steadily gained ground every day during the year, and more men are in love with it, believe in it, and are following it now than formerly. Many farms it is true have been deserted; but all over our State men are returning from the city to the farm, and, putting into operation business principles and intelligent direction, are working out good results, and stimulating improved farming throughout large sections. Patient investigators in the somewhat obscure fields of science as applied to the practical matters of the farm, are also making their studies and carefully recording the results for the benefit of thinking, questioning farmers everywhere. Through these combined agencies, and by the diffusion of intelligence, and the spread of correct information, our average farming is being brought up year by year to a higher standard, and is claiming its right to the dignified rank of a science.

Respectfully submitted.

SAMUEL L. BOARDMAN,

Secretary of Board of Agriculture.

AUGUSTA, December 28, 1875.

MAINE BOARD OF AGRICULTURE.

THE MENHADEN AND HERRING FISHERIES OF MAINE IN CONNECTION WITH AGRICULTURE.

During the session of the Board of Agriculture at Wiscasset in 1874, the attention of the members was called to the facts that vast numbers of migratory fish are taken on the coast of Maine every year, and that the business of converting them into fertilizers has recently assumed great importance. And while it was shown that by far the larger part of the fertilizers manufactured are sent out of the State, the enquiry was instituted whether some plan could not be devised by which the manufactured article, or the fish scrap which so largely enters into its composition, could be used in our State, and thus save to it thousands of dollars now paid annually for foreign fertilizers, and confer a double benefit upon our farmers. Acting under the recommendations of the Board, the Secretary, in 1874 and 1875, personally visited nearly all the establishments on our coast from Boothbay to Eastport, where fish scrap is converted into fertilizers, or where oil is manufactured from the fish, and the crude scrap sold to fertilizer factories—with a view of becoming acquainted with the details of the business, and of ascertaining what could be done towards supplying farmers in the interior of the State with the fertilizers, or the dried scrap, at reasonable cost. In order to get a clear and intelligent view of the whole subject, the enquiries first led to an investigation of the natural history of the menhaden and herring, then to their economic history, and finally to the practical relations of the subject to our agriculture. The following pages embody the results of this investigation.

THE MENHADEN.*

A.—Natural History.

1.—*Classification and Nomenclature.*

The menhaden belongs to the great Herring family, which includes the herring, shad, alewife, pilchard, sardine, anchovy and other less known species. Besides the name of "menhaden," which, for the sake of uniformity, will be used throughout the article, it has various other local appellations of which that of "pogy" is the one most commonly used in Maine.

2.—*Description.*

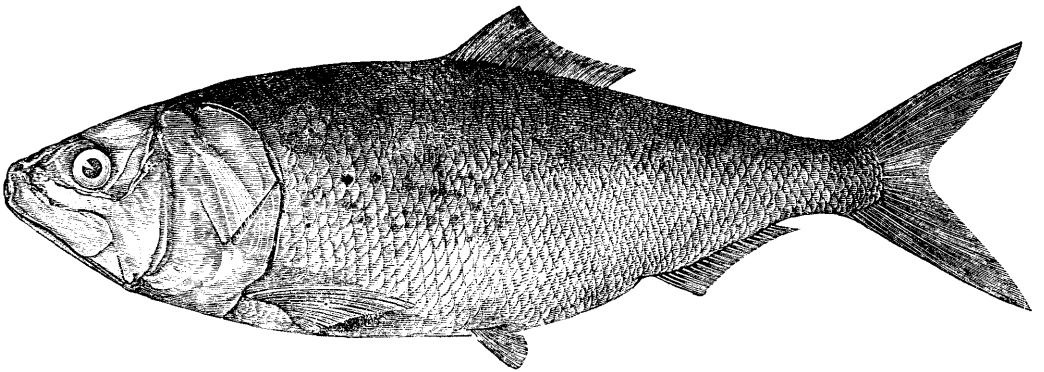
To those unfamiliar with the appearance of the fish, the following brief description may be serviceable: general form very much compressed, like the alewife and shad; head very large and deep, but not very thick from side to side; when seen from above, the body tapers away evenly from the middle to each end. Color commonly greenish brown, sometimes bluish above, silvery beneath; a black spot on the shoulder. Size, larger than the alewife, smaller than the shad, not varying so much as the latter; length 10 to 14 inches, from 160 to 300 filling a barrel; weight commonly one pound or a little more; an extremely large one caught at Boothbay last summer, (1874), weighed 1 lb. 14 oz. (For details of shape and proportions, examine the plate.)

The flesh of the menhaden is fine-grained, has a delicate flavor, and, when cooked very soon after the fish is dead, is as good eating as a shad,—by some persons even preferred; but if allowed to lie long it acquires a strong oily taste that is not pleasant. When in its best condition it is exceedingly fat, a thick layer of blubber envelops the body under the skin, and all other parts contain an unusual proportion of fat. This fat is perfectly sweet, and free from ill flavors, and oil made from it carefully has no unpleasant qualities when new.

3.—*Range, Migrations and Reproduction.*

It is found at some time in the year along the whole Atlantic coast, from Florida to the Bay of Fundy. Towards the northern

*Technical name *Brevoortia menhaden*, (Mitch.) Gill Synonyms: *Alosa menhaden*, *Alausa menhaden*, and *Clupea menhaden*, of various authors. Besides the local names given above, Gill mentions the following: Munnawhatteaug, (Narragansett Indians); poghaden, panhaden, panhagen, hard-head, bony-fish, white fish, (all these in various parts of New England); skippaug and bunker, (Long Island); moss-bunker, bug-fish, (New York); fat-back and yellow-tail, (Carolinas).



POGY OR MENHADEN—*Brevoortia Menhaden.* (Mitch.) Gill.

[From Storer's Fishes of Massachusetts.]

limit of its range it is only seen for a few days at the warmest part of the summer. As we proceed southward, its stay lengthens, until we reach the coast of the Carolinas, where it is found nearly every month in the year. It is the common theory, that this species breeds altogether on the southern coast, or in the Atlantic opposite that coast, moves northward every spring in search of its favorite food, and returns southward every autumn. Although future researches may overthrow our present conclusions, the theory appears in its essential points to be pretty well established, subject to some modifications to be hereafter noticed.

The extreme limit of their southern range appears to be as far south, at least, as Florida. What appears to be the head of the spring migration is said to strike the coast of Georgia about the first of March. Thence northward, it appears successively on the several parts of the coast, in general correspondence with the order of their position, reaching Massachusetts in May, and Maine in June.

Their first appearance on the southern coast of Massachusetts is in the latter part of April, the 21st of that month being considered very early for them to be taken in the pounds at Wood's Hole, the common date of the first captures being about May 10th.* In a weir at Waquoit, a few miles further east, they arrived, for the seven years ending in 1871, each year before May 1st, the earliest date being April 2d, and the latest April 30th. This was just at the close of the alewife season, which ended in the same weir, during the same years, from April 23d to April 30th.† On the shore of Martha's Vineyard they are taken a few days later than in Buzzard's Bay.‡ In the latter vicinity they are caught in greatest numbers in the month of May, the catch falling off as the summer progresses, to be revived again in October.

On the coast of Maine, between Cape Elizabeth and Pemaquid, the first menhaden are seen in the month of May, sometimes as early as the 10th; but they are in very small numbers and but occasionally seen until June. From June 1st to 15th the main "run" sets in. From that time till late in September, and sometimes till October, they are plenty enough to warrant fishing for them. The latest date at which they have been observed is October 25th. The period of greatest abundance is commonly about

* United States Commissioner, Fish and Fisheries, Pt. I., p. 59.

† Massachusetts Commissioners Inland Fisheries, 6th Report, p. 59.

‡ United States Commissioner, Fish and Fisheries, Pt. I., p. 35.

the last of July or the first of August, although for several weeks preceding and following that date there is very little variation in their numbers.*

In the vicinity of Brooklin, on the eastern side of Penobscot Bay, the first menhaden seen are scattering individuals that are caught in gill-nets and wiers in May, often as early as the middle of the month. The schools do not appear until the middle of June, on an average. They leave in September commonly.† In Blue-hill Bay they are sometimes known to stay as late as October.

Eastward from this point the stay of the menhaden is materially shortened up. At Jonesport it is almost confined to the month of August, scattering ones being taken in July.‡ In Passamaquoddy Bay and vicinity menhaden are now rarely seen. Formerly they were found in all these waters in August.

With regard to the reproduction and early growth of menhaden, much is to be learned. Observations made on our coast, tell us plainly that the eggs are laid during their absence from us, and probably at a considerable distance from our shores. Neither are the young at any stage ever seen here, nor is the spawn or milt of the adults near maturity during their stay. In the last week of September the latter are, in specimens caught near Boothbay, so little developed that only a person accustomed to the examination of such subjects can distinguish the sexes. They have evidently time to make a long journey before their spawning time arrives.

At Cape Cod they are much nearer their spawning ground. Not only are the young often found in the harbor of Provincetown, but the spawn and milt of the adults are sometimes well developed before the last of them disappear. Once they were found in one of the Cape Cod harbors fully ready for spawning in the month of December; these are supposed to have been one of the earlier schools, that would have left the coast before that time had they not been detained by a school of blue fish that is believed to have penned them up in the harbor.§

According to testimony collected by the U. S. Commissioner, the occurrence of young menhaden in Vineyard Sound and Buzzard's Bay, is a fact familiar to the fishermen, and they are sometimes as small as an inch or an inch and a quarter long; but the date of their appearance is never before July. The occurrence of so small specimens so late in the summer would favor the opinion

* Statements of G. B. and A. H. Kenniston. † Statement of George R. Allen.
‡ Statement of Z. D. Norton. § Observed by Capt. N. E. Atwood.

that the spawn from which they hatched must have been laid later than the preceding winter, and at no great distance from the place of observation. As to the first point, there is testimony to the occurrence in those waters of adults with spawn in them in the spring; one witness thinks they spawn late in May, another, at no particular time. It is agreed that very few have spawn compared with those that do not, and one careful observer watched through the season of 1872 without finding a single specimen with spawn; a result which warrants a great deal of caution in receiving the testimony of those who thought they had seen menhaden in that condition. As to the other point, it cannot be thought that fish of such diminutive size can have travelled from the Virginia coast, a distance of 300 miles or more; even fifty miles would seem a long journey for them to accomplish. If there be no mistake as to the identity of the young fish seen, a portion of the menhaden must spawn not far from Vineyard Sound. Similar remarks apply to the young observed in Provincetown harbor.

It is not, however, till we reach a much lower latitude that we find ripe adults common, or the young abundant. Off the coast of Virginia, about Christmas, the females can be readily distinguished by the distention of the abdomen; both sexes are so ripe that eggs and milt can be easily pressed from them. In Chesapeake Bay, in early spring, just after the advent of the adult fish, great schools of the young are seen, thought to be one and a half or two inches long. These little ones huddle together in dense schools, preyed upon by shovel-nosed sharks and other enemies. They are bound, so far as can be seen, in no particular direction, and are not supposed to come further north, but to pass the summer there and leave in the fall greatly increased in size. The color of these young fish, when seen in mass, is black, instead of red, which is the color of a school of adults when seen beneath the surface.* Young menhaden are also mentioned as occurring in the harbor of Beaufort, S. C., in December.†

When leaving the coast of Maine in the fall the old fish are described as going off "to the westward" in great schools, as they came. They leave the eastern districts first and have every appearance of moving along the coast. At Cape Cod they are subject to a detention. "The mass of them," says Captain Atwood, "as is well known, pass off the coast in the latter part

* Statement of George B. Kenniston.

† United States Commissioner of Fish and Fisheries, Part I., p. 245.

of autumn. They keep passing out; and in our Provincetown Harbor, where the land crooks around so as to detain them, we catch them a month later."* This fact is, to be sure, capable of some other explanation, but that given by Captain Atwood is at least a very plausible one, particularly when we consider the whole peninsula of Cape Cod as constituting the detaining barrier. At the mouth of Chesapeake Bay a similar phenomenon is observed. In the fall they mass on the southern shore of the entrance just inside Cape Henry, while in the spring they mass on the northern or Cape Charles side. This is precisely what might be expected on the supposition of their migrating north in the spring and south in the fall.

Corresponding with the successive appearance of the menhaden from south to north, there is a progressive improvement in size and fatness. When they arrive in Chesapeake Bay, in the spring, they are thin and lean, and appear to be sluggish and stupid so that they are easily caught,—can almost be taken out by the hand along the shore, which many of them follow closely. Between Virginia and Maine the increase in weight is thought to be one-third. In the fall the increase still continues, but the order of it is reversed, the fish appearing to grow larger the farther south they go, and on reaching Virginia again are twice as heavy as in the spring, and have so gained in strength, swiftness and wariness that they are very hard to catch.†

These statements as to the increase in weight are supposed to apply to the same individual fish, on the theory that they traverse the whole coast from Virginia to Maine and back again, in such proximity to the shore that they are liable to be caught at any point. It is not meant that all of the menhaden come so far north, for they are present through the whole summer on all parts of the coast; but it is maintained that every menhaden that visits us came from the southern coast, and if not intercepted will return to the same place.

The great abundance of the species in our waters,‡ would at first view seem to conflict with the notion of a journey of many hundred miles along the coast, exposed through its whole extent to fearful ravages by man and predatory fishes. But it may only

* United States Commissioner of Fish and Fisheries, Part I., page 225.

† Statement of G. B. Kenniston.

‡ More than half the menhaden oil produced in the United States is made in Boothbay and Bristol.

indicate that the fish, while moving parallel to the coast, have a much wider path than has been assigned them. Instead of all passing along within sight of land, it is very likely that the migrating host occupies a breadth of fifty miles or more. While on our coast they are believed to be often further out than that, and that they should spread out to a breadth of even 100 or 200 miles, when further south, need not be deemed at all improbable. On this supposition it would be only the inner edge of the migrating column that would be exposed to capture on the way by man, and it is not at all certain, perhaps not even probable, that the predatory fishes are so numerous and destructive far out to sea as they are near shore.

The theory in question derives further support from the experience and opinions of fishermen on various parts of the coast. In many places south of Cape Cod they think they recognize Maine fish on their return in the fall, by their superiority in size and quality, to those that have been with them through the summer, the supposed Maine fish bringing a much higher price.* Of the fact of a return in the fall, of superior fish from *somewhere* there is abundant evidence. The business of making oil in Maine was commenced by Rhode Island fishermen, who followed (as they believed) the run of menhaden down to our coast after the spring fishing at home was over; fished here as long as the menhaden staid, and then returned home to fish there again in the fall. These men believed that the Maine fish passed by Rhode Island both in the spring and in the fall. The phenomenon of the partial cessation of the fishery in that district during the summer and its revival in the fall is explained in a different way by some Massachusetts fishermen, who say the menhaden simply go off into deep water to escape from the blue fish, and return again to the shallow waters after the latter have taken their departure in the fall.†

The facts and opinions thus far cited, taken together, are clearly in favor of the theory of a general southward movement of menhaden every fall to breeding grounds lying not farther north than

* My judgment is that those fish which stop south of Cape Cod are not fully matured fish, for Maine fish on their return in the fall are recognized by all, by their size and quality, as readily as would be a different species. All summer in Rhode Island and Long Island, fish are worth twenty-five cents per barrel maximum price. Maine fish readily bring $1 00 and $1.40—caught by same men on their return. My experience south also gives emphasis to such a deduction.—*Letter of G. B. Kenniston.*

† United States Commissioner, Part I., page 45.

Cape Cod, and in part, if not mostly, a good deal farther south, either on the coast of Virginia and the Carolinas or at an unknown distance seaward in the same latitude. The occurrence of young at Provincetown indicates that some of the spawn is laid almost as far north as that point, and the fact that they are in small numbers does not necessarily imply a corresponding paucity in the number of those hatched so far north. Just as the grilse or half-grown salmon of our latitude remain at sea, instead of entering the rivers as they do further north, so it may be that the young menhaden of these northern seas lack the instinct that impels their southern brothers to crowd landward. Pursuing the same train of thought further, we may imagine the spawning ground of this species to extend even further north than Cape Cod, but to lie at a much greater distance from the coast than in more southern latitudes. To reach it our menhaden would only have to run off the course obliquely, moving at the same time southward and seaward, a total distance of perhaps a hundred and fifty miles. Such a theory is not, however, supported by any definite evidence, and indeed the only modifications of the common theory that the evidence seems to call for, are the extension of the spawning grounds (for a few of the menhaden) to a point near Cape Cod, and the assignment of a very great breadth to the track followed by them in their migrations.

The definite solution of the various questions raised, must await the result of further researches. Much is expected from the report of the United States Commissioner of Fish and Fisheries, who has for several seasons been prosecuting inquiries relative to the natural and economic history of the menhaden.

4.—*Food.*

The exhausting process of spawning leaves the menhaden at the beginning of the year in a state of comparative emaciation, and it is the business of the entire spring and summer to recover and make a little growth. For this purpose it visits our seas, and here it finds an abundance of congenial food. This fact we know from its great increase in size and fatness; but what it feeds on, and in what precise location it finds it, cannot be told from any observations made in Maine. The most that has been observed here, is, that the stomach is always found full of a dark, fine, pulpy stuff, in which the eye can detect no organized substance. The only known examination made by competent observers, is one recorded

by Professor A. E. Verrill, made in April, 1871, at Great Egg Harbor, New Jersey, of which the following account is given:

"A large number of specimens [of menhaden] freshly caught in seines were examined, and all were found to have their stomachs filled with *large quantities of dark mud.* They undoubtedly swallow this mud for the sake of the microscopic animal and vegetable organisms that it contains. Their complicated and capacious digestive apparatus seems well adapted for this crude and bulky food."*

In remarks upon the characteristics of different deposits of mud, Professor Verrill writes as follows:

"In some cases, especially in well-sheltered localities, where the water is tolerably pure, the mud may contain large quantities of living and dead microscopic organisms, both animal and vegetable, and these may even constitute more than one-half of the bulk of the mud, which, in such cases is peculiarly soft and flocculent; such mud is extremely favorable to many kinds of animals that feed on the microscopic organisms, especially the bivalve shells, Holothurians, and many Annelids, and the 'menhaden' among fishes. The last variety of bottom, when it has a substratum of sand or gravel a few inches below the surface, is the most favorable kind for oysters, which grow very rapidly and become very fat in such places."

If soft, pulpy mud be all that is required to grow and fatten menhaden, (and the above statements are on the best authority) surely we have abundant forage for the sustenance of greater schools of them than there is any reason to expect.

But be it mud, or be it anything else, the food they find is abundantly nutritious, and they fatten up rapidly. The early fish taken at Boothbay about the 20th of June, sometimes only give about two quarts of oil to a barrel of fish. The amount increases gradually through the summer, and about the first of October the yield is four, four and a half and five gallons per barrel. At Jonesport the amount stated is three and a half to four gallons per barrel of fish, at the end of August.

There is a remarkable variation in the fatness of the menhaden of different years; this is the universal experience. At Brooklin the yield of a barrel of fish in June is one gallon of oil, in some years, and in others (1874, for example) three gallons; while the

* United States Commission of Fish and Fisheries, Part I., p. 520.

September yield varies from two to five gallons per barrel. There is a corresponding variation in the size of the fish. Of the smallest ever caught in Maine, it is thought a barrel will hold three hundred; of the largest about one hundred and sixty.

5.—*Common Habits.*

Like all the members of the herring family, the menhaden is a gregarious fish; and probably it surpasses in this respect all the other species of the family. They are occasionally found singly, and by these single scattering fish, or at least by very small bodies, the approach of the schools to the coast is always heralded days or weeks in advance; but they generally form immense schools, numbering ordinarily perhaps 100,000—sometimes a great deal smaller, and sometimes, undoubtedly, comprising millions. The largest schools are too great to be enclosed by any of the seines in use, and their numbers can only be estimated roughly, on the basis of those actually taken, which often number 100,000, and sometimes a great deal more. These schools are dense masses of fish, moving close together, all in the same direction, as if by a common impulse. This, of course, refers to their movements when at the surface, at which time only can they be observed. When near enough to the surface to be seen, the whole mass is of a reddish color, which can be distinguished at a long distance by a practiced eye, though quite invisible to a landsman. Sometimes when moving slowly and undisturbed, they swim so high that the tails and back-fins of the uppermost ranks cleave the surface, giving it a dimpled appearance, like the rippling of a light breeze. Their movements are generally leisurely, but sometimes very swift. When alarmed they generally sink a little beneath the surface and move off rapidly. All the surface movements of the fish are termed by the fishermen, "playing." It is not witnessed in all sorts of weather; dull and rainy weather is unfavorable. One of the best days for it is when the wind is northwest in the morning, dying out in the middle of the day and then springing up again in the afternoon from the southwest, with a clear sky. About the change of the wind on such a day, the menhaden come to the surface in great numbers. The general abundance of menhaden at the surface in the most favorable weather, over the whole area frequented by them, shows that in bad weather they are not necessarily absent from the locality, but simply too far beneath the surface to be seen. Whether, even in the best weather, they *all* rise to the surface is

uncertain, but probably they do not. For aught we know, there may be even then many times more at the bottom than are in sight. The object of these movements is quite a mystery; it may be food. Even admitting that they mainly feed on the rich mud of the bottom, there is as yet no proof that it is their only food; nor is it impossible that a portion of the minute organisms, that look in their stomachs like mere masses of mud, may have been collected by them from the water while swimming.

The schools are found moving in all directions. Sometimes they are close to the land, sometimes in bays and harbors, and sometimes in the open sea. How far seaward they run cannot be told, though some suppose it to be fifty miles or more. In the early days of the industry in Maine, the fishing was all done near the shore; now, the Boothbay fishermen often stand boldly out to sea until nearly or quite out of sight of land, and there, during the summer of 1874, they met with excellent success. Off Penobscot Bay, they are frequently caught by Brooklin fishermen outside of Isle au Haut and Great Duck Island. They almost every season run up such rivers as the Kennebec and Penobscot, into water but little salt, but such fish are generally inferior as to fatness, which seems to indicate that they find there a poor feeding ground, and also that their stay in those waters is long enough to affect their condition.

In general it is safe to say that the surface movements of the menhaden are characterized by nothing so much as by capriciousness. They appear suddenly in the most unexpected spots, and, after a stay whose length nobody can foretell, all at once they disappear. One day they may be found at the mouth of the Kennebec, the next at Pemaquid, and the third all along the shore. Occasionally they reappear daily in the same spot for weeks at a time. Such was the case in the latter part of the season of 1874, over the sandy bottom off the Phipsburg beaches. Then it will sometimes happen that a whole season will pass without their appearance in bays where they have previously swarmed.* Again,

* These points are further well illustrated by the following extract from a letter of George R. Allen of Brooklin, Hancock county: "As to the fishing grounds, it is quite uncertain where they will appear most plentiful; some years in this and some in that bay. Bluehill bay is the nearest and best fishing ground to us, but they often fail to appear there, but are certain to appear either in Penobscot, Bluehill or Frenchman's bays some time during the summer months. Three years ago no fish were caught with seines in Bluehill bay; two years ago they were quite plenty for two weeks, none the remainder; while one year ago (by this I mean last summer) they appeared there the

in some seasons they crowd the harbors and coves; in others they seem to avoid them altogether. For some years past they have so generally absented themselves from these places as to excite a good deal of speculation as to the cause.

6.—*Causes Affecting their Abundance.*

The menhaden will evidently continue on our coast as plenty as now, but for the operation of some cause tending to their disappearance, either by an actual diminution in the number of species, or by their removal to other seas. The causes which suggest themselves as efficient in producing these results are the following: 1—disease; 2—scarcity of food; 3—overfishing; 4—predacious enemies.

1—Disease. Very little is known respecting the diseases, properly so-called, that afflict fishes; but there is no reason to doubt that such diseases do exist, and it is not at all improbable that they may sometimes prevail to such an extent as to make serious inroads on the numbers of certain species. Old fishermen, when preparing cod and the allied species for their own use, cull the heap of captures carefully, and many a fish goes overboard as being not fit to eat. Though often, no doubt, the selection is based on a whim, there is no question that the quality of the flesh is subject to great variations besides those attendant on the development of the reproductive organs, and is often unpalatable if not positively unwholesome. You may often find codfish sold for food, to be afflicted with a disease of the head and throat which attacks the bones, rendering them soft and spongy, cementing them together and quite destroying the articulations. Blindness is known to be not very rare with some fishes; it was remarkably prevalent among the salmon caught in some of the rivers tributary to the Bay of Gaspe, in 1873.

Parasitic diseases are quite common among fishes. Our common pond fish are in some places dreadfully infested by them; and what is remarkable, this is sometimes most noticeable in the purest waters. The little shiners of a pond in the town of Industry are

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most numerous I ever saw, and remained the longest, and very fat, growing better every week until the last of September. We fish all the way from Owl's Head, forty miles west, to Schoodic Point, thirty miles east from this harbor, (Center Harbor) wherever we can find them. Sometimes they are outside Isle Haut and Duck Island, and others in Somes' Sound, Mt. Desert, Patten's and Morgan's bays in Bluehill and Surry, and sometimes in Puddle Dock, as we call Pelfast bay; and other shoal waters."

universally infested by a white worm so large as to greatly distend the abdomen. The same thing is true of the stickle-backs of Craig's pond in Orland, dozens of which have been examined without finding a single specimen free from that parasite. The menhaden is much infested by a curious crustacean,* which buries its star-shaped head in the flesh and subsists on the blood of its victim, the body with two long thread-like appendages hanging out from the wound it makes. Professor Baird notices this parasite in his notes on the fishes of the New Jersey coast in 1854, and they have been found in considerable numbers at Cape Jellison, Penobscot Bay. It is conjectured that epidemics may sometimes occur among certain species, of sufficient virulence to exterminate them in the districts where they prevail. This is one of the modes of accounting for the sudden and complete disappearance of the blue fish from Vineyard Sound in 1764, and it is thought worthy of note that this occurred in the very same year that witnessed a very destructive epidemic among the Indians of the neighboring shores, suggesting a possible connection between the two phenomena.

2—Scarcity of Food. If further observation confirm the conclusions of Professor Verrill, and mud be established as the exclusive diet of the menhaden, there will be little danger of a scarcity. We cannot say that a scarcity would be impossible, but the microscopic animal and vegetable organisms supposed to impart nourishing qualities to the mud exist and multiply prodigiously under such simple conditions, that a scarcity seems an extremely improbable event.

3—Over-fishing. Since the establishment of the business of making menhaden oil in Maine, and the introduction of seining to supply the work, there has been a constant war of words between those engaged in seining and their opponents, as to the effect of the new and productive mode of fishing, on the supply of fish. The former maintained, that the numbers of the fish were so enormous that with all the engines he could devise and put in motion man could destroy but an infinitesimal part of them, so that the results of his operations would never be perceptible. The others held, that the use of such destructive modes of fishing would certainly, and at no distant day, result in the ruin of the fishery. Such wholesale destruction—the capture of whole schools at once,

*Lerneonema radiata : United States Commission, Fish and Fisheries, Part I., p. 578.

and of tens of millions in a season, is a drain (they said) against which no species can long maintain itself. There have been seasons during the past ten years when there seemed some ground for apprehension that these gloomy predictions would be verified, but looking back now at the experience of the whole decade, and particularly at the season of 1874, there is but one conclusion to be drawn. There is now no symptom of a falling off in the supply of menhaden. From Portland to Bluehill the general testimony is that they were never more plenty than the past season. The fishermen at Boothbay say that they have, until very lately, been merely nibbling away each summer at the edge of the supply, the main body of the fish having been so far off shore that they were never reached.

The whole tendency of experience thus far, then, justifies the theory of the seiners, that the numbers of the menhaden are too vast to be perceptibly affected by man's operations, unless they are much more extensive than now.

4—Predacious Enemies. A list of the species that prey upon the menhaden would include nearly all the large fishes that frequent our coast, besides seals, porpoises and the like. Among the species especially worthy of mention in this connection are the pollock, silver hake,* horse-mackerel, or tunny, and blue fish. The pollock is the most active species of the cod family that is found on our coast, with perhaps the exception of the silver hake. It hunts in schools, pursuing its prey quite to the surface. It is caught near the surface, and often by drailing. In the Bay of Fundy it sometimes drives herring ashore, and in our waters it doubtless often pursues the menhaden.

The silver-hake appears to be a sort of northern representative of the blue-fish, though inferior to that species in nearly every quality, good or bad.† It is not a very large fish (Storer says eighteen to twenty-four inches long) but it is very active and swift. It is known to pursue both herring and menhaden. The

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*The silver hake of Maine is *Merlucius bilinearis* (Mitch.) Gill. It is called "whiting" in Massachusetts and Saint John, N. B. The technical names of the other species mentioned are, according to Gill: pollock, *Pollachius carbonarius;* horse-mackerel, *Orcynus secundo-dorsalis;* blue fish, *Pomatomus saltatrix.*

†In Boston bay, 25 and 30 years ago, the silver-hake was exceedingly numerous; they were sometimes thrown from the fishermen's nets in such numbers as to require the interference of the board of health.—*Storer.* But since the blue-fish rounded Cape Cod, it has become a rare species.—*Lyman* in Massachusetts Commissioners' Inland Fisheries, 6th Report, page 49.

former it devours in great numbers, and at Grand Manan a great many of the smaller ones are sometimes caught in the herring nets. In Bluehill bay, in the Kennebec river, and doubtless in other places, it is caught in the weirs; and the Brooklin fishermen often take it in their seines with menhaden. Its teeth are rather long and remarkably sharp, and they are charged with wounding a good many menhaden, which are afterwards caught with their sides and backs lacerated as if in that way.

The horse-mackerel, otherwise known as "albicore" and "tunny," is a very large species of the mackerel family, sometimes measuring eight to ten feet in length, and weighing 1000 to 1,800 pounds. It is plenty on our coast as far east as Penobscot Bay, beyond which it is less common, although its range extends to Labrador. No use is made of it except to try out oil from its head and belly.* It is a notorious enemy of menhaden, and is said to sometimes drive them ashore. At Brooklin it is accounted their most powerful and harrassing enemy. "I have often," writes Mr. Allen, "observed these pests, with the most imaginable indignation, in their destruction of these fish, and watched their antics from the mast-head of my vessel, rushing and thrashing like demons amongst a school of fish, darting with almost lightning swiftness through them, scattering them in every direction, and throwing hundreds into the air with their tails." The horse-mackerel is a summer visitor.

The blue-fish is at the present day found on the whole coast of the eastern United States from Georgia to Mt. Desert. It is, however, like the menhaden, present only a portion of the year, retiring, it appears, to deep water on the approach of cold weather, and reappearing in the spring. On the coast of the Carolinas they first appear in March or April, and at more northern points are found at successively later dates precisely as with the menhaden, being everywhere just a little behind that species. In the fall it leaves the northern shores earliest, staying later and later, as we go south, and not finally leaving the coast of North Carolina until late in December. It is supposed that it moves in vast bodies along the coast from its far southern winter home to the northern limit of its wanderings, and returns southward again in the autumn. Throughout the summer season, from May to October,

* On some parts of the Gulf of St. Lawrence it is used as food, and is sometimes eaten in New York. The European tunny, regarded by some European experts as identical with ours, has since ancient times been a favorite article of food.

they are very abundant on the coast of the Middle States and Southern New England. North of Cape Cod they are found in smaller numbers, and north of Cape Ann there is a still further falling off. On our own coast they can hardly be said to be plenty, but they are occasionally met with as far east as Mt. Desert, where a few have been taken.* Although excellent eating when fresh, there is scarcely any demand for them in our State, and fishermen generally avoid them as much as they can. Near Portland a few are caught in July and August in nets, or by "stopping them in creeks," and one dealer estimates that twenty-five barrels of them are pickled yearly, and most of them sent to New York or Philadelphia. These Portland fish weigh from one and a half to four pounds. One informant says they are increasing, another that they remain about the same, and a third that fewer were caught during the last ten years than during the preceding ten.† In the Kennebec river they enter the weirs, tear the netting, frighten away or devour the shad and alewives, and often disgorge the contents of their stomachs, consisting mostly of chopped-up fish, to the great disgust of the fishermen, who strenuously object to having their clean weir floors covered with such filth. In 1868 the fishermen said they were increasing, and to this fact they attributed the falling off of the sea shad. They are taken now and then in the seines of the Boothbay menhaden fishermen, who report that since 1866 they have increased largely. In 1874 they were plentier than usual. One seine, belonging to a firm in Linakin's bay, in setting for menhaden enclosed a large body of blue-fish. The seine was badly torn, but in spite of that and of efforts to get rid of them, fifteen barrels were taken. The blue-fish taken in the seine weigh on an average six or eight pounds. Very small ones are not taken; the minimum may be put at about eighteen inches in length.‡ At Brooklin, Mr. Allen, who has followed the business of catching menhaden for ten years, never saw a blue-fish among them, and has heard of only two instances of their being caught there, and then only single ones; he thinks it

* Mr. Isaiah Young of Lamoine, formerly fished with wiers for herring in the town of Tremont; at one time in the month of May he caught several strange fish, that were at first supposed to be salmon, but afterwards found to be blue-fish. The year of this occurrence is not known.

† Letters of Lewis, Whitten & Co., Geo. Trefethen and C. P. Skillings.

‡ Mr. A. H. Kenniston, who has been for nine years engaged in the menhaden fishery, says he has never seen one smaller than this.

very rare to find them east of Monhegan island. Probably the blue-fish does not breed on the coast of Maine. Some of the Kennebec fishermen hold the opinion that it does, and say they have seen the young, three or four inches long, in the river.

The blue-fish is remarkable for periodical fluctuation in numbers and range. It is believed to have been a resident of the coast of York county in 1672. During the first half of this century it was unknown in Maine, but it probably re-appeared here soon after 1847, about which time it was first seen north of Cape Cod. In other seas it has exhibited strange and unexplained irregularities in its migrations. During the latter part of the last century it appears to have been for many years absent from the coast of Massachusetts. In the present century it did not become abundant about Nantucket until about 1830, and it was first noticed in Massachusetts Bay in 1837.* In numbers it culminated south of Cape Cod in 1850 or 1860, and since then has declined, at least in some districts. At Cape Ann the period of its greatest abundance is stated to have been near 1850, since which time it has greatly declined.

The voracious character of the blue-fish is thus described by the United States Commissioner of Fish and Fisheries:

"As far as I can learn, there is no parallel in point of destructiveness to the blue-fish among the marine species on our coast, whatever may be the case among some of the carnivorous fish of the South American waters. The blue-fish has been well likened to an animated chopping-machine, the business of which is to cut to pieces and otherwise destroy as many fish as possible in a given space of time. All writers are unanimous in regard to the destructiveness of the blue-fish. Going in large schools, in pursuit of fish not much inferior to themselves in size, they move along like a pack of hungry wolves, destroying everything before them. Their trail is marked by fragments of fish and by the stain of blood in the sea, as, where the fish is too large to be swallowed entire, the hinder portion will be bitten off and the anterior part allowed to float away or sink. It is even maintained, with great earnestness, that such is the gluttony of the fish, that when the stomach becomes full, the contents are disgorged, and then again filled. It is certain that it kills many more fish than it requires for its own support.

* United States Commissioner of Fish and Fisheries, Part I., p. 238.

"The youngest fish, equally with the older, perform this function of destruction, and although they occasionally devour crabs, worms, &c., the bulk of their sustenance throughout the greater part of the year is derived from other fish Nothing is more common than to find a small blue-fish of six or eight inches in length, under a school of minnows, making continual dashes and captures among them. The stomachs of the blue-fish of all sizes, with rare exceptions, are found loaded with the other fish, sometimes to the number of thirty or forty, either entire or in fragments.

"They appear to eat anything that swims of suitable size, fish of all kinds, but perhaps more especially the menhaden, which they seem to follow along the coast, and which they attack with such ferocity as to drive them on the shore, where they are sometimes piled up in windrows to the depth of a foot or more."

From evidence before him the commissioner proceeds to estimate the number of fishes destroyed by the blue-fish on the southern coast of New England. The number of the latter yearly visiting that coast is estimated at one thousand millions (1,000,000,000,) and each of these is supposed to destroy ten fish per day. From these data he reaches the conclusion that within the district named, ten thousand millions (10,000,000,000) of fish is a reasonable estimate of the number thus destroyed every day during the stay of the blue-fish.

It is easy to see that it requires no great body of blue-fish to affect materially the movements of the timid menhaden. A school of hundreds of thousands may perhaps be turned from its course, driven up into the bays and rivers, or more likely out to sea, by a few dozen of their fierce foes. In the summer of 1874 the Boothbay fishermen obtained their best success either in close proximity to the shore or at a considerable distance from it, there being an intermediate space several miles broad where scarcely any menhaden could be caught. In explanation of this singular phenomenon, some of the fishermen advanced the idea that the blue-fish were ranging along the coast, mainly in the unproductive belt, which they occupied so completely as to drive all the menhaden off to either hand. Whether this be the true explanation or not, it is quite plausible.

Besides the foregoing, there might be made a long list of species that probably prey on the menhaden. Very likely some of these will be found, when the history of the species is better known, to

have really more influence on its numbers and movements than some of those to whom more prominence is given. There are, for instance, the cod, hake, haddock, halibut and dog-fish.* The first three are named, not from any direct evidence, but because it is reasonable to infer that fishes so omnivorous, so voracious, and so large, will hardly fail to feed upon the menhaden, which must often come in their way, when at the bottom, where it is supposed to feed. This view is strengthened by observations made on the halibut, in whose stomach the remains of menhaden have been found, along with those of haddock, mackerel, herring, &c.† All these species may, perhaps, exert more influence by driving away the menhaden from their grounds than by devouring them. The same thing may be said of the dog-fish, a kind of shark, twenty to thirty inches long, with a very rough skin, bringing forth young alive; but the latter is of such a tyrannical character, and on some parts of the coast so abundant, that it may do more harm than the other four combined. They are very abundant off our coast at a distance of five to fifty miles. They rarely come into shoal water here, but in Vineyard Sound great numbers are caught in weirs in the month of May, often several thousand in a single weir, and then they are found to eat menhaden.‡ In July and August they are so plenty that many of the Portland fishermen give up business in those months. The dog-fish drive off the cod, hake, and in fact all the valuable bottom fishes, tear the nets, swallow all the hooks, and being valuable only for the oil contained in their livers are not worth catching.

To the list already enumerated we might add all the kinds of sharks found on our coast, seals, (which Mr. Allen thinks very destructive), porpoises, grampuses or black-fish, and other cetacea; nor is it complete without the addition of the predacious species of lower latitudes, which the menhaden must encounter if the theory of a migration to distant southern regions be correct. Enough, however, has already been said to show how vast is the array of foes that work to destroy the poor menhaden.

7—*Variations in Number and Range.*

Though more constant by far than some other species that might be named, the menhaden has exhibited occasional fluctuations of

*Technical names (according to Gill), Cod, *Gadus morrhua;* hake, *Phycis chuss;* haddock, *Melanogrammus aeglefinus;* halibut, *Hippoglossus Americanus;* dog-fish, *Squalus Americanus.*

†Storer's Fishes of Massachusetts. ‡Commissioners Inland Fisheries, 6th Rept., p. 55.

importance. Two instances may be cited. The first is the general desertion of harbors and coves, observed during several years past, and the other is the desertion of the whole coast east of Jonesport.

Of the desertion of the harbors and coves there seems to be abundant testimony. An observer in Boothbay says: "Menhaden can be driven out of small bays so that they will not come in." "Certain it is that they do not come into the bays as they used to." In Bluehill we are told the same story. In Jonesport it is said, "Pogies used to run into all the coves and creeks. Of late years they do not appear to frequent the shores as formerly." Testimony of this sort might be multiplied; but it is unnecessary. The fact is notorious. During the past season they returned to some of their old haunts in great numbers,* but have by no means resumed their former habit in this respect. Of this singular change of habit there are various explanations offered. According to some persons it is caused by the practice of seining; others lay it to the oil and decaying matter from the oil-factories. Neither of these causes appears sufficient to produce such a result. The desertion of the coves is observed in localities far removed from those where the alleged causes have operated. Perhaps, after all, the thing to be accounted for is why the menhaden ever crowded into small bays as they used to. Were they there in search of food, were they simply obeying blind instinct, or were they driven in by hordes of hungry foes outside? The latter supposition seems quite as probable as the others. We know that small fishes sometimes rush ashore to escape pursuit; we know that this happens with herring when flying from the pollock and with menhaden when flying from the blue-fish and horse-mackerel. The presence, outside, of a large number of predacious foes, of whatever species, would be ample to drive the menhaden in. This might happen year after year; while with the cessation of the cause the result would cease too, and the menhaden would no longer crowd into the coves as before. If this view be correct, then the recent absence of the menhaden from the shores indicates an improvement in its chances of life, by the removal of its destroyers. Lack of information forbids an attempt to point out the

*George B. Flye of Brooklin, writes: "Pogies (menhaden) were never more plenty than last summer (1874); came into the harbors more than usual, and never stopped in the bays so long." Mr. Allen makes a similar statement in the extract quoted in the foot note above.

species that have been most active in producing these movements of the menhaden; and indeed the theory itself is not proposed as one that has much of positive evidence in its favor, but just to show the possibility of accounting for the absence of the fish from shore on the hypothesis of the operation of causes purely natural, and not inimical, but positively favorable.

The desertion of the eastern coast also rests on ample evidence.

At Jonesport menhaden used to be very plenty. They were commonly caught in gill nets two and one-half fathoms deep, but it was practicable, almost any time, to get enough to go fishing with by spearing. They became scarce, seven, eight or ten years ago, and now very few are caught although some come as far as this every year.*

At Lubec, thirty years ago or more, menhaden were so plenty during their short season, (July and August,) as to be a nuisance. They have not been plenty since 1840 or 1845, and now none are found east of Jonesport. They left suddenly, and since the date mentioned have been rarely seen. Mr. E. A. Davis of Lubec, a man of long experience in the herring fishery, has not seen a single specimen for ten years. Mr. E. P. Gilles, also of large experience, in 1860, or thereabouts, got three hogsheads of them one afternoon tide, and since then has seen none.

At Pembroke, Mr. Moses L. Wilder says, that "twenty years ago, and always before that, the menhaden used to come here every year in great numbers, filling every cove and creek; but for the past twenty years none whatever have been seen. Little use was ever made of them except for bait, and of that but little was needed here.

In 1850 the menhaden was mentioned as being sometimes caught in weirs within the harbor of St. John, N. B., in considerable numbers.† Of late years none have been found in New Brunswick or to the north of Grand Manan.‡ This well established movement of the menhaden is equally mysterious with the other, and speculation on its causes would, in the present state of our knowledge of the influences in operation, be equally fruitless. It is, however, worth observing, that there do not appear to have been any artificial causes at work sufficient to produce such a result. Not only

* Statement of Zimro D. Norton of Jonesport.

† Perley's Fisheries of New Brunswick, page 208.

‡ J. F. Whiteaves, in 6th Report, Department Marine and Fisheries, (Canada), Appendix U, page 195.

is that coast more thinly peopled than any other along which the menhaden range, but the pursuit of them by man was on the very smallest scale. It is, therefore, among the natural causes affecting them that we must seek an explanation. Neither of the phenomena cited proves that there has been a general diminution of the number of the menhaden. Even their absence from the coast of a whole State, does not prove that they are not present somewhere else. Especially inadequate to the proof of diminished numbers is the absence of the fish from the immediate vicinity of the shore. The converse is equally true. Unusual abundance of menhaden in any particular district or even along the coast of a whole State does not prove a general increase. All such variations, whether they seem to indicate decrease or increase, can be accounted for on the hypothesis of a change in range.

If we now attempt the consideration of the question whether there has been any great variation in the total number of menhaden on the coast of Maine, during the past ten or twenty years, we shall find the subject involved in great difficulties. That there have been great variations in the number caught can be easily shown; but the catch is dependent not only on the comparative abundance of the menhaden, but also on various other important conditions; among which may be mentioned the extent of the pursuit, the character of the apparatus, the prevalence of favorable or unfavorable weather, the position of the main body of the fish relative to the land, whether near or remote, and also with reference to the factories. To these we may add the prevalence or absence of predacious enemies, or other disturbing influences, upon which, perhaps, the greater or less timidity of the fish may depend; the skill of the fishermen; and finally, the accidents on which success often turns. To demonstrate a scarcity or abundance of fish in the bays may be sometimes an easy task; but he who would pronounce upon the variation of the total number of the wandering menhaden in our seas, without incurring the accusation of rashness, must do so only after a laborious collection and comparison of facts and statistics, far surpassing in completeness anything now accessible on the subject.

B. — Economic History.

1.—*Modes of Capture.*

Menhaden are captured on the coast of Maine in three different modes—1st, weirs; 2d, gill-nets; 3d, purse-seines.*

1st, *Weirs.* In nearly all the weirs built for salmon, shad, alewives and herring, in salt and brackish water, as far east as the range of menhaden extends, some of them are caught every summer. The herring weirs are, however, not well calculated to take menhaden, the entrance being so wide that they are apt to play out after once entering. Weirs built for salmon and alewives are more successful with menhaden. Some weirs are built expressly or mainly for this species, but the number of such is very small; in Penobscot Bay two or three near Stockton are all that can be mentioned. In a still further number the menhaden constitute an important part of the catch. In the remainder, constituting the majority of the weirs, they are not caught in sufficient numbers to be of much account. The whole number caught in this mode is very small compared with those taken in nets.

2d, *Gill-nets.* Until the introduction of purse-seines, this was the principal mode of catching menhaden. It was carried on on a small scale by almost every fisherman on the shore, to supply bait for his own lines, or for sale to schooners in the cod-fishery. It is still followed, on a limited scale, both by small boats and schooners. One of the favorite resorts of schooners engaged in this fishery is in Penobscot Bay, near Searsport, where they set their nets in long lines. The catch being used almost wholly for bait, no extended inquiry was made into this fishing.

3d, *Purse-seines.* These are of recent introduction, and are the means by which nearly all the fish are now caught. The seines used at Boothbay have meshes about two and one-half inches long (that is, $1\frac{1}{4}$ inches square), and are of small cotton twine, except the middle, or "bunt," which is of very strong twine, to hold the fish when they are gathered into a small compass. These are commonly 225 to 275 fathoms long, 20 fathoms deep in the middle, tapering to 14 fathoms at each end. The upper edge is buoyed

* As an illustration of the variety of fish caught in some of the weirs in salt water, take this list, given by George B. Fly, of those caught in his weirs in Bluehill Bay, Brooklin: "Herring, mackerel and pogies, that we make use of; men that are engaged in catching lobsters use sculpins and flounders for bait; then there are harbor pollock, tomcods, squid (a kind of mollusk, not a true fish), lump-fish, dollar-fish, sturgeon, brit, shrimp (a crustacean, not a fish), sharks, hard-heads, smelts, silver-hake."

by corks, the lower edge is lightly weighted by leads, and furnished with rings through which play the purse-lines, by means of which the bottom of the seine is gathered together like the end of a purse. They cost about $900 apiece, and a gang of fishermen will use up two seines in three years. In using the seine it is set in the water in the form of a circle around the fish, the two ends being brought close together; the bottom is then pursed up, giving the seine the form of a bag, in which the fish are enclosed.

Attached to each seine is a gang of fishermen and boats. The gangs are described as "sailing gangs" or "steamer gangs," according to the means of locomotion. A *sailing gang* comprises two working boats and a light row boat for the "driver;" two carry-away boats, with a capacity of about 250 barrels each; one vessel and ten men in all. The working boats work the seine, the carry-away boats carry to the factory, and on the vessel the crew are fed and lodged. In a *steamer gang*, the vessel and the carry-away boats are replaced by a screw steamer of thirty-five to sixty tons (new measurement) and the number of men is reduced to nine. These steamers cost from $10,000 to $16,000 each, and will carry 800 barrels of fish. They were introduced on the coast of Maine three years ago. The advantage of the steamer over the sailing gang is obvious. It is not dependent on the wind and can proceed without loss of time to the place where the fish are playing. Of course they catch a great many more fish, but they are so much more expensive that they do not appear to be much more profitable. The seine gangs are always attached to the oil factories, and the latter employ no other mode of fishing. Each factory runs several gangs.

Let us now follow the process of catching the fish as practiced by a steamer gang. We will begin at the sailing of the gang from the harbor, some clear morning in August. The engineer bestirs himself in the wee small hours of the night, and has on steam early enough to reach the fishing ground about as early as the fish can be seen. The fishing ground is just where experience, and parparticularly the experience of the last few days, dictates. Commonly it is out to sea. As soon as it is light a sharp watch is kept on every side. Wherever menhaden are seen, thither the steamer's head is pointed. Sometimes it is close by home, and sometimes twenty or thirty miles are passed over before there is a single school to be seen. On approaching a playing school they always try to get on the outside of it, because the first movement

of a school of pogies on finding themselves entrapped, is invariably a rush seaward. The driver, in his swift row-boat, armed with a pile of stones, gets on the other side. Having divided the seine between them, one end and half the seine being on each, the two working boats approach the school within a short distance, and endeavor to get in a favorable position. Sometimes a whole day will be spent in vain endeavors to get near swiftly moving or capricious schools. When the favorable moment comes the boats separate and row around the schools of fish, paying out the seine from each as they go. Meanwhile the driver, on the opposite side, throws stones at the timid fish and starts them in the direction of the boats. At last the boats have encircled the fish, and meet on the side opposite to their starting point; instantly the purse-lines are seized, and no man stops to breathe until the bottom is pursed up. The crews exert themselves to complete the operation before the fish take the alarm, and many a time it happens that they pass out between the boats just before they meet, or under the bottom of the seine before the pursing is complete. The affrighted fish first, it is said, rush seaward. Finding themselves shut in on that side, they turn and rush landward; headed off there, they furiously follow the net around at the top of the water, some going this way and some that. Finding the circuit complete, they gradually subside, and finally settle to the bottom of the bag. The seine is now drawn aboard the working boats until only a small portion of it is left in the water, and the fish brought in a compact body to the surface. The steamer is now brought along side, and with a great tub holding two or three barrels, and worked by steam, the fish are rapidly taken on board. When everything works well it takes about two hours to catch and take on board a school of 500 barrels; commonly it is longer than that.

2.—*Utilization of the Menhaden.*

The menhaden caught in Maine are utilized in three ways; 1st, for bait; 2d, for oil; 3d, for fertilizing purposes.

1st. For bait the menhaden is used either fresh or salted. For the shore cod and hake fisheries it is a favorite bait when it can be had fresh. It is also very commonly used in the cod and halibut fisheries of St. George's Bank, being taken out by the schooners engaged in that fishery and kept on ice. The seiners sometimes sell bait for this purpose. As the opportunity to dispose of their catch fresh, does not often occur to the gill-net

fishermen, the most of their menhaden are "slivered." This operation consists in slicing off the fleshy parts of the sides which constitute the "slivers," and are preserved for bait, the head, back-bone and the most of the fins being rejected, and either thrown away or tried and pressed to extract the oil. The slivers are salted down, and sold by the fishermen to dealers who supply fishing vessels. On such bait as this the bank fishermen used formerly to depend largely, but the practice of using fresh bait now prevails. In the mackerel fishery on this coast and in the Bay of Chaleur, the slivers are mostly consumed.

2d. Oil is made from the refuse of slivering, but on a small scale. In time of an abundance of menhaden, if oil is reasonably high, the whole fish are devoted to this purpose by those who would otherwise sliver them. But the oil from all other sources is insignificant in amount compared with that produced by the factories run especially for that purpose.

3d. The fertilizer is always an incidental product of the preparation of bait and oil. In former times, when the art of making oil from the menhaden was unknown or little practiced, the whole fish were frequently used to enrich the land, but such a thing now rarely happens. The processes involved in the making of oil and the incidental production of fish-scrap as employed in the factories, now demand description.

3.—*Making Oil and Scrap.*

The primitive mode of making oil was by chopping up the fish, boiling them in a kettle, and skimming off the oil that rose to the surface. A large percentage was by this process left in the scrap. By and by screw-presses were introduced, to press out the oil from the scrap. These were just like cider-presses, and the fish were laid up, like apple pomace, in cheeses, but a coarse cloth was used for an envelope instead of straw. This mode is a very efficient one, and is still in use in all except the larger class of establishments. East of Bristol it is now the only apparatus in use either for menhaden or herring. The kettle-and-hand-press method, though it utilizes the products of the fish excellently, is not sufficiently expeditious and economical of space and labor to answer for very large establishments. With the enlargement of the fishing operations, steam was introduced into the factories to cook the fish and perform the heavier kinds of mechanical work.

It now has to draw the fish up from the landing place to the factory, cook them, press them, pump water and oil, &c.

There is quite a variety in the arrangement of the details of the various factories, but in all essentials the methods of working are so nearly alike that the description of one will answer for all. The establishment of Kenniston, Cobb & Co., on Linakin's Neck, though not one of the largest, is generally conceded to be a model of convenience and efficiency, and is selected for description.

The main floor of the factory stands a considerable height above the water. Here are all the steam tanks and the press, and in an adjoining building is the boiler and the principal engine. The tanks are of wood, eight feet square and four feet deep, with a capacity of fifty-one barrels, with a board platform on which the fish rest, four inches above the bottom. Into the space between the platform and the bottom the steam is introduced. There are tanks arranged in two rows, between which runs the track leading from the landing. Another track passes by all the tanks and leads to the press. On this track run several cylindrical curbs made of wood and iron. The press is hydraulic, and is worked by steam. On a lower level than the steam tanks are series of receptacles for the oil and water, that are brought to them by conductors leading from the tanks and press. Under the main floor is the scrap-house, into which the scrap is dumped through a scuttle in the floor. The track that runs between the rows of tanks leads down a steep incline to the landing, where there is another engine, and an elevator to take the fish out of the boats. The elevator delivers the fish into a hopper that holds fifty barrels, and from this they are drawn into a car that holds seventeen barrels, so that the unloading of the boat may go on without intermission while the car is carrying its load up to the tanks The car is drawn up by the engine on the landing, and dumps its load into either of the tanks at pleasure.

Preparation for the fish is made by filling the tank a foot deep with water and steaming it until hot. The fish are at first steamed hard from forty to sixty minutes, then punched and broken up. After simmering for five hours longer the free water and oil are drawn off, and then if possible the broken fish stand draining and cooling for several hours. At last they are pitched into the curbs, run under the press, and subjected to a pressure which is gradually brought up to seventy-five tons. This wrings out all the water and oil that it is practicable to extract, and the cheese is

now dropped into the scrap-house to remain until the following autumn or winter.

The oil and water running together into the receivers, separate, by the oil rising to the top whence it can be drawn or skimmed off. Great pains must be taken to separate the oil from the water before the impurities contained in the latter begin to ferment, for if this happens, the quality of the oil suffers much. Moreover, in what appears at first to be pure oil there is a variable amount of finely divided fleshy substance, that must be allowed to settle, as it will after a while, and the clarified oil drawn off before putrefaction sets in. In order to effect the separation, the oil is commonly passed through a number of settling vats, and a portion of the impurities deposited in each, and finally before barrelling, the oil is, if practicable, exposed some hours to the sunlight, in a broad, shallow tank. If all these processes are successfully carried through, the oil is light-colored, sweet, and of prime quality; but if it is exposed at any time to the influence of putrefying animal matter it becomes dark and "strong." The very strongest of oil is made from the "gurry," or settlings of the oil, by steaming or boiling it over.

It naturally happens, that every manufacturer makes several grades of oil, of very different quality, of which the best is very sweet, fine oil, bringing ten cents per gallon more than a strong article. Notwithstanding this fact, it is said to be the common practice of dealers to pour all grades into the same vat, and this has led manufacturers to take less pains to keep them separate.

It is a curious fact, that oil made from early fish is not so good as that made later. It is called "weak," and brings in market five cents per gallon less.

The various processes of utilizing the scrap, with statistics of the business and other practical matters, will be treated in a subsequent section.

THE HERRING.

1.—*Natural History.*

The herring* inhabits the American side of the Atlantic, from New York to the Polar regions, and is most abundant at various points between Maine and Labrador. Its migrations appear to be limited on our coast to movements to and fro between the deep and shallow water. During the cold weather it stays in deep water, but during the warm season it frequents the shores in large schools. In the vicinity of Eastport their winter quarters are at the bottom in twenty fathoms deep, where they can be found any time between October and April, and perhaps later. It was formerly supposed that during the winter they migrated to a great distance, and the discovery of their presence so near their summer quarters was made only about five years ago. Probably they are equally near all parts of the coast.

In the spring and summer, as the temperature rises they come in schools to the shore. Their favorite ground is said to be in about twenty feet of water over a sandy bottom. Occasionally they come to the surface to play, probably to feed. Their favorite hour for visiting the shore is early morning; in the middle of the day they are in deeper water. At Lubec the date of their appearance in shoal water is about June 1, when the weir fishing commences. They retire again in the fall, so that few are caught in the weirs after October 1. These dates correspond with those observed further west, although there, of course, the season is longer, and the herring run earlier in the spring and later in the fall. In Bluehill bay they are caught from May 1st till October.† These are the dates given by fishermen as the dates when the herring are caught in weirs; but when spawning they frequently visit their chosen grounds in shoal water at other seasons.

The most remarkable point in the natural history of the herring is its habit of spawning at various seasons of the year. Not that the same individual spawns sometimes at one season and sometimes at another; but this we know, that some herring spawn in the spring, some in the summer and some in the fall. At the Magdalen Islands in the Gulf of St. Lawrence, they spawn in April and May,—as soon, some say, as the ice is out of the way.‡ At the southern head of Grand Manan, they spawn according to

* Technical name, *Clupea elongata Les.* † Letter of George B. Flye. ‡ E. P. Gilles.

some, in August, September and October,* according to others in October and November.† About Lubec they say there are two schools, one spawning in November (in Johnson's bay, for instance) and another in April. Young herring one inch long are seen there in December and in May. The most of the spawning about Eastport appears to be done in the spring; for then all the large female herring caught are distended with spawn. One-third of the catch then consists of males. Spawning is not strictly confined to the two seasons mentioned, for herring full of spawn at Eastport and at Pembroke can be found almost any month in the year.‡ At Gott's Island, near Mt. Desert, the herring caught about the middle of July consist mostly of adults that are apparently just about to spawn. At Boothbay and Georgetown there is a run of large female herring full of spawn in October and November, and they are said to spawn there at that season. Harmon's Harbor, in Georgetown, is one of their favorite grounds.

Herring appear to attain maturity, (that is, reach the spawning age), when about ten inches long. Some mature males have been observed at Gott's Island a fraction of an inch shorter. The finest herring are a good deal larger than that, being from twelve to fifteen inches long; of these the majority are females, and are always at their proper season found full of eggs, of which they produce immense quantities. Great quantities are caught when from five to seven inches long, and these never have spawn or milt.

At Lubec herring are said to feed on "shrimp" from one to one and a half inch long. These are very abundant, and the herring are commonly found "chock full" of them. Such is the testimony of the fishermen. Professor Verrill has made some observations on this subject, and from the American Naturalist for September, 1871, we extract the following note from his pen:

"The herring (*Clupea elongata*) in the Bay of Fundy feeds very extensively, at least during all the months when I have observed them (June to November), upon several species of *Mysis* and *Thysanopoda*, called 'shrimp' by the fishermen. These swim free at and near the surface in extensive 'schools,' and are persistently pursued by the herring. The commonest species, apparently a *Thysanopoda*, is about an inch and a half long, of a pale reddish color. The species of *Mysis* are smaller and paler. The two

*S. F. Cheney, in United States Commissioner Fish and Fisheries, Part I, page 135.
†U. S. Treat. ‡U. S. Treat and Moses L. Wilder.

genera often occur together. Young pollock or coal-fish, four to ten inches long, pursue the same species in large schools, often coming around the wharves of Eastport in great numbers, in eager pursuit of their prey, and by leaping out after them produce a great commotion in the water. When thus pursued the *Thysanopoda* will leap out of the water to the height of a foot or more. The common *Sebastes*, or 'Red Perch,' at Eastport, feeds upon the same species when they come around the wharves, but probably does not pursue them to the same extent as the herring and pollock."

Probably the herring use food of a similar character at other seasons and places.

The Eastport shrimp have the reputation of being very nutritious; for they say that "one belly-full will fat a herring up."* At any rate, the herring which come in in very poor condition in the spring (which by the way favors the conclusion that they have lately spawned) are found to fat up with surprising quickness. In July and August they are fattest, and are often so fat that it is impossible to cure them.

Herring are preyed upon by all the large fishes, especially by the various members of the cod family, which abound through the herring region. When at the surface they are fiercely pursued by pollock and silver-hake, and when at the bottom they fall victims to the voracity of the cod, hake and haddock. It is well known that the presence or absence of herring determines the success of the hake and cod fisheries near Grand Manan; and it is believed that the success of the Grand Bank fisheries is greatly influenced by the same cause.† The effect upon the herring is simply to hold in check its prodigious fecundity.

2.—Economic History.

The herring fisheries of Maine are carried on by means of gill-nets and weirs. An extensive winter fishery is now carried on near Eastport by means of nets of two or two and one-half inches mesh, sunk to bottom in from fifteen to thirty fathoms of water. The grounds already fished are all around Cobscock and Passamaquoddy bays, around Grand Manan, and as far up the Bay of Fundy as Point Leprault. This fishery has only been practiced during the past five years. Further west, along the coast, gill-

*E. A. Davis. †Letter of Prof. S. F. Baird, in 8th Report of Maine Commissioners of Fisheries.

nets are the common mode of taking herring from spring to fall. They are commonly floated at the surface, but sometimes sunk beneath it. At Millbridge a remunerative fishery of this sort has recently sprung up, carried on in part by the inhabitants and in part by vessels from the westward. The mesh here used is two and one-quarter inches, and this lets the small herring through.

The principal seat of the weir fishery is in Lubec and vicinity. In the town of Lubec twenty-three weirs were built in 1874, which was a falling off of about one-third in number in five years.* Pigeon Hill bay, in Steuben, Frenchman's bay and Bluehill bay are other localities where weirs are built for herring; but the fisheries in all these places are of small extent compared with those of Lubec and vicinity. The weirs in Lubec and vicinity are all of the kind called "deep weirs." They are built by driving piles where the water is from six to twenty feet deep when the tide is out, and weaving in brush. They commonly consist of a single large enclosure with a very wide entrance, and such leaders as the circumstances of each case may dictate. As the water never leaves the pound the fish are taken out of it with a seine. These weirs vary greatly in cost according to circumstances, but on an average the first cost is from $200 to $300, and the annual repairs from $25 to $50. The seine is commonly twenty-five fathoms long and four fathoms deep, costs $100 to $125, and lasts five or six years.

During the past five years there has been a decline in the price of smoked herring, and to this cause is attributed the decline in the number of weirs in Lubec, as stated above. The decline in price has been from thirty and forty to fifteen and twenty-five cents per box, accompanied by a slight decrease in the size of the box. This is attributed to the market being overstocked by an increased catch of herring, not in Lubec, but on the neighboring islands, in Passamaquoddy Bay, and all along the shore further west,† which is attributable to increased fishing.

The product of the herring fishery is used in four ways: 1st, for food; 2d, for bait; 3d, for oil; 4th, for manuring the land.

The herring used for food are marketed fresh, pickled or smoked. A great part of the product of the winter fishery is sent in a frozen state to Boston and New York, and thence into the interior. All of the summer catch that are large enough are scaled and smoked.

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*E. A. Davis. †E. A. Davis and E. P. Gilles.

The very largest and finest of the winter herring are salted and smoked lightly, and sent to market under the name of "bloaters."*

The herring forms a favorite bait for the cod and other deep sea fisheries. It is common for fishing schooners bound for the banks to visit Eastport or vicinity and take a quantity of fresh herrings, enough to last them a short time after arrival on the fishing grounds, keeping them packed in ice.

The practice of making oil in the vicinity of Lubec was introduced by Capt. U. S. Treat, about fifteen years ago. Now every fisherman has a press. As a rule only those herring that are under average size, say six inches long or less, are pressed for oil. Sometimes the larger ones are put to this use, but such is the case only when the comparative prices of oil and smoked fish warrant, which is not often.

For the purpose of making oil the herring are always salted, with about two bushels of salt to a hogshead (four barrels) of fish. This is necessary in order to separate the oil from the scrap and "gurry."† They lie in the salt until enough have accumulated to demand attention, when they are boiled and pressed in screw-presses. The presses in common use have a capacity of a barrel and a half at a time. The fish are enveloped in bagging, in small parcels laid one above another, and receive such a pressure that the scraps come out in rather hard cakes, that are afterwards broken up with hoes.‡ This is generally barreled up without further drying, but Captain Treat dries it on platforms in the air. The amount of oil obtained is on an average one barrel out of fifteen or twenty barrels of fish. The fattest yield about one barrel out of ten. The oil is always sweet, as the salt prevents putrefaction, but it brings a lower price than menhaden oil, and it is said will not stand cold so well.

The scrap is sold as a fertilizer, and it occasionally happens that a school of herring is taken composed of fish too small and poor to use either for oil or smoking, and these are in some places applied directly to the land. In 1871 the most of the herring caught in Pembroke were of this quality, and great numbers of them were applied directly to the land.§

* U. S. Treat. † Captain Treat thinks this may be owing somewhat to the *texture* of the fish, menhaden being coarser and the cheese more porous, so that the oil runs out freer. Mr. Wilder and Mr. Davis locate the difficulty in the "gurry," which Mr Davis describes as being the "silvery substance under the scales next the skin." Without salt they say, this gurry will not separate from the oil.

‡ E. A. Davis. § Statement of M. L. Wilder.

PRACTICAL DETAILS OF THE SUBJECT.

A.—Industry and Statistics.

1.—*Menhaden Fisheries of the Eastern Coast.*

The catching of the menhaden and the manufacture of oil had assumed such large proportions on the eastern coast of the United States, that in 1874 those interested in the business in Maine, Long Island, Connecticut, Rhode Island and New Jersey, formed themselves into an organization known as the "United States Menhaden Oil and Guano Association." From statistics presented at that time it was found that within the section embraced in the above localities, sixty factories were in operation, having an invested capital of $2,388,000. These companies employed 383 sail of vessel and twenty steamers, and also had in their employ 1,197 fishermen, and over eleven hundred operatives at their several factories. The total number of fish caught was 1,193,100 barrels, (250 fish to a barrel); producing during the year a total of 2,214,-800 gallons of oil, and 36,300 tons of fish guano. This association of the oil and guano companies was found necessary in consequence of the importance of the business, and was formed for the purpose of rendering to each other mutual aid and assistance. Most of those in this State engaged in the menhaden fishery are members of this association, with the exception of some small firms to the east of Bristol, which is the great centre of this industry on our coast, Boothbay and Bristol furnishing one half of all the menhaden taken in the United States.* In 1873 it was estimated that in this State alone $291,000 was invested in factories, and $335,000 in fishing apparatus; 443 men with thirty-seven vessels and twenty steamers were employed in taking fish, and about 250 workmen were employed at the factories. Of the 429,000 barrels of fish taken, 2,300 were sold for bait; 966,000 gallons of oil, and 12,885 tons of guano made.

2.—*Statistics of* 1874, *in the Boothbay District.*†

The amount of menhaden taken at Boothbay, and the number of gallons of oil produced during the season of 1874, by the several companies engaged in the business was as follows:

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*Statement of George B. Kenniston. †Returns to Custom House, Wiscasset, Col. Orrin McFadden, Collector; and statement of Geo. B. Kenniston.

Name of Company.	Bbls. fish taken.	Gals. oil produced.	Value.
Atlantic Oil Works	62,000	155,000	$55,800
Kenniston, Cobb & Co	30,000	75,000	27,000
Galloup & Holmes	27,000	67,500	24,300
Galloup & Manchester	26,000	65,000	23,400
Suffolk Oil Works	29,000	72,500	26,100
Total	174,000	435,000	$156,600

In addition to the above, 5,800 tons of chum were produced, valued at $11.00 at the factory, making a total for the chum of $63,800. In the above instance the oil was reckoned at 36 cents per gallon, and two and a half gallons of oil were allowed to the barrel of fish. The total value of oil and scrap or chum was $220,400.

In the district formed by the towns of Bristol and Bremen, the following are the returns:

Name of Company.	Bbls fish taken.	Gals. oil produced.	Value.
Church Brothers	142,000	390,500	$148,390
L. Brightman & Sons	60,000	165,000	62,700
J. Tarr & Co	60,000	165,000	62,700
Round Pond Company	31,000	85,250	32,395
Bristol Company	30,000	82,500	31,350
Bremen	30,000	82,500	31,350
Wells & Co	28,000	77,000	29,260
Total	381,000	1,047,750	$358,145

From the fish obtained by the above companies 12,700 tons of scrap were obtained, which at $11 per ton would yield $139,700; making a total in oil and scrap of $497,845. It must be remarked here, that Mr. Kenniston in his returns from the above district, estimates a barrel of fish to yield two and three-quarter gallons, and reckons the oil at 38 cents per gallon—while Col. McFadden in the statistics for Boothbay allows but two and a half gallons of oil to a barrel of fish reckoned at 36 cents per gallon, which he says is "low enough, certainly." From the above statistics we have a grand total of $719,245, as the product of the menhaden fishery (in oil and scrap), in the above towns.

In Sedgwick, Brooklin, Bluehill, Surry, and other towns on that part of the coast, are numerous smaller establishments for the manufacture of oil. These establishments have from five to ten kettles each, with as many hand presses, and produce from 5,000

to 10,000 gallons of oil, and from 50 to 100 tons of scrap. In 1874 the oil sold for 30 cents per gallon, and the scrap or chum for $9.00 per ton at the factory. The latter was all shipped to Baltimore.* The statement is made in one of the replies to enquiries sent out for information, that Mr. John Bartlett of Bluehill was one of the first to engage in the manufacture of oil from the menhaden. He boiled the fish in kettles, sending the oil to Boston, and gave the scrap to his sheep and hens. This was more than thirty years ago.

3.—*Statistics from other Points.*

In the Ellsworth district, in 1874,† 910,000 barrels of menhaden were taken, and 18,210 barrels of oil made. Within the district 20,000 boxes of herring were also put up. From the returns made to the collector of customs at Castine,‡ it appears that the amount of menhaden taken in that district the same year was 18,025 barrels, from which 1,650 barrels of oil were made. Of herring 2,465 barrels were taken, and 10 barrels of herring oil produced. In the town of Brooklin 350 tons of scrap or chum were made. The collector at Eastport§ reports 4,000 barrels of herring caught, yielding 1,400 gallons of oil, worth $5,000; from which 100 tons of scrap or pomace were obtained, worth $1,000, and 25,000 boxes of herring were smoked, valued at $5,000.

4.—*Disposition of Scrap at the Factories.*

The production of scrap, although an important item in the menhaden fishery, is of course of secondary consequence—the main object being the manufacture of oil. At a season of the year when the chief aim is to economize every hour of time in the taking of fish and the pressing of oil, when the crews at work are forced to their utmost power to secure all the fish possible, and when the period for the taking of fish is looked upon as somewhat variable, if not uncertain—little thought can be given to the utilization of the scrap, other than to get it well out of the way as fast as it comes from the press. So long as it is looked upon as a waste part of the business—so to speak, and can all be sold at from $9 to $11 per ton, which will net a handsome profit to the owners of factories, they will not be at great trouble to perfect methods to dispose of it in any better manner. As it now comes from the press it contains from forty to fifty per cent. of water.‖

* Letter of George B. Flye. † J. D. Hopkins. ‡ Wm. H. Sargent. § N. B. Nutt.
‖ Statement of Geo. B. Kenniston; Report Conn. Board of Agriculture, 1873, p. 205.

By taking more pains to expel the moisture, a higher price could be obtained for the scrap; but any plan to accomplish this would consume additional time, which would result in a loss in the capture of fish and making of oil, far greater than would be realized from the increased price of the chum or scrap. As it now leaves the press, the scrap is discharged in the basement of the factories or dumped upon the wharves to be conveniently loaded into vessels. The greater part of that produced in this State is sold to companies engaged in the manufacture of commercial fertilizers in other States; and among those with whom contracts have been made for the delivery of the scrap the past year are W. L. Bradley, Boston, Mass., Wood's Hole Guano Company, Mass., one company in Wilmington, Del., two companies in Philadelphia, and five companies in South Carolina. The scrap varies somewhat in quality, as in some factories it is pressed better than in others, and consequently contains less moisture. Exposed to the action of the atmosphere, the scrap is constantly becoming drier, but it is also parting with a considerable amount of ammonia. The companies to whom it is sold do not take it, generally, until late in the fall of the season it is made, or say during the month of December—and in some instances it is not taken until the following spring, as they desire it shall dry as much as possible before transportation. It is estimated that as it comes from the press it will take from twenty-three to twenty-four barrels for a ton, in December thirty-two barrels, and in the spring thirty-five barrels.

The best means of drying it is upon elevated platforms by solar heat. This plan has been tried to some extent, and while it presents the most effectual method yet devised, it has many disadvantages. The rains, dews and fogs tend to retard the process of drying; and the capital and labor required to dry it by this mode, to erect platforms (which should be covered as a protection from the rain and dews) and to provide the necessary employees to cart the scrap to the platforms, to keep it in motion while drying, and then to put it in barrels—would be such as to prevent the adoption of this plan. It is true, if dried in this manner, and the greater part of its moisture expelled—say 70 to 80 per cent.—fertilizer manufacturers would willingly pay $30 or $35 per ton for it—but the owners of oil factories would in reality receive less profit than they do now to sell it from the press with 50 per cent. of water, at $9 to $12.50 per ton. Attempts have been made—in

answer to the demands for dried scrap—to dry it by artificial means, and large sums have been expended in experiments to this end, but they have proved unsuccessful. One of these plans comprehended a cylinder eighteen feet long and six feet in diameter, filled with hot air, slightly inclined, through which the scrap was made to pass, being about ten minutes in passing entirely through. This proved to be a failure, as there was found to be a sufficient amount of fat and oil left in the scrap to fry the same, and the result was the manufacture of fish balls on a pretty large scale, instead of dried scrap. These experiments proved that the only perfect and effectual means of drying the scrap was by sun and air. The Bradley Fertilizer Company who formerly preferred the dried scrap, now use the raw instead.*

5.—*The Manufacture of Superphosphate.*

The Cumberland Bone Company, whose works are located in Boothbay, is more largely engaged in the use of fish scrap in the manufacture of commercial fertilizers than any other company operating in this State.† The works of this company formerly located in Cumberland county, were removed to Boothbay in 1873-4, and altogether occupy six buildings for the various purposes connected with their business. They use South Carolina phosphatic rock, Nevassa, ground bones, fish scrap, sulphuric acid, salt cake, and a slight amount of deodorizing compound. The phosphatic rock is heavy and solid, of a grayish color, in lumps of all sizes, and is bought by the cargo. The Nevassa is reddish brown in color, quite fine, a little lumpy, but not at all solid, and is a sort of guano from an island of the same name in the West Indies. These two are ground together in the proportion of two parts of the former to one of the latter; being ground to a fine powder which is of a greyish cinnamon-brown color. The fish scrap used by the company is furnished by the Atlantic Oil Works,‡ whose establishment is situated very near the works of the former company. Before being used it is treated with the deodorizing mixture—a substance of a very faint yellow color, of which, judging from its appearance, one would say that gypsum might be the foundation. This mixture is made in one of the buildings of the company provided with a furnace and the neces-

* Statement of George B. Kenniston. † Lewiston Evening Journal, Aug. 17, 1874.
‡ Lewiston Evening Journal, Aug. 17, 1874.

tanks or retorts, and its preparation is a secret process, understood to have been invented by the President of the company. It is said to have been thoroughly tested and to work well, and it is thought will come into use generally among the companies that handle fish scrap. At present a good many of them are troubled with injunctions because of the stench arising from the accumulated scrap, which is constantly giving off its ammonia. After being treated with this deodorizer the scrap is placed in barrels, and is quite inoffensive, a slight odor of ammonia being observable. Bones are ground raw; to get them fine enough they go through several mills, but they are not reduced near so fine as the phosphatic rock or Nevassa. The company sell large quantities of this bone meal as feed. One of the buildings of the company is used for the manufacture of sulphuric acid, of which sulphur and nitre are the principal ingredients. Salt cake is a residue from the distillation of nitre as carried on in the acid works. The mixing of the ingredients into superphosphate is performed in the mixing room, an apartment of the main manufacturing building. Over a circular floor, about eight feet in diameter, revolve horizontally several arms with breaks and scoops attached. Ingredients are poured upon the floor, the arms revolve, dense fumes arise from the chemical action, and in a very short space of time the process is complete. The arms stir the mixture together perfectly and collect it in the middle of the table, whence it is dumped into the basement. Here it is piled up, and as soon as convenient it is passed through a long cylinder, where it is dried by hot air. It is then passed through a long series of revolving sieves, and all the coarser particles, which consist altogether of pieces of fish, are dried and ground over again. The superphosphate is then barrelled. It is a very dark gray, almost black in some specimens, but drying off to a light gray. In some lots there is a brownish tinge. In mechanical texture the superphosphate in the barrels is not perfectly fine—a great quantity of bits of fish remaining unchanged in it. The proportion of the different ingredients used in the manufacture of superphosphate at these works cannot be stated, and is probably one of the secrets of the business. A gentleman who has furnished much information for this paper, says, that "one ton of fish scrap furnished the ammonia for three tons of superphosphate; the larger portion of the other ingredients being Nevassa, which costs about $14.00 per ton, and gypsum, which costs 75 cents per ton." The capital stock of this company is

$200,000, and it gives employment to about fifty men. It made in 1874, 10,000 tons of commercial fertilizer, valued at $450,000.* The works are regarded as the most complete of the kind in the country, are provided with a seventy-five horse-power engine, and with extensive fixtures for the manufacture of sulphuric acid, which when in operation will make six tons of acid per day. The entire cost of the buildings and machinery was $110,000. "It is obvious that these works were located here with good reason. One sees a car moved by steam ascending from the porgy-oil factory loaded with chum. It passes upon scales, is weighed and then moves on over an immense bin into which it is dumped. A chemical mixture is added to the heap to prevent the escape of ammonia and to kill the offensive effluvia."† To what extent this company supplies the deodorized scrap directly to the farmers of the State, cannot be stated, but the following would indicate that such is a part of the business of the company: "*Fish Scrap or Pomace.* Of this we have a quantity packed by ourselves direct from the presses, which has been chemically protected from deterioration and loss of ammonia. It is best used in composting, and is a cheap and effective substitute for Peruvian guano."‡ The price of this product has not been ascertained.

6.—*Herring Scrap—Its Manufacture and Use.*

Along the bays and coves of the extreme eastern coast of Maine, in Jonesport, Cutler, Machiasport, Perry, Pembroke, and other towns, are numerous small works for the manufacture of oil from the herring. The scrap or refuse from these works is used as a fertilizer, but from the small amount to be obtained at any one point it is not shipped to any great extent. At Treat's Island, Eastport Harbor, Messrs. Treat, Staples & Co., are however quite largely engaged in the herring fishery, and in the manufacture of a fish guano from the refuse of their oil works and from the small herring which are not utilized in any more profitable manner. These gentlemen have been engaged in this business for twenty-five or thirty years, and in that time have learned to take advantage of all its fluctuations and make the most of its ups and downs. When oil is dull, the herring are smoked and prepared for market as food; and when their abundance breaks down the

* Lewiston Evening Journal, Aug. 17, 1874. † Lewiston Evening Journal, Aug. 17, 1874.
‡ Business Circular of the Company.

market, oil generally "goes up;" and in order to get the advantage resulting from both these extremes, the business is changed to suit the times, or both branches are followed to some extent at the same time. The scrap which is produced at the different oil works about Eastport and Lubec, is purchased chiefly by fertilizer companies out of the State, considerable quantities being bought by the Pacific Guano Company, Wood's Hole, Mass., and the Bradley Fertilizer Company. That which is taken in bulk as it comes from the press, usually brings $12 per ton, and when dried more and if packed in barrels, brings a still higher price. Messrs. Treat, Staples & Co., manufacture a fish guano, which has been sent abroad some, and also used by our inland farmers to some extent, that has given good satisfaction. The scrap is thoroughly dried on elevated racks, until nearly all the water is expelled. It is not allowed to remain out nights while being dried, nor is it exposed to fogs or dews; so that it contains not more than 20 per per cent. of water, and will show 12 per cent. of ammonia on analysis. This is ground and packed in barrels, and finds a ready sale. Mr. Treat, the senior member of the firm, says that when first putting their fish guano upon the market, he sent samples to parties at Wood's Hole, Mass., to Philadelphia, and other places, for trial. From the former place no returns as to its value were ever received; but instead he received word: "We don't want a manufactured article here, but will purchase all the fish scrap you have for sale." At Philadelphia and in Connecticut, the article gave excellent satisfaction, and large orders were forwarded for it. Among our own farmers it has been growing in favor wherever used. Barrelled, this fish guano sells for $33 per ton. Messrs. Treat & Co., are also engaged in the manufacture of a manure from rock weed, which has given good satisfaction as a fertilizer for potatoes. The rock weed is first reduced by steam, then ground, and dried by the addition of 10 per cent. of quicklime. With some of it a portion of fish scrap is also added. From the fact that the herring are salted before the oil is expressed, the scrap will keep longer without deterioration, than will that of the menhaden in which no salt has been used. It is, in consequence, better adapted for transportation in bulk or in barrels—being inoffensive.

B.—Fish Scrap as a Fertilizer.

1.—*On the Valuation of Manures.*

The leading agricultural chemists of the country, among them Prof. Samuel W. Johnson of New Haven, Conn., Prof. Ch. A. Goessman of Massachusetts Agricultural College, and others, both in this country and abroad, have adopted the following prices as the nearest approach to the true value of the fertilizing elements of manures that can be made at the present time, viz:

Ammonia per pound	25 cents.
Soluble phosphoric acid, per pound	16 "
Reverted phosphoric acid, per pound	13 "
Insoluble phosphoric acid, per pound	6 "
Potash, per pound	7 "

In commenting upon the above valuations, Prof. Geo. H. Cook, Secretary of the New Jersey Board of Agriculture, says:*

"These are the only substances which are considered worth taking into account in estimating the value of commercial manures which sell for more than fifteen dollars a ton. The prices named are for the substances when they are in forms to decay and dissolve quickly and easily. If they will not decay in a reasonable time they are worth less and may be of no value at all. Leather has in it the elements of ammonia, yet it decays so slowly as to be worth nothing for manure. Granite rocks contain a good deal of potash, but their decay is so slow that they are considered of no value for manure. And phosphoric acid is found in many minerals, where it is so solid as to be of no use as a fertilizer. The ammonia in horn, hair, and other substances which decay slowly, is worth something, but not so much as that in guano. Potash in green-sand marl has some value, but not so much as it has in the *soluble potash* of commerce. The phosphoric acid in bones and in green sand marl has some fertilizing effect, but it is not so valuable as the soluble superphosphate of lime.

The price set down for insoluble phosphoric acid is not satisfactory, but it is perhaps as safe as any price we can at present assign. The phosphoric acid in mineral phosphates such as those found in our iron ores, or even in the Charleston phosphates, is but very slightly soluble in weak acids, and would be dear at six cents a pound. And on the contrary that in bones, though considered

* First Annual Report of the New Jersey State Board of Agriculture, 1874, p. 32.

insoluble, does dissolve in weak acids, so that when in very fine dust it approaches closely in value to that which is called reverted phosphoric acid, being worth more than six cents a pound. It has been found that superphosphate of lime does not always remain constant in its properties, but that some kinds of it change, the phosphoric acid which was soluble when it was first prepared, gradually becoming insoluble in water, though dissolving easily in weak acids. The part that has become insoluble is called *reverted* phosphoric acid. Other constituents of manures have some value, which in those of lower price will necessarily be taken into the account. Ground gypsum or plaster is worth with us a half cent a pound. Common salt is worth the same price. Lime is worth from a quarter to a half cent a pound; and the carbonaceous or strawy vegetable part of our barnyard manures, though it is not possible for chemists to assign to it a value which will at all show its usefulness on different soils, is indispensable."

2.—*Analysis of Fish Guano.*

Prof. G. H. Cook* has given an analysis of menhaden caught in the Raritan river the latter part of October, five of which weighed four and one-fourth pounds—their average weight being three-quarters of a pound. The oil was first separated by adding water to the fish and boiling until the flesh was reduced to a pulp. The oil was then skimmed off and purified from water and other substances by ether. It then weighed 2.66 ounces, which is equivalent to 3.914 per cent. of the original weight of the fish. The substance of the fish remaining was then strained out and carefully dried in an air bath, at a temperature of 290° F., when the dry mass was found to weigh 11.8 ounces. On account of the solvent power of the sulphuric acid, which was added to the fish, it was thought proper to separate all the mineral matters from the fluid in which the fish had been boiled, add them to the dried fish, excluding of course the sulphuric acid. These weighed 1.1 ounces, and added to the weight of dried fish given above, 11.8 ounces, made for the whole weight of the dried matter 12.9 ounces, which is equivalent to 18.93 per cent. of the original weight of the fish. There was still left in the fluid some animal matter, which could not be satisfactorily separated, and was left out. The water in the fish was 77.15 per cent. as ascertained by deducting the

* Geology of New Jersey, 1868, p. 497.

percentage of oil and dried matter from 100. The nitrogen in the dried fish was ascertained by ultimate analysis to be 7.76 per cent., which is equivalent to 9.28 per cent. of ammonia. The mineral substances contained in the fish were freed from the organic matter by pressing, and then separated from each other by the ordinary process of analysis. The result shew the composition of the fresh fish to be as follows: water 77.15; oil 3.91; dried fish 18.93. The analysis of the dried fish was as follows :

Organic matter and loss	78.30
Lime	8.67
Phosphoric acid	7.78
Silicic acid	1.33
Potash	1.54
Soda	1.02
Magnesia	0.67
Chlorine	0 69
	100.00

By the standard of valuation just given, Prof. Cook* places the following valuation upon a ton of fish guano, viz :

185 pounds of ammonia, at 20 cents	$37 00
155 pounds of phosphoric acid, at 13 cents	20 15
20 pounds of potash, at 7 cents	1 40
	$58 55

Dr. James R. Nichols of Boston, published† an analysis of two specimens of fish pomace or fish guano, made in Gloucester, Mass., with the following result:

No. 1.		No. 2.	
Water	17.26	Water	20 01
Ash	10.43	Ash	29.92
Organic Matter	72.31	Organic Matter	50.07
	100.00		100.00
No. 1.		No. 2.	
Contained Nitrogen	6.82	Contained Nitrogen	6.50
Phosphate of Lime	8.01	Phosphate of Lime	24.74

Concerning this analysis, Dr. Nichols says: "The amount of water may seem large, but it is difficult and expensive to carry dessication to a higher point; and therefore it may be assumed that about twenty per cent. of water in the substance is an unavoidable quantity, and may serve as a standard in estimating its

* Report New Jersey Board of Agriculture, 1874, p. 43.

† Boston Journal of Chemistry, vol. 6, page 90.

value. The amount of phosphatic and nitrogenous matter contained in these specimens, proves that they are valuable manurial agents, and well adapted to all grass and grain crops."

In his analyses of superphophates, Prof. F. H. Storer * says the presence of nitrogen in them is in most instances due to an admixture of rough fish scrap, otherwise called fish pomace or pogy chum; "which for several years has been obtained in Maine at the rate of about $15 per ton." Specimens of this were obtained from Mr. W. L. Bradley of Boston, and was found to contain 5½ per cent. of phosphoric acid, and 6½ per cent. of nitrogen, nearly two per cent. of the latter being in the form of ammonia. Prof. Storer allows thirty cents per pound for nitrogen in the form of ammonium compounds—this estimate being somewhat higher than the price at which active nitrogen can usually be bought either in the form of guano or nitrate of soda. Consequently in a ton of such fish scrap as the above, there would be 112 pounds of phosphoric acid, worth $6.72; and 30.4 lbs. of nitrogen in the form of ammonia, worth $9. There are, moreover, 98 lbs. of nitrogen not in the form of ammonia, worth probably 15 cents per lb. or $14.70. So that the calculated manurial value of a ton of fish scrap is from $34 to $35, the price charged for it being not above $15 per ton. Prof. Storer's analyses show that superphosphates sold in the market at $60 per ton, possess a calculated value of from $20.50 to about $44 per ton, according to careful analysis and actual valuation of materials. In referring to this analysis and valuation of fish scrap, a correspondent of the *Country Gentleman*,† the leading American journal on agriculture, says: "Thus it will be seen that those wanting a manure strong in nitrogen, will find in fish scrap a very cheap article, not bulky or difficut of application. But as the bulk of the nitrogen is not in the form of ammonia, or, in plain English, is *not* readily absorbed by vegetation without previous preparation, this preparation is best effected on the farm by grinding the scrap, or chopping it very fine, and then piling in alternate layers with peat or loam, when in mild weather it will soon ferment, and by turning over once or twice, the nitrogen will mostly become available for use by vegetation. It should be noted, however, that although fish pomace contains a large percentage of nitrogen, and also considerable phosphoric acid, two very important ingredients in manure, and very generally needed,

* Bulletin of the Bussey Institution, 1874, page 19. † W. D. Philbrick.

and is, moreover, cheap, selling at $12 to $15 per ton on the seaboard; still, it is not to be considered by itself a *complete manure*, as it contains no potash, and if used for several years, would probably fail to produce good results on soils which are deficient in this most essential article; as most of our worn out soils need potash in some form, the fish guano will be found insufficient without being used in altenation or combination with horse dung, or some other potassic manure, which I believe is the experience of those who use it to the best advantage. The mixers of so-called superphosphate of lime depend very largely upon this article, and probably would fail to give satisfaction or reap profit without being able to buy it at $15 or less per ton, and after mixing with Carolina rock, and acid, costing about $20 per ton, get a return of $40 or $50 from the long-suffering farmer. It is much to be desired that the farmer should understand the value of the various raw materials he needs, and do the mixing himself."

Prof. Storer says: "It is possible, of course, that the nitrogeneous materials in the superphosphates analyzed may not have been derived from fish scrap, but from bone or from flesh, or from tankings—and it may be that the nitrogen in these materials is more active as a fertlizer than that in fish scrap. Moreover, the price ($15 per ton) at which fish scrap is obtainable upon the seaboard of New England, is probably much lower than it would be in the interior. Where water-carriage is not to be had, the cost of transporting this rather offensive substance would doubtless be comparatively high." Prof. G. H. Cook of New Jersey, in his report as Secretary of the State Board of Agriculture, writes:* "The supply of material for fish guano is almost unlimited in this State, and it only needs capital and skill to build up a business of great importance to the State and profit to the manufacturer. On the coast of Long Island and of Maine, where the business has been carried on for the oil which could be got from the fish, the residuum has been sold at various prices, from $15 to $30 a ton, and has been a very popular fertilizer with those who have used it. It is sought for by the manufacturers of superphosphate of lime, to mix with their product, and there can be no doubt that it is very beneficial in such a mixture, giving quickness to its action, while the superphosphate would add to the duration of efficiency. When this source of manure is properly worked, it can be made to supply all the guano needed in the State."

* First Annual Report of the New Jersey State Board of Agriculture, 1874, page 44.

3.—*Practical Notes on the Use of Fish Scrap as a Fertilizer.*

The use of fish as a fertilizer is not by any means a new thing. Along the coasts of Europe, Newfoundland and New England, its use for this purpose has been quite general for many years; and it is not a little surprising, that, considering its abundance, and its usually satisfactory results as a manure, its use has not become more extended away from the coast, and that more thorough attempts have not been made to ascertain the best method of using it, and its positive value. More than thirty years ago, before fish oil had become a marketable commodity, the farmers of our Eastern coast were in the habit of using the fish whole in different forms. In some cases, two or three fish were put in a hill for corn, and covered before the corn was planted; in others they were covered by being thrown into the furrow as the land was being plowed,* while in instances less frequent they were made into a compost and applied as a top-dressing. These were the ruder forms of using fish as a fertilizer, and generally practiced before the manufacture of oil and the consequent accumulation of fish scrap. And its use even in this way, notwithstanding the results were almost always satisfactory, except in some instances where it was was used in too large quantities,† did not seem to extend to any great extent back into the interior; and even along the coast, where farmers could get the scrap for the hauling, not half of them made any use of it. When the business of extracting oil from menhaden was first engaged in along the coast of Hancock county, and especially in Union River bay, the works were situated on shipboard, and the scrap was thrown overboard into the bay.‡ The result of this was, to drive out all the deep water fish, as mackerel, cod, &c., and this was continued for many years. On the first establishment of oil works at Bluehill Falls, and other places, the scrap was given away, and farmers could get a scow load any time they wished. It is said that the farmers in the town of Brooklin first utilized the scrap by applying it to the

* This was the method formerly in use among the farmers of New Jersey; and Prof. Geo. H. Cook, in his report on the geology of that State, says the practice there was to plow a furrow along side the rows of corn, deposit the fish, and then turn the furrow back again, covering them. In this way the farmers carried their corn through to maturity, and good crops were gathered from the poorest and lightest soils in the State. A Massachusetts correspondent of the Country Gentleman—vol. 5, page 152—says the application of fish compost "appears to ameliorate the effects of drouth."

† Agriculture of Maine, 1861, page 49. ‡ Hon. Samuel Wasson, East Surry.

land, and during days when no catch of menhaden would give work at the factories, the men would cart the scrap away and spread it as a top dressing on grass lands. It was used green from the press, and on the sandy soil of that town its good effects were most marked. Afterwards, it began to be composted with muck or with fine loam, and was applied to potatoes and grass with excellent results. As a top dressing to mowing fields it was spread on after haying, and in this way was generally used fresh. Too large an application was found to induce too rapid a growth of grass, and to cause it to rust, and it also gave a fishy flavor to the hay, not relished by cattle—but these matters were gradually learned from experience in its use, and as gradually mastered and overcome. As its value became known its price advanced, and for several years, from about 1858 to 1864, it went up to $6.00 per ton.

In speaking of the menhaden as a fertilizer, Prof. G. H. Cook says,* "The value of these fish for manure is well known, but the best methods of applying them has not been at all understood. They have been usually spread upon the surface, or very incompletely covered with earth in the compost heap or the field; so that in their decay they have filled the air with their odor, and generated swarms of flies. Their cheapness and their efficiency as manure, are strongly in their favor, and enable them to maintain their ground in spite of these objections. By composting them with muck or other vegetable matter, in sufficient quantity, these offensive products could be avoided, and the whole of the fertilizing properties of the fish retained. It is said that in Cambridgeshire, England, a compost of one barrel of fish refuse to four or five cart loads of earth, is approved by the farmers. And it is probable that from five to ten times as much of the absorbent as of the fish should be used." Dr. DeKay in the Natural History of New York, says: "The use of this fish as a manure is well known in the counties of Suffolk, Kings and Queens, where it is a source of great wealth to the farmer who lives upon the sea coast. They are used in various ways: for Indian corn, two or three are thrown on a hill; for wheat, they are thrown broadcast on the field and plowed under, although it is not uncommon to put them in layers alternately with common mold, and when decomposed spread it like any other compost. Its effects in renovating old grass fields,

* Geology of New Jersey, 1868, page 496.

when spread over with these fish at the rate of about two thousand to the acre, are very remarkable." This statement was written fifteen years ago, since which time it is pleasant to think a better way of top-dressing grass land has been discovered than to spread two thousand of these fish on an acre of ground, there to decompose! In Connecticut* the farmers use the fish scrap in what is called a "fish pie." The scrap is drawn to the farm, a few furrows are turned up near where they want to use the fish scrap the next year, a layer of scrap is put over these furrows, then a layer of sods, and so on forming a compost heap four or five feet high. Eight or ten times as much earth as scrap is used, in bulk or weight. After it has lain a few weeks in this condition, it is forked or shoveled over, so that it is all intimately mixed, and the scrap very nearly absorbed by the soil, and in that condition it is fit either to be spread upon the soil or retained for corn or any other crop the next season. It is also used in connection with stable manure. †"The scrap is carted into the yard where the stable and yard manure is heaped up, and mixed with that. It adds very greatly to the value of yard manure. They will put, perhaps, one ton of the scrap to ten tons or more of yard manure; and then, after it has remained two or three weeks, it is carted off for top-dressing for corn or potatoes, or the ordinary crops of the farm. In the same report ‡ Mr. W. Clift of Mystic Bridge says: "A year ago last summer I used a ton of fish scrap on half an acre of land. It was nothing but gravel. There was hardly any vegetable matter—none but what had grown out of the gravel, and perhaps a little washed from the surrounding land. I did not pay anything for the land; the owner did not consider it worth anything. I got a glorious crop of corn, cabbages and potatoes on that little piece of land, by the use of a ton of fish scrap." This is the amount used by the farmers of this State in some instances.

Hon. J. T. Hinkley of Bluehill, in a private letter, writes: "I have never used it only in one way. I mix it with fine dirt or sand and use it as a top-dressing on grass land. A dressing of one ton of chum mixed with five times that amount of dirt, is about the quantity I would put on one-half acre of land, and from that I have a good crop of grass for four to five years, without injury to the land."

* Report of Connecticut Board of Agriculture for 1873, page 200. † Ditto.
‡ Connecticut Agricultural Report, 1873, page 206.

Mr. William Kenniston of North Boothbay, furnishes some interesting statements regarding the use of scrap upon his farm. He has used it more or less for the past eight or ten years, and says he "could not farm without it." He hauls it from the factory generally late in the fall as it is dryer then and less objectionable to handle, and composts it with yard and stable manure, muck and loam. When one year old this is hauled out and spread in the fall or winter whenever it is most convenient to do so, at the rate of about eight cart loads to the acre. In using the scrap without being composted as he has sometimes done, he regards one ton of well dried scrap better than three just as it comes from the press. The dry scrap is much easier and better to handle, and may be used on grass at the rate of three tons to the acre; but the raw scrap from the press should invariably be composted. In 1867 he used five tons of scrap mostly in a green state. It killed the corn, the grain lodged and was damaged and grass has lodged on the piece ever since, although no manure has been applied since. He had spread it on grass fields both in the spring and fall, but preferred the latter. Mr. Kenniston believes if the scrap was packed in barrels just as it came from the press it would stand transportation by steamer or rail to almost any part of the interior of Maine without becoming offensive.

The farmers in Machias purchase herring chum from Lubec, whence it is brought in small schooners. It is usually packed in barrels of from 220 to 280 lbs. each, at $11.50 per ton, but is not used in very large quantity. Lobster chum from the canning factories at Englishman's river, is also made use of to some extent as a top-dressing. It is obtained in scows and boats at about $4.50 per ton delivered in Machias and vicinity. One ton of it is composted with ten loads of common loam, and this amount spread upon an acre. Applied to grass land in the fall, the results are most satisfactory.

Mr. H. T. Smith of Machias, has perhaps made a larger use of fish scrap, as a fertilizer, in different ways, than any farmer in that place or vicinity. His usual practice is to obtain the scrap (generally herring scrap) in the fall, and apply it in the spring. When grass land is in fair condition he uses about one-fourth of a ton per acre; and never more than one and one-fourth ton per acre. It is of course less expensive to apply it directly to the land as it comes from the press, but it is often composted, using three parts of earth to one of scrap. For grain, Mr. Smith has plowed

under seven hundred pounds to the acre, from which he has grown very heavy crops of barley, oats and wheat. Mr. Smith says: "I have paid $80 per ton for superphosphate, and if given my choice had rather have one ton of fish scrap than one ton of superphosphate. If barrelled as soon as it comes from the press (he is speaking of herring scrap, which, it will be remembered, is treated with salt before being pressed) it has no unpleasant odor, and is not offensive to handle. There is nothing equal to it for the land. It is as valuable as night soil, and is good for grass, grains, corn, garden crops, anything that grows out of the earth."

Capt. Jason Collins of the steamer Star of the East, thus relates in a private letter, his experience in the use of fish scrap as a fertilizer: "My experience in the use of fish chum does not reach over many years, but I have applied it to barley and on grass. The amount used per acre for barley was 1500 lbs., which was mixed with two parts loam to one of chum. This was spread on and harrowed in. In the fall of 1873, I had five acres plowed up, on which I put 2000 lbs. to the acre. It was harrowed and rolled in the fall, and the following spring, about the last of March I think, it was sown to grass-seed alone. The grass was cut the last of August, and it was very heavy. I have also used it for turnips and potatoes, and it has done well for each crop. In the fall of 1873 I also had chum spread on some six acres of grass land, as a top-dressing, at the rate of three-fourths of a ton per acre, mixed with loam in the same proportions as that used for barley. It did first-rate. This fall (1874) I shall use more, which I shall compost and lay over until another fall, as in that form it will be better about handling. From all I can learn, and from my own experience, I am satisfied that late fall is the best time of the year to apply it as a top-dressing for grass lands; and the amount should be from three-fourths of a ton to a ton per acre. It is best if used as a compost as I have stated. For hoed crops it must be used very carefully, and should in all cases be thoroughly composted. In regard to its price: it cost me $12 per ton green, in bulk, and have had it brought from Boothbay to Gardiner in lighters. When in barrels it costs $15 per ton, but it is cheap at that price, and I shall buy no other fertilizer, until I find something better for less money. At $12 per ton it is cheaper than it is to haul stable manure, even if the manure is given to you. Perhaps I have not used it long enough to speak of its effects upon the land, but during my experience with it I have wit-

nessed no ill-effects, although if used in too great quantities the grain will grow rank and lodge. I can hardly yet tell what it will do in a long run, but am satisfied with it after a five years' trial."

Another quotation may be appropriately made here from Prof. Cook's* report, in which he has devoted much space to the scientific and economic history of the menhaden. He says: "While the most common mode of using these fish is in the hill or furrow for corn, they are often employed in a compost with barnyard manure and a little lime. *Those who have tried such a mixture say that it is superior to any guano in the market.* When applied on corn, the crop is considered as certain. Some farmers mix them with muck and apply the compost upon wheat. This fertilizer is wonderfully rapid in its effects, showing changes in the growth of a crop in a few days after it has been applied. But it is not a lasting manure. In a year or two this stimulating effect is gone, and a second application is necessary. For producing quick results it is so efficient that all farmers who have tried it, unite in testifying to its value."

It is well known in this State, especially among those who are engaged in handling oil, that large quantities of fish scrap go to Connecticut and are used by the tobacco growers in that section. At one of the meetings of the Connecticut State Board of Agriculture,† the whole subject of marine manures was pretty thoroughly discussed, the discussion having been opened by a lecture upon the subject by Mr. William Clift of Mystic Bridge. From this lecture, and the remarks of gentlemen following, an abstract is made of such portions only as relate to the use of fish scrap, as it is believed to be of great importance in connection with the subject under consideration. In speaking of the manufacture of oil along the coast of that State—for although Connecticut produces largely of fish oil and scrap, it does not produce a sufficient amount of the latter to supply the demand for it from her own farmers—Mr. Clift said, that where oil works were situated on the mainland the farmers could come down from the interior with their teams and take the scrap away. "Sometimes they get it in season for the farm crops, or for turnips, and always in season for the rye crop in the fall. The price is from $13 to $16 per ton. Through the latter part of the season, and in the winter, it is also bought very largely by the manufacturers of superphosphate of lime. A large part of the value of this superphosphate, the ammonia part of it,

* Geology of New Jersey, 1868, p. 498. † Report for 1873, p. 197.

is furnished by this fish scrap. I suppose these manufacturers have made very large profits on their sales of superphosphate, for which they get $40 per ton, the principal value of which has come from the fish scrap which they have bought at from $13 to $16 per ton. You can judge what the profit must be, and how much the farmers are cheated, if we may call it by that name. A great deal of it goes up the Connecticut river. The tobacco raisers know the value of fish scrap, and it is sent quite a distance into the country." With regard to the value of the green and dried scrap, and the loss of value in drying, Mr. Clift said: "As it comes from the press, after all the oil has been pressed out of it that can be gotten out by the strongest hydraulic pressure, there is still a great deal of moisture in it—forty or fifty per cent. As it lies on the platform under cover, there is, of course, a constant loss of moisture, but there is also a loss of ammonia, which is very valuable, so that I am not able to say whether the the fish scrap is any more valuable after it has lain a month or two in the house, than when it first comes from the press. I think I should prefer to take it as it comes from the press. I think the ammonia which is lost is worth more than will be gained by the evaporation of the water. Fish scrap at $12 to $15 per ton, is the cheapest manure we can buy. It is the only commercial fertilizer I have bought for the last six or eight years. I do not invest in superphosphates or bone dust. I would invest in the latter, if I could get a pure article, but when it is half plaster-of-paris I do not known what I am buying. But this article when it comes from the factory, is generally fish scrap and nothing else. It always produces just about the same result; you can depend upon it. If you apply one or two tons to the acre, you know what you will gain by its use, if it is properly put into the soil, and you have a fair season. I think it is a perfectly secure investment for the farmer to make." Mr. Loveland said he had used fish scrap for eight or ten years, and had used it with Bradley's, Coe's, Wilson's and other high-priced manures, on tobacco and other crops, and he had always found that the fish manure was fully equal to them—it bore up its crop as well as any of the commercial fertilizers in the market. He had bought it mostly in the green state in bags or barrels, and it had cost him about $23 per ton, to get it up in the north part of the State. But he had invariably used it as a compost and believed that to be the true method of using such a fertilizer. He believed with Dr. Nichols of Boston, that when

fish scrap could be bought in its green state for $20 per ton it was "the cheapest manure in the market and he felt warranted in using more of that fertilizer than of any of the other fertilizers in use." Mr. Hall of Wallingford, said: "My experience in regard to fish scrap is that when it comes from the press it is about 65 per cent. water. Now if that is worth $12 to $15 a ton to carry back ten or twenty miles into the country, when you come to add the freight and the inconvenience of handling it to the freight, I should consider the dried the cheapest. I have used a great many tons myself, and I have always used the dry as the most economical. I have been so situated I could have either, but I preferred the dry; and as Mr. Clift has said, by analysis, it was a cheap manure at the prices at which it was sold." Mr. Clift replied: "Mr. Hall means a different thing by dried fish guano, from what some gentlemen do by 'dried fish.' He means the article spread upon a platform, and made as dry as it can be in that way. What is termed 'dried fish' is another thing. It will take from two to two and a half tons of fresh fish to make a ton of dry, and after that has lain in a tight building for some time, it will take two tons of that to make a ton of the dry guano. When the green manure is spread out and immediately dried in the sun, there is no loss of ammonia, but when it is kept in a pile, of course putrefaction begins, and as it advances there is loss of ammonia. There is no considerable loss of ammonia by drying in the sun and of course the dry manure, finely ground, is very much more valuable than that which is dried in a heap where there is a great loss of ammonia."

Numerons testimonials similar to the above, could be given from correspondents of this office, and from the agricultural reports and journals—but enough has been stated for the present purpose, that of showing the great value of fish scrap as a fertilizer, when composted, or judiciously applied in connection with animal manure. Too much stress can hardly be put upon this qualification in regard to its use. An instance is mentioned in a former volume of this report* of a farmer who first began to use the scrap, composted it in the fall with three times its quantity of earth. The next spring the mixture had so much the appearance of common earth, and the party had so little faith in its efficacy that a shovel full to the hill was applied for corn. It came up well, grew for a time looking green and thrifty, but soon began

* Agriculture of Maine, 1861, page 49.

to grow pale, finally died and the crop was a failure. But the effect of this application was noticeable for many years afterwards, and even with no other application of manures of any kind the land continued to bear an immense burden of grass. In the discussion to which reference has been made, before the Connecticut Board of Agriculture, Mr. Fowler of Guilford gave a word of caution which he thought should be exercised in the application of fish scrap. He said: "My experience has satisfied me it will not answer to use fish alone as a fertilizer for a term of years. It forces the crop and finally leaves the land in very bad condition, very hard and sterile, and it will usually show a pretty heavy crop of sorrel after harvest. But if it is used as it should be invariably, in connection with stable or barn yard manure, it is perfectly safe to use every year for a term of years, for any crop."

Hon. J. T. Hinckley of Bluehill, writes: "There is an objection here to dressing too heavily with scrap, as it injures the quality of the hay; but using it at the rate of one ton to the acre in a compost of three parts loam, will produce no effects of this nature." Now to correct the error into which a good many farmers are led by statements that the application of fish scrap, or other active special manures, like guano or superphosphate—damaged the land rendering it unproductive and sterile; it may be stated here that the real cause of this sterility does not come from the application of these so-called *forcing* manures which are applied to the land, but from the taking off of the large crops which follow their application. They exhaust the soil by drawing from it elements which the manure put on does not contain, and which repeated applications of the same fertilizer would not supply—it is in fact the crop taken off, not the manure put on which injures the land. But it must also be remembered that after land has been brought up to a condition of productive capacity by the use of fish scrap or special fertilizers, it can be kept so only by the application of stable and barn yard manure, or the manure made by consuming the hay grown upon the soil thus improved. This should invariably and in all cases be given back to the land, or the time will speedily come when it will refuse to "discount."

C.—Fish Scrap as a Feeding Stuff.

As early as 1864, if not in fact previous to that date, the attention of members of the Board of Agriculture and farmers generally, was called to the matter of the value of fish pomace or scrap as a

feeding stuff for sheep, swine and poultry. In a communication to the Board * Mr. William D. Dana of Perry, spoke in high terms of its value as a feed for domestic animals, in which he said: "Fish pomace, or the residuum of herring after the oil is pressed out, is greedily eaten by sheep, swine and fowl; and probably pogy chum would be eaten as well. Smoked alewives and frost fish also furnish a food palatable to cattle. Sheep thrive well, get fat and yield heavier fleeces when fed on this pomace than when fed on anything else produced in this section of the State. Careful and observing farmers who have fed it, assert that it is of equal value with good hay, ton per ton, and that its value for manure is in no degree diminished by passing it through the living mill, and thus reducing it to a much more convenient state for applying. If it could be sufficiently dried, without other substances, to prevent putrefaction, it would form a valuable article of cattle feed in regions from which it is now excluded by the expense of transportation and its own odoriferous nature." In remarking upon this the Secretary of the Board said that if sheep would eat the scrap readily, much poor hay or straw could be used to good advantage, thus allowing the farmer to consume all his first quality hay in keeping other stock. He thought the meat would not taste of the flavor imparted by the scrap, provided other food was substituted for a proper length of time before slaughtering.

From time to time following this, the matter was discussed before the Board, and formed the subject of many articles in the agricultural journals. In 1869, Mr. M. L. Wilder † of Pembroke, then a member of the Board, presented a brief paper embodying his experience in the use of scrap as a feed for sheep, in which he said he believed "fish offal to be not only cheaper, but much superior to any other kind of provender he had ever used" for this purpose. An extract from his paper is given: "I keep about one hundred sheep, and have fed fish offal to them for the past ten years. The offal is made from herring caught in weirs, salted the same as for smoking, cooked and the oil pressed out, leaving a pomace for which the sheep are more eager than for grain. For the last three winters I have kept my sheep on threshed straw with one-half pound per day to each sheep of dried fish pomace, or one pound of green, (as it shrinks one-half in drying) and they came out in the spring in much better condition than when fed on

* Agriculture of Maine, 1864, p. 43. † Agriculture of Maine, 1869, p. 60.

good English hay with corn. I consider the dry pomace worth as much as corn, pound for pound. When I have had enough to give them one-half pound per day, I have found that the weight of the fleece was increased one-quarter, and not only that but also the carcass in a like proportion; the weight of the fleeces per head averaging from five to seven pounds." Similar statements to the above, were made by Hon. Samuel Wasson* and other gentlemen, not only at public meetings of the Board, but through the press, so that the subject has been kept alive and invested with some interest down to the present time. Wishing to test the value of fish scrap as a feed with more care than had apparently attended any of the trials that had been reported, and also wishing to make a sort of competitive trial of it in connection with corn, a quantity was obtained for this purpose of Mr. M. L. Wilder of Pembroke. It was herring scrap, salted before the oil was expressed, and packed in barrels directly from the press, each barrel containing about 220 lbs. Its cost in Augusta, including freight from Pembroke via Portland, was not far from $2 00 per barrel. This scrap was placed in the hands of Mr. J. R. Farrington, the Instructor in Agriculture at the State College, Orono, with the request that he would feed it to sheep, in connection with Indian corn, in such way as would best serve the purpose of ascertaining its comparative value as a provender, or feed. Few instructions were given him, and he being left to carry out the experiment in his own way—and public acknowledgment should be here made for his interest in undertaking the matter and for the care and faithfulness with which the experiment was conducted. The report of Mr. Farrington follows:

"The statement made by a prominent agriculturist that for feeding sheep fish chum was equal to corn, pound for pound, furnished the basis for the experiment, which we conducted to ascertain the comparative value of corn and fish chum when fed to sheep. Ten lambs, dropped the previous spring, were selected. Each one was designated by a number, the number being stamped on a metallic tag and attached by a copper wire to the ear of the lamb; Nos. 1, 2, 3, 4 and 5 constituted Flock 1; Nos. 6, 7, 8, 9 and 10, Flock 2. We began feeding January 15, 1875. Flock No. 1 was fed with corn; Flock No. 2 was fed with fish. Each flock was given what good hay it would eat. The hay fed to each flock during the month (four weeks) beginning February 13,

* Agriculture of Maine, 1874-5, p. 1.

was weighed. Flock No. 1 ate in four weeks, 335 lbs.; Flock No. 2 ate 338 lbs.

At commencement of feeding, January 15, 1875:

Flock No. 1 weighed as follows:

Sheep No.	1	weighed	46 lbs.
"	2	"	77 "
"	3	"	67 "
"	4	"	55 "
"	5	"	68 "
Weight of flock			313 "

Flock No. 2 weighed as follows:

Sheep No.	6	weighed	49 lbs.
"	7	"	74 "
"	8	"	68½ "
"	9	"	67 "
"	10	"	58 "
Weight of flock			316½ "

During four weeks ending February 13, 18¼ pounds of corn were fed to flock No 1 At this date

Sheep No.	1	weighed 50 lbs.	a gain of	4	lbs
"	2	" 81½	"	4½	"
"	3	" 73	"	6	"
"	4	" 59	"	4	"
"	5	" 77	"	9	"
Weight, Feb. 13,		340½	"	27½	"

During four weeks ending February 13, 18¼ pounds of fish were fed to flock No. 2. At this date

Sheep No.	6	weighed 52 lbs.	a gain of	3	lbs.
"	7	" 81	"	7	"
"	8	" 72½	"	4	"
"	9	" 68	"	1	"
"	10	" 64½	"	6½	"
					"
Weight, Feb. 13,		338	"	21½	"

During four weeks ending March 12, 20 pounds of corn and 335 pounds of hay were fed flock No 1. At this date

Sheep No.	1	weighed 50½ lbs.	a gain of	½	lbs
"	2	" 75½ lbs.	a loss of	6	"
"	3	" 69	"	4	"
"	4	" 56½	"	2½	"
"	5	" 70	"	7	"
Weight of flock,		321½	"	19	"

During four weeks ending March 12, 20 pounds of fish and 338 lbs. of hay were fed flock No. 2. At this date

Sheep No.	6	weighed 55½ lbs.	a gain of	3½	lbs.
"	7	" 79 lbs.,	a loss of	2	"
"	8	" 71½	"	1	"
"	9	" 67½	"	½	"
"	10	" 63	"	1½	"
Weight of flock,		336½	"	1½	"

During the above four weeks, the *corn fed flock*, weighing 340½ pounds, ate 335 pounds of hay and lost 19 pounds in weight. The flock eating fish, weighing 338 pounds, ate 338 pounds hay, and lost 1½ pounds.

During four weeks ending April 9, 19 pounds corn were fed flock No 1. At this date

Sheep No.	1	weighed 51 lbs.	a gain of	½	lbs
"	2	" 76½	"	1	"
"	3	" 75½	"	6½	"
"	4	" 64½	"	8	"
"	5	" 78½	"	8½	"
Weight of flock,		346	"	24½	"

During four weeks ending April 9, 19 pounds of fish were fed flock No. 2. At this date

Sheep No.	6	weighed 62 lbs.	a gain of	6½	lbs.
"	7	" 84	"	5	"
"	8	" 75	"	3½	"
"	9	" 71	"	3½	"
"	10	" 65	"	2	"
Weight of flock,		357	"	20½	"

During four weeks ending May 7, 15 pounds of corn were fed flock No 1. At this date

Sheep No.	1	weighed 55 lbs.	a gain of	4	lbs
"	2	" 79	"	2½	"
"	3	" 80	"	4½	"
"	4	" 65	"	½	"
"	5	" 82	"	3½	"
Weight of flock,		361	"	15	"

During four weeks ending May 7, 15 pounds of fish were fed flock No. 2. At this date

Sheep No.	6	weighed 62 lbs.	a gain of	0	lbs.
"	7	" 87	"	3	"
"	8	" 75	"	0	"
"	9	" 73	"	2	"
"	10	" 67	"	2	"
Weight of flock,		364	"	7	"

During the sixteen weeks of the experiment

Sheep No.	1	gained	9 lbs.
"	2	"	2 "
"	3	"	13 "
"	4	"	10 "
"	5	"	14 "
Flock No 1 gained			48 lbs

Fed with corn—weighing, January 15, 313 pounds. Gained 48 pounds, or 15⅓ per cent.

During the sixteen weeks of the experiment

Sheep No.	6	gained	13 lbs.
"	7	"	13 "
"	8	"	6½ "
"	9	"	6 "
"	10	"	9 "
Flock No. 2 gained			47½ lbs.

On fish—weighing, Jan. 15, 316½ pounds. Gained 47½ pounds, or 15 1-126 per cent.

The results of this experiment seem to indicate that fish chum is of about the same value as corn, "pound for pound." The details were not carried in a manner entirely satisfactory to me, but we did the best we could under the circumstances. Our opportunities are not perfect, and I find it impossible to get help who will do work that is entirely reliable. For example, my assistant, who had charge of the feeding and kept the figures indicating weights, assured me the gain from corn was double that from fish. Going over the computations for the first time, to-day, I find the results as given above. I count his error an *exception* as he was *usually* correct. I am certain more care and attention were given to it, than the average of feeding experiments receive from those who conduct them. The amount of corn and fish fed to the sheep was so small because the quantity of fish given was all the sheep would eat, and we let this govern the weight of corn fed, as pound for pound was to be the test. The sheep came out in the spring looking well, yet how small the increase! Does such sheep husbandry pay? I fear not; but I am so pressed with work and care that like other farmers "I haven't time" to figure it all out and discover a better way. When will our farmers see their interests in the true light and so *man* this institution that matters like this can receive proper care and attention?"

D.—Summary and Conclusion.

1.—*What has been Learned.*

The investigation of this subject furnishes a knowledge of the enormous numbers of fish visiting our coast and of the great quantities that may be taken for economical purposes. Even if our enquiries are alone confined to the menhaden, leaving entirely out of consideration the herring and other food fishes, there is but one word that will give an idea of their numbers, and that word however great its significance, will fail of doing it adequately—immense. There is no data, perhaps, by which their actual numbers can be ascertained with anything like a satisfactory accuracy, but it is safe to say, and the assertion seems established beyond doubt, that they are inexhaustible. It is true there have been some years when they were less numerous than others, but for the past ten years the concurrent testimony of all observers is to the effect that this species has been found in abundance, in fact in increased numbers year by year, and that those taken all along

our coast by all the means and appliances now employed produce no perceptible diminution in the supply. Parties engaged in taking menhaden now go off ten and twenty miles from shore, whereas they formerly fished near the coast, and they now find the best and most profitable fishing at that distance. The large outlays which have been made for factories and outfits for the manufacture of oil and fertilizers in our State in recent years, show that those who have deeply investigated the subject, are satisfied past experience gives abundant indication that the future supply will be sufficient for all the means now at hand for their utilization. The same statement is true of the herring. Some years ago a commission authorized by the British government, investigated the matter of the herring supply on the English coast with a view to ascertain if the great quantities taken would not be liable to result in the ultimate loss of the species. After three years careful inquiry on the part of four or five scientific gentlemen, among the fishermen of the Kingdom, the conclusion was that not three per cent. of the herring that were destroyed annually, were destroyed by the agency of man.

A careful study of the figures and statistics given on pages 34–36, will help one to understand the large proportions which the business of taking fish for oil has assumed in our State during the past few years, and it may be reasonably expected that the coming decade will witness a still greater extension of the business. The quantity of scrap or refuse obtained from this business, is simply enormous—and our farmers have no need to fear that the supply of manure from this source will not be fully equal to the demands made for it by their hungry fields.

The value of fish scrap as a fertilizer is a matter about which there is no question. The fact is evinced by analysis, by the testimony of those who have used it, by the efforts of manufacturers of commercial fertilizers and others interested in it as a speculative operation, to obtain it. The united testimony on this point is positive and unquestioned. It may be said in a few words that while the price asked for it at the factories is from $12 to $15 per ton, its calculated value per ton, according to the best analysis, is from $34 to $35 per ton.* But it must be remembered that its best results as a fertilizer, are to be obtained when used in connection with stable and farmyard manure; and that the

* Bulletin of the Bussey Institution, 1874, p. 18.

hay grown from land manured with fish scrap should be consumed on the farm, and the manure thus obtained restored to the land.

The fact is apparent that along the coast where such immense quantities of fish scrap are to be obtained, its use as a fertilizer is but limited. In Boothbay, where over five thousand tons of scrap are made annually, "not over twenty tons are used by the farmers."* It is easy to explain this fact. Along the coast farming is not carried on to the extent, or in the manner, it is in our best farming sections. The people there are mainly engaged in other pursuits, and what farming is done is carried on in a small way. Those who have used the scrap as a fertilizer, have used it for many years in succession on the same land, and without the supplemental aid furnished by other manures, and have found the land to become unproductive after a series of years, as has been already shown, page 55; and hence they have abandoned its use. But farmers, who like Mr. William Kenniston of North Boothbay, or Mr H. T. Smith of Machias—both living near the coast—who have used the scrap for years, *and fed the grass and hay it has grown*, are satisfied to use all they can get, and say they had rather have it "ton for ton" than any phosphate they have ever used.

It has been found that a most valuable manurial agent is contained in the water in which the fish are boiled, and which is drained off and completely wasted. This is of a grayish color, and is fully impregnated with fine particles of animal matter, which render it a most powerful fertilizer. In some instances it has been run into scows from the factories, saved and applied to the land, as a top dressing to grass. Its results in this direction have been most marked—as it contains the very essence of fertilizing matter in a form to be readily taken up by the growing crops. There is enough of this which runs to waste from a single factory to fertilize a whole town; and this product may be utilized, and form a profitable source of fertility to our needy fields. Shall it not be saved?

In regard to fish scrap as a cattle food, the conclusions are not so positive. It may be safely stated, however, that it is the herring scrap rather than the menhaden scrap, which is most used for this purpose. One reason why this is most relished by sheep may be that it is treated with salt while the oil is being expressed, while the menhaden are pressed fresh. In towns at the extreme eastern coast, as Lubec, Pembroke, Dennysville, Calais, &c., large

* Statement of George B. Kenniston.

numbers of sheep are kept, which are fed in winter largely on herring scrap.* That made at the presses late in the fall keeps fresh all winter, and the farmers purchase from one-half to two tons each, as a winter feed for sheep. Farmers living along the coast who have small pot works for the making of oil, will no doubt find it more profitable to feed the scrap than to purchase corn for the same purpose, and use the scrap as a fertilizer.

2.—*Can our Maine Farmers obtain Fish Scrap?*

Bearing in mind the fact that fish scrap is an outside product of the manufacture of oil, that the profits on oil alone are large, that the scrap is, so to speak, a clear gain in the business; the question arises if this scrap cannot be so disposed of from the factories in its crude state, that the farmers in the interior of Maine, and not the tobacco growers of Connecticut, or the cotton growers of the South, may obtain the great profit there is in its use? However desirable such a result may be, there are many obstacles to prevent it, but they are not altogether such as may not be compassed. During the season when the oil factories are working to their fullest extent, they are aiming, not to make scrap, but to obtain the greatest amount of oil, consequently little attention is given to the care or disposal of the refuse. It is dumped away in the most ready place where it may not interfere with the working of the factories. The entire force of the men employed by the manufacturers, is devoted to the taking of as many fish as possible, and the making of as much oil as possible. The weather is hot, the time of taking the fish is limited to a few months, the farmers are so busy with haying they cannot well attend to getting home scrap from the factory; hence it accumulates in large heaps around the buildings. In some cases contracts are made for the scrap at fixed prices, by manufacturers of commercial fertilizers, who take it away whenever most convenient for them; in others the scrap is not sold until late in the fall, when it brings a somewhat higher price than in summer. At this time farmers can obtain portions of it, and some do cart it many miles into the interior, paying therefor a price varying from $14 to $16 per ton. The makers of commercial fertilizers, however, and the farmers of Connecticut, Massachusetts, Maryland, Pennsylvania, and the Southern States, understand the value of fish scrap, and are anxious to obtain it, consequently they are sure to be on the look-

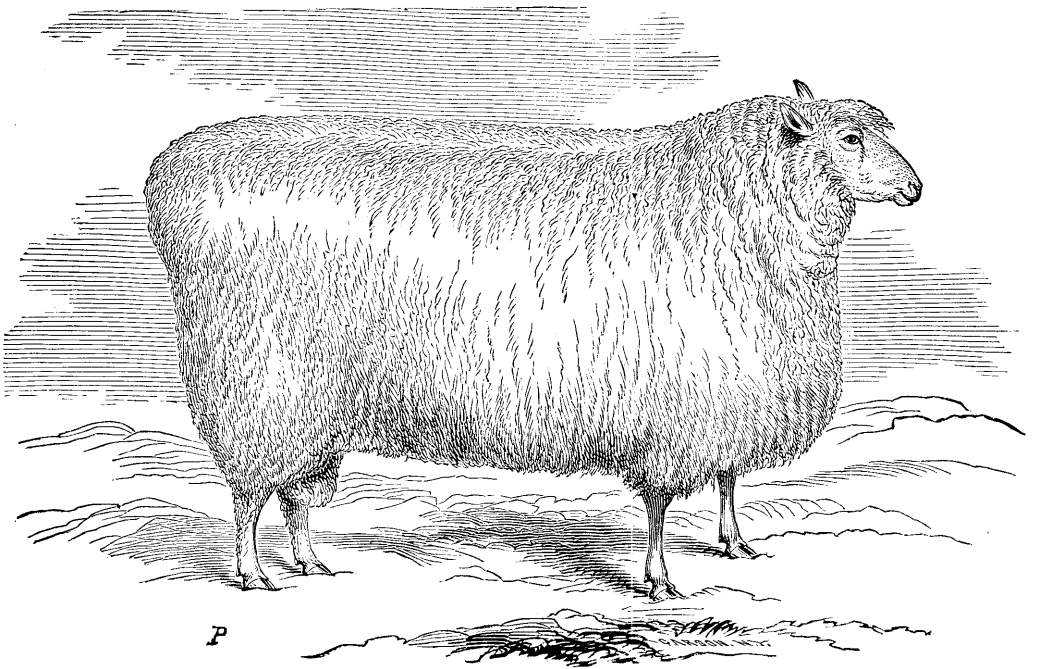
* E. P. Gilles.

out for it, and obtain a supply at as low a price as possible; and where men whose main profit in the business comes from oil, can sell the refuse for $10 per ton and have no trouble from it, they are of course willing to do so. But if the scrap is so valuable to farmers in Maryland, and to the fertilizer makers—is it not equally as valuable to our own farmers, and may they not obtain it at a fair price? Certainly it is; and it is believed the obstacles which have heretofore militated against its use by our farmers may be overcome. If it is found profitable to export the scrap in bulk, by the cargo, to England—as it is thought of being done, and which there is great danger may be done—may it not be transported into the interior of our own State where it is produced, at such a price that farmers can afford to purchase it? If they can afford to purchase manufactured fertilizers at $45 to $55 per ton, can they not also afford to purchase fish scrap, even at a price somewhere near its calculated value as determined by analysis, and which they may obtain, in all probability, at a much lower price? Our farmers generally have had imperfect notions of the value of fish scrap, and the manufacturers of commercial fertilizers have as generally not been anxious to give to them any information upon this matter, so long as they could purchase it for a merely nominal price and sell it again in their own product for $50 or $60 per ton. And it is not impossible they may have thought, if a knowledge of its real value should be familiar to farmers who would be anxious to obtain it, they would have to pay a higher price for it themselves than they now do, which would of course lessen their own profits. This much is known; fertilizer manufacturers are very anxious to obtain the scrap at almost any price, and if a demand for it arises in any part of the State, likely to increase its market value, they will be sure to have it, even at a much higher figure than now paid. Some say our farmers cannot compete in its purchase with the tobacco and cotton growers of other States, that our crops are not of sufficient value to warrant it;—but such a view is not a correct one, unless we are to advise our farmers to abandon Maine as a State and farming as a business—a thing no prudent man would be willing to do. If it is necessary to keep up the fertility of our farms, to grow profitable crops of grass, grain and fruit, and farm stock, then our farmers may certainly find it to their profit to purchase fish scrap, at a sum close on to its calculated value per ton, by analysis. These men advise the purchase of artificial manures,

but are careful to say little about fish scrap; the latter they wish evidently to control in their own interest. If our farmers can afford to purchase the former that they may become successful, can they not afford to purchase the latter and accomplish the same results at a less outlay? The manure makers control large capital, the farmers very little ready money; consequently the former can make more advantageous offers to oil manufacturers than can the latter, and so the scrap goes out of the State, or to the makers of phosphate nearer home. But cannot this, even, be overcome?

It has been decided by good authority,* that the manufacture of a "portable, inoffensive and efficient manure, from fish scrap, is perfectly practicable; that no costly machinery or complicated processes are required; that all that is necessary is to cook the fish, express as much of the oil and water as may be, and dry the remainder as quickly and thoroughly as possible." There is nothing impossible or difficult in these conditions, and they may be carried out with as much certainty as almost any other business is prosecuted. It is true, if the scrap is not dried rapidly and thoroughly as it comes from the press, fermentation and loss soon sets in, ammonia is evolved, maggots and flies work, and the whole mass becomes almost totally valueless. But these obstacles are not insurmountable, and may be successfully overcome. The sum of the whole subject is, that the farmers must look out for their own interests in this matter, and, if needs be, combine to protect themselves. A company formed for the purpose of taking the scrap from the oil factories, and preparing it for transportation into the interior, where it can be obtained by farmers generally, at a reasonable rate, to be used as a top dressing or as compost, is what is now demanded for the farmers' interest. Such a company should be formed of farmers themselves or of men who will stand by the interests of farmers. Are there not capitalists in our State who have sufficient pride for the good of the State, and who will be content to make a handsome profit in the business—who will engage in the drying and barreling of fish scrap for farmers' use; that the farms of our State may become renovated and productive, and the immense quantities of this valuable fertilizer which now go to enrich the lands of other States, be used at home?

* Agriculture of Maine, 1861, p. 56.



IMPORTED COTSWOLD RAM "BROADFIELD'S PRIDE,"
Six years old; weight 445 lbs. Bred by Wm. Lane, North Leach, Gloucestershire, Eng.
Owned by C. P. Mattocks, Portland, (Stock Farm at East Baldwin,) Me.

LECTURES AND PAPERS,

PRESENTED AT THE WINTER MEETING OF THE MAINE BOARD OF AGRICULTURE, AT

WATERVILLE, FEB. 16, 17, 18, 1875.

PLANTING AN ORCHARD.

By Z. A. Gilbert, President of the Board of Agriculture.

The day was long since passed when fruit could be classed as a luxury. It has become a necessity. Every day in the year, in some form, it enters into the *cuisine* of every well appointed household. So fully is its importance established, that it would be with reluctance that we would give it a position secondary to our meat and bread. The importance, then, of planting fruit trees and growing fruit, is at once made apparent.

Every owner of a tract of land, whether it be the narrow enclosure of a yard and garden, or the extensive estate of the large farmer, should grow fruit in some variety for the use of his family. The aim should first be to grow fruit in good variety and in great abundance, to supply the wants of the family for all purposes the year through. This would call for the planting of many different kinds, that the supply might be varied according to the needed demand. At this time, however, what I may have to say will relate chiefly to the apple, for however desirable other kinds of fruit may be, the apple always heads the list as first in importance. It is without question the king of fruits. Every farm, then, should have its apple orchard. In saying this, I am perfectly aware that all soils are not adapted to the production of apples. Good fruit soils will produce almost any varieties one may desire to grow,

while soils not considered natural fruit soils *may be made* to produce selected varieties in sufficient quantities for home use. Thus all, if they will, may grow a supply of this indispensible fruit.

It being thus admitted that all should plant for home use, the query then presents itself, "Shall we plant extensively?" This question has been so fully discussed at agricultural meetings and in the columns of the agricultural press, that it seems at first thought to be unnecessary to consider it here; yet so important is it in this connection that it can hardly be left out. In order to answer it intelligently it becomes necessary to first consider whether the raising of apples in Maine is a profitable branch of business when pursued with that end in view. In support of the affirmation of this question, the strongest argument that can be brought forward is to present actual facts as found in the experience of our orchardists. I might cite you to many examples where this is proving profitable above almost any other branch of farming among us. In my own county the most successful farmers, financially, are those who make fruit growing a specialty; and those who give it their chief attention are finding their income sure and satisfactory. These results are not confined alone to our county—the same holds true in every fruit-growing county in the State. The profits of orcharding, then, may be set down as rapid and sure, and are such as should encourage a large planting out of trees. Under the hand of intelligent culture the limit to success can hardly be measured. A tree in the hands of one who fully understands his business is entirely under his control—the crop of fruit even being forthcoming or delayed at his will.

Much good orchard land is now of trifling value, which if well planted out to trees and cared for, in a few years will be largely increased in value. As an investment, then, to say nothing of the fruit, this rapid rise in value will be found a better income than the interest on any stocks in the market. What a vast wealth there would be added to the State were these cheap lands all devoted to fruit trees.

The cry, however, is frequently heard, that the business will be overdone. "If one half the trees now being set," I have heard it said, "should bear fruit, the markets would be overstocked. Then why should we plant now?" There is a certain class of people who can always see ruin ahead for all those go-ahead farmers or orchardists who are enterprising enough to look out for the future by adopting such methods and taking measures to

secure such products as promise the best income, instead of following closely in the footsteps of the past. Fortunately the looked-for ruin never comes. Like the "will 'o the wisp" it is always just ahead, but never reached. The idea that the production of good fruit can be overdone is too foolish to receive attention at this time, were it not for the fact that some are so short-sighted as to believe it. The fact is, we are hardly producing fruit enough, even apples, for the use of our own State. Large quantities of apples, and nearly all the pears we use, are frequently brought in here from other sections, even from far-off Michigan. This should not, and need not be so. Not only should we supply our own consumption, but we should produce vast quantities, especially of apples, towards the supply of other markets. The English market now calls for large quantities of our late keeping apples, and New York contributes largely towards its supply. No State in the Union can grow better shipping apples than can Maine; and no State is better situated for the business. Should a large surplus of choice late-keeping apples be grown and thrown upon the market, a shipping trade would be established that would call for all we can grow. Now we are not growing enough to attract attention. Were our hills covered with orcharding, and our product correspondingly increased, we should have as ready a market as we now have. Dull markets and low prices will occasionally occur as they do in all branches of business, yet we may go on planting trees in yearly increasing numbers, and if we care for them well we shall in the future as has been the case in the past realize satisfactory returns for the labor rendered.

Success in fruit growing will depend largely upon the selection of a proper soil for the orchard. Many failures in all branches of farming come from a misdirection of soil capabilities. We need to study adaptation in all branches of farming, and especially in fruit growing, where years of attention are required before the reward is realized. We have an abundance of good orchard lands, and to these we should resort on which to plant our orchards. A good strong highland soil, naturally well drained, should be selected. Some varieties will succeed well if the soil be quite moist and heavy, provided it is high. Trees standing upon high lands are far less liable to injury from the severity of our winters than if planted upon the low lands and intervals. Trees on the river lands, bordering on the Androscoggin river, have been nearly all winter killed, while in my own and neighboring orchards, situ-

ated but a short distance off, but on high land, such a thing as a winter killed tree was never known. The winter of 1872-3 was severe on trees standing in valleys and low lands, while upon elevated ridges the foliage came out in the spring vigorous and healthy. It is folly to waste time and money by planting trees on low, flat lands. As a rule our hard wood ridges are good orchard lands.

Much has been said about the aspect or situation of an orchard, whether it be a northern or southern exposure. While more will depend on care than on inclination, still this is a matter of no small importance. There are good orchards on southern exposures and the same is true of northern inclinations. The elevation being the same a northerly or westerly inclination is to be preferred, from the fact that experience proves that there is less liability to injury from sudden changes of temperature. We all know that a plant when frozen may many times be restored by shading from the sun and gradually bringing up the temperature. Apple trees on a southerly or easterly inclination receive the direct rays of the sun in the morning, suddenly changing the temperature, and may be are thereby killed—while if on a northern aspect the sun's rays have less effect and the trees are seldom injured. A strong highland soil, taking the keenly cutting northwest winds of winter without a break, will grow apple trees as hardy as the rock maple which was removed to make room for the orchard.

Where shall we get our trees? The irresistible and irrepressible tree agent is everywhere—but is it policy to purchase so many foreign trees? While purposely avoiding the question of the worthlessness or the value of the trees brought into the State in such quantities, I strongly maintain that we should grow the trees we wish to set. If for no other reason, we should produce them here that the vast amount of money now going out of the State to enrich other sections should be retained here. It is the sheerest nonsense to claim that these foreign trees are better for us than any that can be grown at home. If a tree can maintain a healthy growth after it is large enough to plant out in an orchard, it can make a healthy growth in the nursery. Worthless trees are sometimes found in our nurseries, but by the hand of intelligence good healthy trees may be produced. I have realized the best results from growing seedlings in the nursery till large enough to plant out, and when well established graft in the branches.

Where this course is pursued, it is good practice for each one to grow his own trees, when they can be taken at the most convenient time direct from the nursery to the orchard. There are some varieties that make just as good trees if grafted or budded in the nursery as when grafted into the branches, but no better.

Trees should be planted in the orchard about thirty feet apart. Certain varieties which never attain a large size will bear to stand some nearer together. If it is desired to plant a large number of trees on a small space, a tree somewhat dwarfish in its habits may be planted in the centre of the square formed by four other trees. There is, however, nothing gained by crowding trees on land which bears no greater value to the acre than does most of our orchard lands. Indeed, as a rule, more apples will be grown on a given area where the trees have plenty of room, than if they are crowded. In many cases I have seen trees which were purchased of agents, stuck into small enclosures no more than ten or fifteen feet apart, and while I knew the owner knew no better, I have thought that his ignorance of orcharding worked to his benefit, since only a narrow space was occupied while the trees were dying. Trees standing at goodly distances apart take up through their roots all the nourishment we give them—if nearer together they do no more.

The supply of nourishment to an orchard is a matter of great importance. It matters not how good trees we set, if they are not properly cared for they will produce neither growth nor fruit. A young orchard, receiving the usual rotation of the farm, will make a good growth while the trees are small, if they are kept carefully mulched while the land is in grass. After the trees have attained more size and are producing fruit, mulching as ordinarily practiced is not sufficient. Fruit for the market and hay for the stables are difficult to obtain in liberal quantities from the same land. Generally we do not manure heavily enough for this. The grass will get its share, while if not enough for both, the trees must starve. It is well understood that trees obtain their nourishment from the soil through the spongioles at the extremities of the roots and the soft and spongy rootlets to which they are attached. After a tree has attained considerable size the roots extend far out into the surrounding soil, and therefore a great proportion of these rootlets and spongioles are at some distance from the trunk of the tree. If then the mulch is confined to a limited circle around the tree, it largely fails to accomplish the object in view.

Better results would be realized if the mulch were applied beyond the extremities of the branches—of bearing trees—covering and fertilizing the soil beneath and in which the rootlets are found. Experiments carefully conducted have determined that mulching, or cultivation, directly under the trees is of little value. The whole space between the trees should be devoted to the benefit of the trees and their fruit. With fruit growing, as in other branches of farming, a high degree of fertility brings the best results. Liberal manuring and thorough cultivation applied to the orchard will be rewarded with bountiful crops of the fairest fruit. This point cannot be too forcibly impressed. It is well understood by those who make orcharding a specialty and depend upon it chiefly for an income, that this is the true and only course. Without it satisfactory results are never reached, and it will be well for those who propose to make fruit-growing a specialty to study well the practices of those who are now successful in its production.

While the remaining time might well, perhaps, be filled with the subject of orchard cultivation, still, before closing, I wish to say a word in relation to varieties. This is an important matter, and it is one on which fruit growers may—and honestly, too,—differ. Yet when the characteristics of the different kinds of fruit are fully understood, there will be little difference of opinion save in matters of taste. This perhaps is all the argument needed to enforce the importance of a diligent study of varieties. Each variety has its own peculiar habits and characteristics, and they can be learned only by experience and observation. I believe in something of a variety, even when grown wholly for the market. During the past winter, common Baldwins and Greenings have borne a low price and have been slow of sale; yet notwithstanding this I have succeeded in selling in our local markets—and many others have done the same—choicer and rarer varieties, in considerable quantities, at very satisfactory prices. The markets demand something of a variety. I do not, I wish to say emphatically, believe in propagating those kinds only good enough for cooking. Good apples, choice apples—our best varieties—can be grown just as well as "cooking apples;" and the best fruit is just as much better for cooking purposes as it is for other uses. Our lists of fruit are full of the names of varieties accompanied with the remark, "good for cooking." When a variety has no other recommendation than this, it may safely be discarded.

For a market orchard the varieties planted should be either *very early* fruit, or *late winter* or *spring*. The reasons for this opinion are at once apparent. In fruitful years there is a time during October, November—and December, perhaps—when the market is glutted with choice yet perishable fruit. Choice early fruit never has been produced in excess of the demand, while late keeping varieties may be kept till the glut is over, or sold for shipping when we have enough to attract buyers. An "old-fashioned list would contain the Early Harvest, Red Astrachan, Porter, Gravenstein, Hubbardston Nonesuch, Baldwin, Rhode Island Greening, Northern Spy, and Roxbury Russett, with sweet ones enough for variety. This would make a good list, but I would not have you think that I recommend these above all others. Other kinds may for certain reasons be advantageously substituted for some of those in the above list. The Yellow Bellflower in certain localities is not excelled in point of profit by any in the list. The Hurlbut is giving perfect satisfaction with some as an early winter fruit. The Granite Beauty, though not extensively disseminated, may prove a substitute for any of the late winter. So I might go on with a long list if time would allow. Any way, if you have the above kinds, you will be well satisfied that you have a good list—if you have others substituted in part you will quite likely be just as well satisfied. Above all things give good cultivation—give to the orchard all the attention its needs require. Plant no more trees than can be well cared for, always bearing in mind that two trees well cared for will produce more fruit and return a greater profit than a hundred will do under neglect. When all the necessary conditions are complied with—when the business is prosecuted with reasonable diligence, success will be sure to follow.

THE INFLUENCE OF EDUCATION UPON LABOR.

By Prof. M. C. Fernald, Maine State College.

It has been said, and the statement is undoubtedly true, that only so far as mental endowments may be transmitted, can the babe of civilization be regarded less a savage than the babe of barbarism. Newton at his birth knew quite as little as does the offspring of the Feejee Islander.

It is our schools and facilities for culture which transform the child of civilization into a philosopher, and the absence of such advantages which allows the half-clad, dwarfed and superstitious child of barbarism to remain in the rudeness and unthriftiness of savage life.

"The record of human progress is the history of education, and the superiority of our civilization to the rude and cruel life of the unlearned, is the measure of its power."

Since education is the leading out and the training of the faculties of the mind, its influence is felt "in every field of thought, in every executive enterprise and social interest," but will be considered at the present time only in its relations to labor.

It is a law of Political Economy, that profitable labor requires intelligence, whereas an ignorant population is cursed by superstitions and conceits which shrivel manliness and cancel thrift. Not a long period since, in the counties of England in which not more than one person in ten could read, "the people wore charms for the ague; killed and cured their cattle by enchantments; excluded witches by a horse shoe nailed to the threshold; carried bits of coffins in their pockets to baffle the cramp; and still tilled the soil with the old Roman plow and harrow."

Even in our own time, there are those who trust implicitly in dreams and omens, who fear the ghosts of a church-yard, who will not enter upon an enterprise on Friday, who are troubled if they see the new moon over the left shoulder, "whose potatoes run to tops if planted at the increase of the moon, and whose pork boils away in the pot if killed at its decrease." The condition of society which originates and fosters such blighting puerilities is

precisely the condition which binds countless human beings to abject servitude, and condemns them to hopeless poverty.

Ignorant, unskilled labor is always narrow and mechanical in its character, and hence it is, and ever must be poorly paid. If we analyze the cost of any finished commodity, we find that the elements which make up its value, are threefold, viz: "the wages of labor, the wages of skill and the reimbursement and profit of capital." The wages of labor, that is, the remuneration of mere physical force, the power which simply sets bodies in motion, and which has involved no knowledge of the processes and no skill, constitute only the smallest part of this value. This form of labor has never in the world's history, done more than maintain itself. Left to itself, it can, in fact, produce only enough to sustain life bordering on starvation. The original inhabitants of this country passed centuries in the very localities where now wealth and affluence abound, yet with no accumulations for the future and hardly satisfying supplies for the rudest wants of their natures. Let any farmer in Maine fail to apply even a considerable degree of intellgence and skill to the operations of his farm, and although the land might be given, and he and his family toil incessantly, he could not more than supply the necessities, not to say the comforts of life. In our own country, the wages of unskilled labor may be, indeed are, doubtless, somewhat greater than the cost of subsistence. This results from the fact that in the development of our resources, in the construction of railways and other enterprises of internal improvement, labor has been in demand above the supply. In the older countries, where new fields of industry are seldom opened, the earnings of such labor are scarcely sufficient to save the families of the operatives from starvation.

As our own country becomes more and more fully settled, the tendency will be to a reduction rather than an increase of wages, for simple muscular labor. Although production will increase, it is safe to assume that the demand for unskilled labor will diminish. Every year the amount of labor done by hand is relatively less and less There was a time, when almost no other form of power was pressed into service, but now machinery driven by water, wind or steam power is fast superseding hand labor. The shovel and the pick-axe, in the main, are destined to be driven from the field, and the steam engine or other mechanical agencies made to do the work which hitherto the strong muscles of the laborer have

been accustomed to perform. The outlook in the future for this form of labor is far from encouraging.

The second element in the value of a manufactured commodity, is the wages of skill. The amount of this form of wages is controlled chiefly by the well established principle that the more delicate and complicated the work done, the greater the compensation, inasmuch as it involves s higher type of labor. A bar of iron worth $5 is said to be worth $10.50 when wrought into horse shoes, $55 when made into needles, $3,285 when made into penknife blades, $29,480 when made into shirt-buttons, and $250,000 when made into balance springs for watches. The skill required in the several cases directly determines a large percentage of the enhanced value. From an address given by the Hon. J. W. Patterson of New Hampshire, before the American Institute of Instruction in 1872, we learn that "a director in one of the extensive corporations for the manufacture of cotton in Lowell, Mass , stated to a Congressional Committee, a few years since, that only forty-five out of twelve hundred operatives employed in *their* mills were unable to write their names, and that the wages of the eleven hundred and fifty-five who could read and write, was twenty-seven per cent. higher than the wages of those who could not. This illustrates a law. Estimates based upon a wide generalization of facts, have shown that generally the labor of an educated person is twenty-seven per cent. more productive and remunerative than that of an ignorant person." From the same source we learn that in the same mills were a hundred and fifty girls who had been teachers, and that their wages were seventeen and three-fourths per cent higher than the general average, and more than forty per cent. higher than the wages of those who for signature were obliged to make their mark. The discrimination in the pay of labor made in the mills of Lowell is virtually made in every department of industry throughout the country, the only difference in other localities and under other conditions, being simply one of percentage.

The master mechanic or manufacturer who understands his business in all its details, who can skilfully and successfully direct the labor of others, and who can secure the highest reputation for the articles he manufactures, generally, in fact nearly always commands remuneration for his services commensurate with his known skill and ability. No one questions that his compensation should be generous inasmuch as his skill supersedes the necessity of a

large amount of lower priced labor, if indeed it were possible that such labor could take the place of his supervision. His work is also in the interests of the consumer, for the articles which he furnishes, under a less skilful superintendence, could be produced only at a larger cost. But this sort of skill, which efficient directorship pre-supposes, except in very rare instances, is acquired by education alone—not only from the training of the hand but also of the brain. Just here an important distinction should be observed. The mistake is often made of confounding educated labor with skilled labor. The distinction between the terms is so cleverly brought out in the article to which reference has been made, that I am sure I shall be pardoned for transcribing it.

"That facility and accuracy of manipulation which we call skill is acquired by perpetual repetition of one thing, and arises from that division of labor which always takes place in densely populated countries where work is a drug, wages low, and food scarce. The lace and tapestry weavers of France, and the trinket makers of Japan and China, have skill, but they are necessarily narrow, stupid, and starved. They know but one thing, and can do but one thing, and when that ceases they die. They are useless for all other purposes of industry, and for all purposes of social or public life.

Skilled labor is transmitted from father to son, and treads its narrow round without thought of change, but educated labor is curious and inventive, seeking constantly to relieve toil and make its results more perfect and remunerative by improved methods and the introduction of new forces. When our countryman, Bigelow, would improve the carpet loom, and was stupidly refused admission to an English factory, he bought a piece of carpet and studiously unravelled it, till he had invented a loom which superseded the English loom, on English soil, and has added immeasurably to the productive industry and wealth of our country. It is the forecast and insight of disciplined intellect, not brute muscle, which accumulates the treasures and wears the honors of the world. Centuries ago the sun-stained Hindoo first made cotton cloth, but to-day a Yankee girl will spin as much as three thousand daughters of Delhi. Such is the spirit of an enlightened industrial population. They advance with the advancing years, and sustain the progress they have helped to create."

Since the object of all labor is to produce some useful change in the substances with which it deals, thereby adapting them ultimately to human wants, it necessarily requires intelligence to do

this with success. Not *any* changes, but only those of a particular character are useful. Moreover, since all productive labor must be in accordance with nature's laws, it is an indispensable requisite for the workman who would be truly skilful that he understand those laws.

No amount of labor will make fire burn under water, or plants thrive where nature's conditions for plant growth are unfulfilled. Many of nature's laws are obvious, or may be learned by ordinary observation and experience, others are recondite and can only be mastered by careful study. A knowledge of chemistry, physics, and mathematics is indispensable to the highest type of skilled workmanship. The skilful artificer must understand the properties of the materials with which he is working, and the action of nature's elements upon them—he must be familiar with the mechanical powers, the strength of materials, the laws of friction—that he may apply the forces he attempts to control without loss or waste. He must become acquainted with the laws of trade, and the functions of money; must be able to economize resources, to calculate results, and to give to his products the highest perfection and value. He needs general culture, also, for he will establish relations, both business and social, with the intelligent and the educated, exert an influence of no inconsiderable importance upon the character of his associates, and hence he is under obligation to maintain a position in society worthy of respect and confidence—especially if he would contribute to the advancement and upbuilding of the calling which he has adopted. It should not be forgotten, that the profession *never* determines the quality and character of the men who are in it, but that the men determine the character and standing of the profession.

The third element in the price of a commodity is the reimbursement and profit of capital. Labor is said to create all values, and hence capital is simply the form in which labor has stored up its accumulations. It has been shown that labor itself, that is, mere physical force, accumulates nothing, but that the wages of such labor are at most simply sufficient to meet its immediate wants, if indeed adequate for this purpose. Capital is, therefore, "the accumulated savings of the wages of skill." Perhaps by a more nearly technical definition, these savings would be regarded as wealth, which is the broader term, capital being only that part of wealth devoted to production. In advanced states of society, capital is generally devoted to such aids to production as buildings, imple-

ments or machinery, motive power, and raw materials. Moreover, in many cases the food and shelter of the operatives are supplied by capital, while the labor is being performed.

Now, before one dollar can be added to capital, the wages of labor and the wages of skill must be paid; it must also be reimbursed for cost of material, wear and tear of implements or machinery, for taxes, and the losses to which it is constantly liable from fire, storm, flood, shipwreck, or other forms of disaster. What remains over and above these expenditures, is the profit on capital. It is evidently not unjust that this profit be reasonably large, especially as capital incurs the principal risk, labor venturing essentially nothing save where the work is of a dangerous character. It is when capital can be satisfied only with exorbitant gains that it becomes oppressive.

Abstractly considered, capital and labor meet on an equality. Capital cannot increase without labor, and labor cannot live without the wages which capital can give; each is indispensable to the other. Their union is essential to the production, and even to the very existence of wealth. Antagonism between them is destructive to the interests of both. In practice, however, their true relation, that of partners, co-laborers for a common end, is not unfrequently ignored. The working men of the country are now loudly demanding larger pay and greater privileges, and are organizing to obtain rights which they claim have been withheld; and it must be admitted, that in many cases they doubtless have cause of complaint, but it should not be forgotten that no reform movement in the interests of labor can accomplish anything of good which does not rest on the broad and true proposition that labor and capitol are partners, not rivals, and which does not inscribe on its banner, "What God has joined together let not man put asunder."

The condition most favorable for the harmonious union of labor and capital is secured when they both meet in the same person; that is, when the laborer owns the capital he would employ in production. No antagonism can then arise, since both elements are directed by one will, are controlled by the same self-interest. Such an adjustment, however, cannot be universal. In fact, many forms of production most essential in an advanced state of civilization, can only be carried on in large establishments, requiring vast capital and many grades of labor. Hence, there is a constant

tendency to the separation of capital and labor, disturbing, although not destroying their mutual dependence on each other.

The educated laborer evidently belongs to both classes. His skill and brain-power furnish the very material from which wealth is created. His earnings include not only the wages of the labor which will feed and clothe him, but the wages of skill which will yield a surplus revenue to be invested as capital, or to be hoarded as the nucleus of prospective wealth. With the savings of each year, it comes to be more and more his interest that capital should yield remunerative returns, for the same measures which would impoverish the larger capitalists would deprive his own moderate investments of value.

When every man can feel that his own interests are identified with those of capital, the antagonism which now palsies the energies of labor and cripples the enterprizes of capital can no longer be maintained. As the case now stands, it is obvious that law can do little more than protect each against the encroachments and oppressions of the other, that legislation cannot measurably enhance the income or influence of industry or quasi political organizations effect advantageously social position, whatever be their relations to civil power.

Labor, however, holds in its own hand the rod with which it may break the shackles of its wrongs. "The sphere of thought is the arena in which it must work its revolution and establish its rights." No amount of legislation can securely protect those rights "so long as the great working majority of a people are unschooled." There is no other class of society so deeply affected by any lapse of general intelligence either by the influx of foreign or the growth of native ignorance. No other class so profoundly interested that national intelligence be maintained. It is education alone that can lift labor from subordination to independence, from pupilage to mastership.

There are other and higher grounds on which the claims of educated labor may still more strongly be urged. Unintelligent labor (as before stated) is mechanical, narrow, and performs its work by the clumsiest and most exhausted methods, while intelligent labor is not limited to single lines of effort, is inventive, and seeks to relieve toil by its own devices. When Humphrey Potter was employed in turning the stop-cocks to a Newcoman's engine, he did not enjoy the monotonous labor. A less intelligent lad would have performed the service with no thought that a simple

mechanical arrangement would save his own attention and labor. Potter, however, contrived to fasten cords from the beam to the handle of the stop-cocks, so that they were opened and closed at the proper times, while he was away enjoying himself with his companions. This device was adopted as an essential part of the machine, and from that day the engine has been self-acting.

Great discoveries have been made ordinarily, by men devoted to science, and the numberless inventions by which the forces of nature are utilized and made to do the work of man, whereby the means of production are immeasurably increased, have been made by practical men whose minds have been quickened and disciplined in the schools. Ignorance rarely shortens or cheapens the labors of production, or makes any improvement in the methods of industry. Inventions have generally been the joint product of the mind familiarized by study with the laws of machinery, and the hand trained to practical skill.

Not always have these two conditions existed in the same individual. Not unfrequently the germinal idea or principle of an invention has been conceived in the brain trained by study and reflection, and long years have intervened before the skilful hand has been found to give it palpable expression and existence. The telegraph had long been a fact in scientific thought, before the first message was transmitted from Baltimore to Washington. When Watt conceived the idea of a separate condenser for the steam engine, by which the waste of fuel and loss of power resulting from the alternate heating and cooling of the cylinder could be avoided, he was not himself capable of the delicate workmanship necessary to give practical realization to his conception. Nor could he find in all Glasgow, skill sufficient for the casting and boring of a cylinder which would answer his purpose. Fourteen years passed away with repeated failures, and the despair which poverty begets, when he was so fortunate as to enter into partnership with Boulton, a trained manufacturer in iron and steel, who furnished the requisite mechanical skill to give completeness to the invention. From that day steam power has maintained undisputed its supremacy as a motor, in advance of all others, and the fame of Watt is now resplendent with the imperishable lustre which inventive genius united with mechanical skill alone could secure. Illustrations might be multiplied indefinitely, but they are not necessary.

The history of all civilized nations testifies that in the proportion in which the skilful hand has been associated with the working brain, has the condition of individuals been improved; the wealth of communities increased; the arts and comforts of life multiplied, and general material prosperity attained. It need not be feared that the era of invention and discovery is passed. It is really but just commencing. We know not what agents are now slumbering unrecognized, which are destined to do the major part of the world's work. Steam has been the mightiest agent in our day; it may, nevertheless, be supplanted by a still mightier energy. The power now obtained from the stored force in our coal fields, and from the destruction of our forests, may be replaced by supplies of force of which we now have little conception, drawn, it may be, from direct solar action, or from some of the elementary forces of nature which the genius of a more progressive age shall reveal. We have harnessed the electric force to our thought,—may not the inventive skill of a later generation attach with no less success some equally subtle agent to their railway trains? Many of the forces in nature are now but imperfectly understood. They will yield their secrets to a siege more or less protracted, of disciplined intellectual power, and their energy to the united efforts of inventive genius and consummate skill. Mind enters into every effort of the hands and controls its results. This law obtains not more fully in the individual than in the national life. Barrenness and poverty reign among the nations where ignorance prevails, while prosperity and power keep pace with advancing intelligence.

The claim for the education of labor with especial reference to productive industries, forces itself into prominence at the present time, from the fact that the so-called liberal professions are immensely over-crowded, and from tendencies which at best can be but partially controlled, must continue to be over-crowded. What has been said of the liberal professions in this regard holds equally true of the mercantile profession. Whatever by the broadest construction can call itself trade or commerce, deems itself respectable. This vocation seemingly presents attractions which many other forms of labor do not possess. Hence we see our towns and cities over-stocked with shopkeepers; hands which could wield the sledge-hammer, measuring tape, and able-bodied men supporting themselves by light commercial pursuits, which might

give a competency to thousands of women whose needles hardly suffice to keep themselves and their children from starvation.

The deranged balance of society can be restored only by rendering back its former honor to labor. It must be recognized that productive industrial pursuits possess the same degree of respectability and dignity accorded to the mercantile or other professions. In a word, agriculture and all forms of handicraft requiring skill and intelligence, must be made liberal professions. This can be done only by stocking them with men of liberal culture; for as before remarked, it is not the profession which gives character to the man, but the man who gives character and standing to the profession.

It has been not an uncommon occurrence within the last ten years, for young men graduating from literary institutions of the highest character, to pass directly into the factory or machine shop, and there as apprentices to learn the various forms of hand work in all their details. With men of generous culture engaging more and more frequently in the productive industries, it will require no extended period of time to demonstrate that in such industries learning and genius and culture may find fit investment, with ample room to grow, and with full recognition as to civil power and social position and honor. With a view to an early and fuller realization of such results, the National Government has come to the aid of the States in the establishment of institutions where special attention may be given to those sciences which bear more or less directly upon the practical industries of life. Whether or not the object immediately contemplated shall be fully attained, no one can now foretell. That a good work will be done for the rising generation, there can be little doubt. Many there are, however, who seriously question whether a course of study, literary or scientific, will not educate young men *out* of industrial pursuits, so that never again will they return to the farm or the workshop. In some cases it may, undoubtedly, have this effect, but in no case necessarily.

There is no institution that has the power, nor ought it to have the desire to determine what the particular vocation of its graduates shall be. It may fit a man for civil or mechanical engineering, but it cannot make him a civil or mechanical engineer; it may prepare a man for high success by all the science and all the practice that can avail for success in agricultural life, but it can-

not make the man a farmer. The selection of vocation will ultimately rest where it should rest, upon individual choice. It should not be forgotten, however, that circumstances may influence the choice, and may sometimes control it; that preparation for the farm will probably lead to life on the farm, that preparation for the shop will probably lead to life in the shop, although not always and necessarily.

It is gratifying, as it is encouraging, that statistics of the agricultural and mechanical institutions which have sent out any considerable number of graduates, show that a percentage really large are engaged in the practical industries of life. But suppose this were not the case; suppose that the probabilities of return to productive industries were ten-fold less than they now are, where is the farmer, or where the mechanic, who would deny to his son the priceless advantages which an education confers, lest he should be lost to the farm or the shop, when God has not implanted in him the aptitude and the inclination for the life which the farm or the shop affords? A wisdom higher than human finally determines the choice. Whatever other results may flow from these institutions, the training they give, the culture they confer, can but serve to improve, to elevate, and to dignify the estate of labor. They will contribute to lift it from "servitude to the clumsy and unproductive past, into sympathy and co-operation with the improved and progressive present," and give it a fairer field for a freer and a more successful conflict in all the peaceful rivalries of the world in the future.

In the argument hitherto, in behalf of educated labor, no mention has been formally made of one half of our entire population, (generally omitted in such discussions), as subject to its advantages. It is almost needless, however, to add, that every advantage which can be named in favor of industrial education, applies as fully to women as to men. Disguise it as we may, the fact still remains, even in our own country, and to a larger extent in foreign countries, that the lot in life of the women and the girls who are dependent upon their own earnings for support, is not less hard than the lot of laboring men. More keenly do they feel the oppressions of capital, more sharply the bitings of poverty, and the withering blight of misdirected and wasted energies, with less of opportunity for redress of grievances and the bettering of life's conditions.

It should be hailed as the brighest omen of the future increased wealth, prosperity, enlightenment and happiness of the people, that as regards equal facilities for the higher culture of both sexes, the new and the old education are taking a "new departure," thereby vindicating their claim to breadth and freedom from class distinctions and exclusiveness. Throughout Europe the facilities for female education are increasing, and the standard rising to a higher elevation. In Russia, England and France, great progress has already been made in this direction, and the work is still advancing. It is more than fitting that the last relic of feudal inequality, manifesting itself in the unequal opportunities for the higher education of both sexes, should no longer be retained in the United States.

In conclusion, it shall only be urged that in our own country a growing comprehension of the relations of education to labor, and the discussions growing out of it are auspicious of the highest good. It marks the dawning of a new era—an era which shall be characterized by a greater application of the powers of the mind to the labors of the hand, and hence an era of greater individual and national prosperity; an era which shall furnish the conditions for new discoveries, opening the way to larger success in American agriculture, to higher achievements of American skill, to grander triumphs of American science and art, and thus hasten the time which shall be recognized as the golden age of American civilization.

ASSOCIATED DAIRYING IN MAINE.

By Geo. E. Brackett, of Belfast, Member at Large.

Associated dairying, so far as it relates to the manufacture of cheese by the factory system, may be considered as firmly established in Maine. Another year has passed, and after another season's experience we have sufficient data to know the results and judge of the promise for the future. There were about forty factories in operation in Maine during the last milk season, and so far as I am aware there has not been a single failure, and but very few where their operations have not been satisfactory to their patrons, while the great bulk have been eminently successful.

This is certainly much more favorable than the most sanguine advocate of associated dairying could expect. When we take into consideration our comparative ignorance of the whole subject of factory cheese making a couple of years ago, the backwardness of those who should have been interested, and the opposition met with in many quarters, and the many difficulties necessarily attendant upon starting any new enterprise, especially among farmers who are proverbially and perhaps with reason prejudiced, if not inimical to new projects, the success which has attended the introduction of associated dairying into our State is certainly wonderful, and marks a new era in the history of progressive agriculture in Maine.

I herewith submit in tabulated form, reports of the operations of our cheese factories during the cheese-making season of 1874. The first table presents a full report of the doings of the factories in Waldo county. Waldo takes the lead in associated dairying in Maine, nine factories having been in operation in the county last year, and three more to commence next season. This table is reliable, having been collated from reports from each factory, made for this special purpose. The report for the whole State has been collated from various sources, and is not so full, but is valuable and correct in the main, and presents a fair exhibit of the operations of thirty-four factories in Maine during the past year.

WALDO COUNTY CHEESE FACTORIES—*Report of Operations during* 1874.

NAME OF COMPANY.	Value of Shares.	Size of Factory.	Cost of Factory.	Cost of Apparatus	Commenced Operations.	Closed Operations	Total am't lbs. of Milk received.	Total am't lbs. of Cheese made.	Pounds of Milk to make a pound of Cheese.	Price per pound obtained for Cheese.	Cost of making Cheese, per. lb.
Brooks	$25	30 x 50	$1,500	$400	July 15	Aug. 29	63,937	6,869	10	15 cts.	2½ cts.
Unity	10	30 x 60	1,025	675	" 13	Sept. 13	88,289	9,917	8¾	"	3
Waldo	25	30 x 50	1,650	295	June 11	" 30	185,849	21,247	8¾	14 to 16	2 8-10
Elm Dale	25	30 x 60	1,400	450	" 15	" 12	216,592	21,252	9 green. 10⅛ cur'd	15	2½
Monroe	10	30 x 50	2,800	In all.	May 4	" 26	452,007	48,737	9½	14½	–
Searsmont and Montville	25	30 x 50	1,100	–	June 1	" 12	184,284	18,583	9 9-10	15	–
Center Montville	25	27 x 50	1,000	500	" 1	" 12	245,500	24,600	10	14 to 15¼	2⅝
Union, of Northport	50	30 x 40	450	700	May 4	" 27	179,558	18,200	9¾	15	2½
Freedom	25	60 x 30	1,205	410	June 22	" 10	132,440	13,283	10	16	3
Total			12,130	3,430			1,748,456	182,688			
Average			$1,236	$490			19,428	20,298	cured 10 lbs.	15 cts.	2.6

WALDO COUNTY CHEESE FACTORIES—*Report of Operations in* 1874, (CONCLUDED.)

NAME OF COMPANY.	Estimated No. of Cows furnishing milk.	Returns in dollars per cow for the milk season.	Wages paid to cheese-maker per month.	Price per gal. paid for milk if bought.	No. of Cheese-boxes used.	Value per gal. of Whey for hogs.	Any coloring used	Rennet, kind and price per lb.	Price of milch cows.	REMARKS.
Brooks	60	$17 17-100	$36 00	12 cts.	None.	2 cts.	Little.	Domestic 15 cts.	$50 00	Use gang press. Factory gives satisfaction.
Unity	80	17 25-100	50 00	"	202	3 "	Color'd	Domestic N. Y.	50 00	Two persons employed.
Waldo	90	25 00	50 00	–	510	3 "	Little.	–	50 00	Milk all furnished by patrons.
Elm Dale	137	–	65 00	–	414	Sold at $11 pr. m	"	Domestic 12½ cts.	55 00	Paid for collecting the milk.
Monroe	180	–	75 00	–	850	Some.	"	" "	45 00	Cheese weighed green.
Searsmont and Montville	–	–	50 00	–	150	–	None.	" "	62 00	Paid for collecting milk.
Center Montville	130	–	65 00	12	400	–	"	"	55 00	Man and boy employed.
Union, of Northport	80	28 00	63 00	–	220	2c. $300 for year.	"	"	55 00	Milk paid patrons 3 cts. pr. qt. net.
Freedom	125	20 00	80 00	12½	175	1 ct.	"	Foreign. 13 cts.	50 00	Promise very good for next year.
Total			534 00		2,921					
Average	110	$21½	$59⅓	12 cts.	Cost 14 cts.	2 cts.		13 cts.	$52¾	

Number of tons of cheese manufactured in the county during the season, 91¾. Cash value, at 15 cents per pound, $27,403.

We summarize as follows: Waldo county—Value of shares in companies range from $10 to $50—$25 shares most common. Average cost of factory buildings, $1,236. Average cost of apparatus, $490. Longest time any factory operated, 147 days; shortest, 45 days. Whole amount of milk taken, nearly two millions of pounds. Whole amount of cheese manufactured, 182,688 pounds, or 91¾ tons; which, at the average of 15 cents per pound obtained, amounted to $27,403. Number of pounds of milk to a pound of cured cheese, a fraction less than ten. Average cost of manufacture, about 2½ cents per pound. Average number of cows to each factory, 110; largest 180, smallest 60. Average returns per cow for the season, $21. Average price paid cheese-makers, $60 per month, and board. Price paid for milk when purchased, 12 cents per gallon. Number of cheese boxes used, 2,921, at a cost of 14 cents each at the factory; these were manufactured in the county. Estimated average value of whey, two cents per gallon. Average price of milch cows during the season, $52. But little coloring used. Mostly domestic rennets used.

For the State. Whole number of factories reported, 36. Average cost of factory, both building and apparatus, $1,911. Longest time any factory operated, 166 days, or five and one-half months. Largest number of cows reported as furnishing milk to any factory, 350; average to each factory, 144. Whole amount of cheese made, 925,299 pounds, or 462 tons; which, at 15 cents per pound, the average price obtained, amounted to $138,794. Average number of pounds of milk required to make a pound of cured cheese, is a fraction less than ten.

Allowing fifty tons as the product of the four factories not given below, and we have a grand total of 1,028,107 pounds, or 514 tons of cheese, as the product of the cheese factories of Maine for 1874, which, at 15 cents per pound, amounts to the sum of $164,216 as the cash product.

OPERATIONS OF MAINE

NAME OF COMPANY.	Size of Factory.	Cost of Factory.	Number of days in operation.	Number of cows furnishing milk	Pounds of milk received daily.	Whole amount of milk received.
Brooks	30 x 50	$1,900	45	60	1,420	63,937
Unity	30 x 60	1,700	62	80	1,423	88,289
Waldo	30 x 50	1,945	111	90	1,674	185,849
Elm Dale	30 x 60	1,850	90	137	2,407	216,592
Monroe	30 x 50	2,800	144	180	3,139	452,007
Searsmont	30 x 50	1,600	104	–	1,771	184,284
Centre Montville	27 x 50	1,500	104	130	2,360	245,500
Northport	30 x 40	1,150	147	80	1,213	179,550
Freedom	30 x 60	1,615	81	125	1,634	132,440
New Portland	30 x 50	1,938	94	–	1,818	170,808
North Jay	28 x 45	1,850	93	150	2,400	218,100
Enterprise	24 x 28	1,300	81	100	1,600	129,666
Stetson	–	–	100	–	–	325,593
Presque Isle	70 x 33	1,600	–	140	2,626	256,080
North Anson	26 x 36	1,650	83	100	–	111,538
South Newburg	50 x 34	2,500	–	150	3,066	430,889
China	56 x 30	1,550	42	100	1,873	78,687
Dixfield	32 x 38	1,700	112	200	2,511	281,300
East Jefferson	26 x 55	2,000	100	120	1,800	185,400
Farmington	26 x 30	2,425	109	–	–	172,000
Kenduskeag	32 x 60	3,500	166	–	–	681,744
South Paris	28 x 56	–	131	250	3,150	416,000
Philips and Avon	28 x 50	2,200	130	165	3,000	400,000
Six Mile Falls	25 x 35	2,100	132	200	–	402,461
South Waterford	28 x 45	2,200	–	–	2,517	242,569
Wilton	26 x 40	1,300	–	90	1,765	197,742
Union	30 x 60	2,200	82	150	2,780	228,960
Fryeburg	30 x 60	2,100	66	100	1,700	112,197
Weld	50 x 26	1,650	–	150	2,700	–
Dexter	30 x 60	–	70	–	–	154,654
Rumford and Mexico	–	–	97	200	–	–
Mechanic Falls	34 x 100	–	138	350	–	–
Dixfield Centre	–	–	–	–	–	–
Bridgewater	–	–	–	–	–	–
East Sangerville	32 x 60	1,900	104	150	–	300,000
Milo	30 x 50	1,700	77	150	–	136,040
Total	.....	55,423	.....	3,897	.....	7,380,876
Average	.....	1,911	.....	144	.....	238,092

CHEESE FACTORIES DURING 1874.

Whole amount of pounds of cheese made.	Pounds of milk to a pounds of cheese cured.	Price obtained for cheese per pound.	REMARKS, &c.
6,869	10	15 cts.	Youngest factory in county.
9,917	8¾	15	
21,247	8¾	15	
21,252	10⅓	15	
48,737	9½	14½	
18,583	9 9-10	15	
24,600	10	14¾	
18,200	9¾	15	Has run three seasons.
13,283	10	16	
16,143	10½	15 & 16	Sage cheese sold at 16 cents.
24,000	9⅞	15	Cheese average 40 pounds apiece.
14,000	9¼	15	
32,961	9⅞	15	Cows paid 20 per cent. more than for butter.
25,308	9 1-10	16	
10,921	9 2-10	15	Whey valued at 2 cents per gallon.
43,152	9 8-10	14	Two persons required to run the factory.
8,243	9½	15	One man Expect to double business next year.
29,000	9 7-10	15	Some milk brought 6 miles; 3 miles is far enough to pay.
18,500	10	15	Second year in operation.
17,200	10	15 & 16	Cheese made by Mass. rule.
79,037	9¾	15	Pd. 1¼ cts. per lb. for milk at factory; 2 men at $4½ pr. day.
42,871	7¾	16	Milk pays patrons about 1¼ cts. per lb. net; 2 men empl.
40,000	10	15	Used 250 rennets & ½ ton salt. Cost 2½ cts. per lb. to manf.
40,314	10	14½	Cost 2¾ cents to manufacture.
24,524	10	15	Two persons employed. Paid 12 cts. per gallon for milk.
20,376	9⅔	15	Second year. Man and woman employed.
22,000	9 9-10	15	Sage cheese sold at 16 cents.
11,715	9½	15	Patrons well satisfied.
29,089	9 7-10	14½	More cows needed. Two persons employed.
16,000	9 4-10	–	Cost 2½ cents per pound.
24,446	–	–	
68,000	–	15	
34,000	–	15	
8,000	–	–	
30,200	9 9-10	15	Cost of making, 2 cents per pound, green.
12,611	10 9-10	–	Paid one cent per pound for milk.
925,299	Fraction		
25,702	less than 10	15 cts	

There are many ideas suggested and lessons to be learned from the facts given in the foregoing tables and reports, but I have neither time nor space in this paper and on this occasion to refer to them in full. I will hastily glance at a few of the most prominent, and to me the most important points.

Perhaps our greatest need and most pressing immediate want, is more cows. Our factories are not half stocked. There is not a factory in Maine but in its present state is capable of manufacturing the milk of 200 cows, with hardly a perceptible addition to the cost of last season, while with a few dollars outlay the milk of 400 cows could be taken care of. The average number of cows to our factories is only 144, while in western factories it is about 250. Then comes the question, Where shall we find the cows? There are probably enough in those portions of the State where factories are not located, to supply the demand for the present. The average price for milch cows in Waldo county last year, during the factory season, was $52.00. But the farmers of Maine must take measures to supply this deficiency. See to it that not a heifer calf goes to the butcher this year or next. It will pay to raise them, for this demand for milk for cheese factories will raise the market value of cows. I wish I could impress this necessity upon the minds of farmers as firmly and fully as I feel it myself.

Our factory buildings are costing too much. The average is about $1,500; and most of them, at least in my county, are fine buildings, clapboarded, painted, blinded, and heavy finished. What is needed, is a roomy, convenient, tight building. Everything in the form of adornment is dead money invested. Of course, if the company has plenty of funds it is all right, for a well finshed building is an ornament to the locality where situated. But I am now looking at the subject from the dollar and cents side. A building 50 by 30, two stories and basement, seems to be the most convenient. I would recommend that the upper story be so arranged that it can be used as a hall if needed, and be made the headquarters of the society, the farmers' club, the grange, and all associations of an agricultural character in the neighborhood.

The cheese box question will be of importance another season. A large portion of the product of our factories last year was sold at home, and but few boxes were required, but when an outside market is reached, as must be the case as our products double in amount, boxes are a necessity. Only about 3000 were used in our county last year, and these were made at a box factory in the

county, and delivered at each cheese factory at 14 cents each. This was done under contract, effected by the Waldo County Dairymen's Association. The price will be two or three cents higher another season. These boxes were made of basswood or elm rims, and ash or fir heads and bottoms, and equal to the best western. Not less than 25,000 cheese boxes will be required in Maine next season.

The value of whey or refuse from the cheese vats is worthy of consideration. Experiments made last summer, in feeding it to hogs, place its value at little if any less than sour skimmed milk. Hogs fed on it wholly for weeks were as thrifty and grew as well as those fed on milk. Fed with a small amount of corn meal it is undoubtedly of much more value in making pork than was formerly supposed. In fact, when factories first began to operate, it was allowed to run to waste. The returns from our county factories give it an average value of two cents per gallon. One of our best informed factory-men fixes its value at a sum equal to the cost of collecting the milk for the factory.

About cheese makers. I again urge upon our factory directors the fact that we are sending too much money out of the State in hiring cheese makers from abroad. Our cheese makers cost us over $75 per month, and our few factories sent away over $10,000 for cheese making. This can all be kept at home if pains are only taken to teach our young men to make cheese. We have plenty of young men of brains, who teaching school winters could run a cheese factory during the summer months, and thus find a year's occupation at paying figures. At the best, we obtain only second rate cheese makers from the West, as a rule; and it is a libel on our farmer boys, to say they cannot do as well, with experience. A part of the cheese makers in Waldo county are our own young men, and their cheese will compare favorably with that of other factories. Let each factory see that one person is taught the rudiments the coming season, and this lack will soon be filled.

The methods of operating our factories vary. In some cases the stock is all owned by farmers who furnish the milk, and after paying the cost of manufacturing divide the product in cheese, or if marketed, in money, according to the amount of milk furnished. In other cases the stock is held largely by persons not contributing milk, and the company pays so much per gallon or quart at the factory. In some cases the milk is all brought to the factory by the patrons, or a neighborhood clubs together and one takes all

on the route for a certain time, each in turn; in others the milk is collected at the farms by persons hired by the company. Which of these methods is preferable depends very much upon location and attendant circumstances.

Factory cheese making is yet in its infancy in Maine. We understand only the outlines of the business, as it were, and our practices and operations are correspondingly crude and imperfect. In the Western States, and especially in New York, where associated dairying is largely followed, and where years have given experience and capital has allowed the subject to be scientifically treated, will be found the cheese factory in its best condition. Of their experiences we can avail ourselves to some extent, but there are many subjects closely identified and connected with the business which we can hardly practice, as we have no experimental data on which to base operations.

There is the question of the best breed of stock for cows for furnishing milk for the factory. We may have our opinion as to whether it is a Shorthorn, an Ayrshire, or a Jersey grade, but the all important thing now is to obtain cows of any breed. So the subject of feeding cows, is a deep and interesting one; but the great point with us is, how best to employ our cows as machines for converting our coarse raw material, our farm products, into a more concentrated form—milk, cheese or butter—leaving the waste or fertilizing elements for return to the soil. Good hay—early cut grass—with plenty of roots or potatoes, will produce good and rich milk, butter, or cheese.

Then there are the dozen and one other points, secondary at present with us, but all important where cheese making has reached a high degree of perfection. The care of cows; odors in milk; temperature at which milk should be kept; factory needs; the social bearing of the question, &c., &c., which we must gradually take up, and into consideration, as we progress in this branch of dairying. For the present what is positively necessary, leaving minutiæ for the future.

In concluding this paper, in which I could only present a few facts and offer a few suggestions, leaving elaboration for abler pens, I feel to reiterate the advice given in my paper on this subject read before this Board last year. I am, if possible, more fully convinced that dairying, and especially cheese making by the associated or factory system, is a branch of farming for which Maine is peculiarly adapted. Therefore, I again recommend it as a

pleasant business, as a relief to over-worked farmers' wives, as a practical method of converting raw farm products into a concentrated form for marketing, as an enterprise which adds to the beauty and real value of the neighborhood and town, as an investment which makes a fair, direct return in dollars and cents, and above all, as a pivotal point in a system of farming which must gradually improve our farms, by slowly but surely adding to their fertility and value; for, to make cheese we must have milk, and to produce milk we must have more cows, to keep which we must consume our farm products upon our farm, and the manure will thus be returned to fertilize our fields too long impoverished by repeated croppings with inadequate returns.

For these reasons, and others of a minor character which might be adduced, I advise the farmers of Maine to examine this subject fairly, and where local circumstances are favorable introduce associated dairying by factory cheese making, for it seems to me that in entering upon this branch of husbandry we have made a new and improved departure in agriculture, and taken a step which promises well for the future agricultural prosperity of our State.

AGRICULTURAL EDUCATION.

By Charles F. Allen, D.D., President of Maine State College.

When we examine the condition of Agriculture as it has been practiced in England at different epochs, we find that more progress has been made within the last two score of years, than was made in the two preceding centuries; both in respect to the knowledge of principles, or scientific agriculture, and in the use of the best methods of practice, or the true art of farming.

It was the boast of Harrison, a writer in the time of Elizabeth, that great improvement had been made in the condition of the people. "Our countrymen," says he, "are grown to be more painful, skilful and careful, through recompense of gain, than heretofore they have been, so that one acre produces as much now as two acres did formerly. Where are oxen commonly more large of bone, horses more decent and pleasant of pace, sheep more profitable in wool, swine more wholesome in flesh, goats more gainful to their keepers, than here with us?"

When we learn that at that time an acre well manured produced twenty bushels of wheat, thirty of barley, or forty of oats, some may suppose that but little advancement has since been made, for such a crop at the present time would be considered evidence of good husbandry. But when we learn that this was not the average, but the very best that could be produced; that the rotation of crops was of the simplest character, the ground being sown one year to winter wheat or rye, the next year to spring grains, barley or oats, and the third year was allowed to lie fallow; that clover was not introduced, no root crops were raised for forage; that there was a constant interference by Parliament to prevent the agriculturists from pursuing the course which tended to their highest profit, enacting statutes that prohibited the change of arable land to pasturage, limited the number of their flocks, and prohibited the sale of wool to any but licensed manufacturers; that pork was almost the only meat of the people, swine being reckoned of equal value with cows, sheep being raised for wool alone and not for mutton, cattle for draught and not for beef, largeness of bone

being a higher recommendation than beef-producing qualities—we can see that there has been some improvement made in the science of farming, as well as in political economy, since the days of the boastful Harrison in the reign of the virgin queen.

When we inquire into the causes of the great advancement made in the methods of agriculture in England, during the past few years, we shall find that a prominent place must be given to the better education of those having charge of the agricultural interests. The land being in the hands of a few proprietors, the superior scientific training of the landed nobility has its influence, and the high rents demanded of the farmers compel them to avail themselves of all the helps that science can afford.

During the present century pure science has advanced with rapid strides. The questioning spirit, penetrating all the secrets of nature, and claiming to be content with nothing but positive truth, has yet made use of the most daring hypotheses, and has been rewarded with brilliant discoveries. Matter has been more exhaustively analyzed—substances supposed formerly to be simple have been decomposed, and new elements have been discovered. The various changes of substances, and all the wide diversity of phenomena are more accurately observed, more carefully recorded, and more correctly classified; the correlation of forces is ascertained. In truth, a new edition of the laws of nature, interpreted by philosophy, has been published. The researches in pure science have been rewarded by the discovery of many truths formerly hidden from man. Vast regions of the unknown and the mysterious have been conquered by the daring invasions of brilliant imaginations, and are taken into full possession by successive inroads, conducted by patient, thoughtful observers and careful experimentors.

Applied science has made still more wonderful advances; for the principles discovered by pure science are capable of endless combinations. Every principle of chemistry, physics, or physiology, is connected directly or remotely with agricultural processes. A new discovery in the laboratory, of little seeming practical use, may work a revolution in the whole methods of farming.

In the vast improvements made in farm implements we may see the direct application of pure science. The curve of the plowshare, best adapted in different circumstances for the double purpose of turning the furrow and pulverizing the soil, with the least expenditure of force, is determined by mathematical formulæ. By the absolute precision of the principles of applied science, the

inventions of the mechanic, embodying as far as possible in rude matter the true ideal, are brought nearer and nearer to actual perfection. Little progress is expected in the exact sciences. In mathematics we know scarcely more than Euclid taught. But the inductive sciences are still in the vigor of youth; chemistry and physiology have made great progress during recent years, while mineralogy and geology as sciences have had their birth in modern times, and throwing off the rude shells that contained the germs of truth, are gradually assuming definite proportions. The applied sciences have escaped from the thraldom of mere theory. They are now allied with the useful arts, and are prized for their economic value. By the tireless activity and energy of the many French, English, and especially the German investigators, these sciences are brought into industrial pursuits. No longer do mere speculative philosophers hold a monopoly of these principles, to gratify the curiosity of the initiated, or to astonish the unlearned by the utterances of their dicta in pedantic terms. Agricultural chemistry has laid a sure foundation in the study of facts and first principles. Practical farmers have disencumbered it of useless accretions, and are beginning to turn it to profitable, rather than curious results. And so of physiology; applied to man it gives us rules of health, applied to animals it increases the amount of profits from their breeding, use and growth. Vegetable physiology has already accomplished much to aid the agriculturalist in successful farming, though in comparison with its promised future it has but just commenced its career of useful investigation.

Agricultural science in its completeness, embraces nearly every science. It levies its contributions on all the vast resources of human learning, and takes tribute from departments of study apparently most remote. It is intimately related to the natural sciences of geology, mineralogy, meteorology, physics, mechanics, chemistry, botany, zoölogy, and physiology. It has also connection with political economy, social science, law and commerce.

A thorough acquaintance arising from independent and original investigations in all these sciences, is impossible for any one, especially for the one engaged in practical agriculture. The devotion of a life to one department of science, will lead to better results in that specialty than desultory efforts can possibly do. It is therefore for the highest interest of the farmer to avail himself of the results of the labors of the men of science, the discoveries they have made, and the principles they have established.

For a successful application of these principles to economic purposes, the scientific man must become thoroughly acquainted with the details of practice, or the practical man must learn the results of scientific investigation. As the details of practice are as varied as are the circumstances of each farmer, and this can only be fully comprehended by actual work, it is much more feasible for the agriculturist to study the principles applicable to his employment, than for the scientific man to comprehend fully the details of practice so as to answer satisfactorily the questions which press for a solution.

Though the art and science of agriculture are mutually dependent, they are not of equal growth. The art was carried to a large development hundreds of years ago, when the science was in its infancy. The first book in the English language on agricultural chemistry was published eighty years ago. The theories advanced were exceedingly crude; and but little light was shed upon the science of vegetable growth. The first accurate analysis of a vegetable substance was not made till fifteen years after this treatise was published, and another period of fifteen years passed before Liebig worked out his numerous analyses with better appliances. So late as 1838, a German academy offered a prize to any one who would prove, what was then in dispute, that the ingredients of the ashes are essential to vegetable growth. It is only within the last thirty years that agricultural chemistry has rested on any sure foundation of accurate experiment. So of vegetable physiology—our knowledge of the laws of structure and growth in plants is of like recent development. But though thus recent in their application to agriculture, these sciences have afforded great assistance to the art of farming. The crowded population of England, Holland and Germany, can attest to the aid afforded. Seven millions in England are sustained by the increase of products from skilful and scientific farming.

It is worthy of remark, that in modern times profound statesmen, learned philosophers, agriculturists of largest intelligence, and associations of practical men, have recognized the importance of more thorough instruction in the principles of science for the successful prosecution of farming. With great unanimity of opinion, our best educators and our most advanced agriculturists agree that great pecuniary advantage would be secured by a thorough system of instruction of farmers in the science of agri-

culture. So thorough was this conviction in Europe, that especial institutions for agricultural instruction have been founded in England, and a larger number of these schools together with experimental stations have been established in Germany, which are now in successful operation.

In our own country, besides the scientific schools and departments in the colleges, which are concessions made to the growing sentiment of the need of technical and industrial education, something has been attempted on a larger scale. The Congress of the United States set apart a quantity of land, equal to thirty thousand acres for each senator and representative in Congress, and gave to the States this princely domain, amounting in the aggregate to ten millions of acres—larger in extent than the kingdom of Belgium with its five million inhabitants. The condition imposed on the recipients of this magnificent donation, was, that each State should establish at least one college whose leading object should be to teach those studies that relate directly to industrial pursuits and tend to promote agriculture and the mechanical arts.

The results of the efforts of this new education in Europe, is seen in the improved methods of culture adopted by farmers, the larger crops and the better condition of the farms, as well as the advancement in knowledge of those who have made agricultural science their work.

The diffusion of intelligence and promotion of agricultural education in our own country has not been without some manifest results. Some check has been put to the former prevalent, reckless manner of wasting the soil by exhausting processes of culture and then abandoning the worn out farms to take up new and virgin soil, and to repeat the same destructive process. Some of these old farms have been reclaimed. Better systems of tillage have afforded to the better instructed farmer more remunerative crops and continual improvement of the soil. This desirable result has been manifested, especially near our cities and larger towns, where the high price of land has induced greater care in the utilizing of waste materials for the fertilization of the soil, and where larger capital was invested and skilled labor employed. The system of farm drainage, the manufacture of composts, and the use of commercial fertilizers, have been more intelligently and successfully employed. The improvements made in the breed and in the better treatment of horses, sheep and cattle, is another advance in husbandry. The use of labor-saving machines has

lifted the employment out of the condition of incessant drudgery to a higher plane, giving more scope for mental activity. The increased facilities of a railroad communication by which surplus products are easily brought to market, render it more practicable to attend to special farming. Individuals giving their whole attention to one department of husbandry, acquire by continued practice greater skill, and are thus enabled to raise larger crops with less expenditure, thus realizing larger profits.

But while we admit all the advancements made in the methods of agriculture, and the increase of knowledge, we must admit there is still large room for improvement. Many important principles in the science of agriculture are still held in doubt, many problems remain unsolved, many important questions continue unanswered. They cannot be determined by the man of science, for lack of necessary facts; nor can they be settled by those who should be familiar with the facts, but who for lack of that education which disciplines the powers of observation, having eyes see not, and who cannot bring a cultivated judgment to bear upon the subject in question. Too often inherited prejudices and traditionary maxims impede the progress of intelligence.

On the other hand, there is too much occasion for the distrust of science and book-farming manifested by shrewd agriculturists, arising from the liability of farmers to be misled by the pretensions of those who claim to be scientific guides, to new and improved methods of husbandry. A little science is a dangerous thing when it is used so unconscionably as some use it, who for selfish ends would impose their notions on the credulous and unsuspecting—whether the vender of patents, with oily tongue and scientific phrases seeks to palm off some worthless machine or new fertilizer, or the wild theorist, imagining he has made some wonderful discovery, would persuade others to try the costly experiment.

Nor will the most truly learned and scientific agriculturist succeed in the practical work of the farm without that knowledge of the art which comes alone by actual practice. Nothing but the combination of science and art, theory and practice, the disciplined intellect and the trained muscles, will advance the cause of agriculture to its desired prominence.

Another advantage of agricultural education, besides the economic value of skilled labor, is the correction of the false impression in regard to the dignity of industrial pursuits. The growing

indisposition among young men to engage in farming is due to the habitual notion of the better educated classes, that agriculturists are inferior in natural ability or in the higher intellectual qualities to the non-producing class. So long as it is considered a necessary truth that he that raises stock on the farm is inferior in intellectual vigor, moral worth, or social position to him that deals in stocks at the exchange, so long will the young farmer sigh for the position of a banker's clerk, and the height of his ambition will be to run the career of a Jim Fiske or a Jay Cooke. In fact, honest, industrious workers are above those that affect to look down upon them. It requires more nervous energy and mental vigor to raise crops than the glib shopman needs to offer them for sale. The successful herdsman, or the prosperous market-gardener, is by profession more accomplished than a small trader, or a deputy sheriff. The farmer's great want is to regain his true position, where he can make his capabilities and his requirements felt, then will his mental power become magnificent. Our industrial, and our social system, under the old forms of education, both unite in giving to literary culture a higher place than to scientific attainments. If we begin by asserting that mental discipline is really and truly attained by studying science, as well as by studying the classics, that words are of less consequence than things, that action is better than words, we are only uttering self-evident truths, but these truths admitted would lead to the inference that he who makes most use of these great principles of science, and when successful must study the plan and act in harmony with the will of his Creator, has need of the best education. So long as society demands cultured manners and social refinement, our farmers must not be surprised if in the neglect of these things their position is accorded far below their real worth. Nor is there any just reason why such advantages of courtesy and refinement should be better acquired by him who spends his days in a dingy counting room, than by him who works in the glad sunshine. There is nothing in the employment of the farmer more uncongenial to good manners than is found in the constant practice of the lawyer dealing with the worst passions, dishonesties and crimes of society; or of the physician, dealing with all forms of physical disease.

There are many reasons why Americans should attain a high position for skill in the science and art of agriculture. They have always manifested an acute instinct for invention, and a great readiness in applying scientific principles to useful ends. The

laboring man has a better social standing, and the more active sympathy of the great public than in the old world. In the eye of the law, and in the theory of our government, he is the peer of the noblest in the land; no official position is too high for his aspiration. His pecuniary interests urge him to higher attainments in knowledge, his social relations demand increased intelligence. Here would seem to be all the conditions for an advanced nation of farmers and mechanics, giving to labor dignity, and ennobling their work by refinement of taste and courtesy of deportment.

If we seek for causes why these favorable conditions have not resulted in greater advancement, and why there is manifested such a dislike for industrial pursuits, we shall find among the causes that the passion for money making, everywhere common, but in this country meeting with such favorable opportunities, is perhaps the most prominent,—young men cannot wait for the slow and sure returns of husbandry. The golden stream must be swift and copious. The young man with his little capital goes out West, not to purchase a farm and live upon it, but to buy corner lots for speculation. The old homestead is sold that the young heir may rush to the city and shave notes. Boys leave the farm that they may become mercantile runners, or insurance agents, for in these employments there is apparently larger pay, though when the expenses are subtracted there is but small remuneration. But another prominent cause of this neglect of farming and other industrial pursuits is the system of education pursued. The tendency is, to educate away from work. The sons of mechanics go to college, or rather are sent to college, not that they may return educated mechanics, but that they may not be under the necessity of working. The farmer sends his boy to college, that he may take a better position in society, and be above the necessity of labor. If one after graduating from a classical college should settle down in some useful avocation of industrial pursuits he is thought to have made but a poor use of the privileges enjoyed, or is sadly degenerated; so that as education is increased, the industrial pursuits are more and more thrown into the hands of the crowd of immigrants that flock to our shores. Refinement, culture, literary spirit and poetic fancy, stand in opposition to the harshness of manual labor.

We know something of the value of classical training, we appreciate fully the arguments in its favor. We do not believe that there should be any abatement made in the study of the fair

humanities of olden time. We cheerfully concede that the claims of those who advocate sound scholarship are just. We wish not to diminish the number nor circumscribe the progress of the students who would take this course. We should rejoice to see them largely increased, and we are jealous of any interference of what may be deemed more utilitarian studies in the curriculum of the classical college.

We need a pious and learned ministry, accomplished and scholarly jurists, thoroughly honest and well educated statesmen, authors to tread the paths of literature and general scholarship, and educators of large culture and extensive knowledge. And where shall we expect to train our youth for these high and commanding positions, but under those classic shades where learning has garnered the richest treasures of thought, and where the bright succession of cultivated intellects has handed down undimmed the sacred fire? But, as we have seen, there are other needs essential to national prosperity and individual welfare, that must be met by another kind of culture, by an education especially adapted for those who are to make industrial pursuits their profession. We do not send the young theologian to a military academy for his mental discipline, nor our soldiers to be trained for generals to a divinity school. Nor need we expect that the wants of a superior agricultural education will be supplied in a classical college. That some who have stood foremost in agricultural science were graduates of old universities, is true, but we venture the assertion that they have forgotten all the Greek, and most of the Latin they have ever studied, and that they themselves, with their riper experience, would insist that there is a more direct path and an easier entrance to the temple of science, than that which leads by devious course through the eastern gate. What we insist upon is, that he who has thoroughly prepared his mind best to enter upon some useful employment, disciplined by severe study, enlarged by copious information, ready for action by well directed exercise, stands the peer of the proudest scholar in the land; that the study of science can discipline the mind, enlarge the understanding, arouse the imagination, elevate the taste and refine the manners, as effectively as the study of literature; that applying science to practical ends, does not degrade learning, but ennobles it. The true glory of education is its abundant fruit. They who from the deep furrows of a well cultivated intellect are able to bring forth the greatest harvest of use-

fulness, who can sow by all waters, are best deserving the appellation of liberally educated.

These, then, are the ends to be pursued in the highest form of agricultural education. First—To raise up those who can successfully stand interpreters between pure science and useful labor, and apply recondite principles to the varied details of practical life, so as to secure abundant harvests without the deterioration of the soil, the best products of herds and flocks with the least expenditure, a competence of worldy good and the joy of intelligent success. Second—To elevate the farmers' calling and make it worthy the choice of the best of our young men. To withdraw the aspiring from the fevered dreams of speculation to the surer returns of healthy, honest, toil, from over-crowded professions to productive employments, from a life of harrassing care to the calm content of honorable independence. And this can only be effected by an education, especially adapted in its aims and methods to this result, and equal in its extent to any form of culture in the land. No mere professional school, with its narrow, one-sided, unsymmetrical developments, no niggardly parsimonious supply of facilities, can answer the demands of the age.

A change has come over the whole system of training for the various professions and pursuits of life. Time was when the young theologian was domiciled with some famous divine, studied his books, copied his sermons, attended his exercises, and was developed under his direction into a preacher. So of the lawyer and the physician, they studied the science and the details of their profession in an apprenticeship to some competent practitioner. Now, we have theological seminaries, law schools and medical schools,—even the rough trade of war is not learned on the tented field, but in piping times of peace, is acquired at the military academy. If the various forms of mechanics can be better taught in schools of technology, and be better pursued by associated action, we need not wonder that it is found necessary for agriculture to have its schools. It is no use to say we must go back to old time usages, the dead past has buried its dead, and we are to act in the living present. There is a call for associated dairying —and for associated instruction our youth must be gathered together. Under the combined influence of skilful teachers and the enlivening power of sympathetic companionship, they will be better led to the knowledge of agricultural science.

In connection with this higher agricultural education, which but comparatively few can or will attain, a better scientific and technical education should be furnished in our public schools. Our free high schools in city or country are not to be mere classical institutes. A great proportion of the graduates go forth at once into the varied avocations of life. How little that is now taught in these schools has any relation to a farmer's life. When intelligent, liberally educated agriculturists have a place on the boards of education, there will be some changes in the course of study.

In addition to the efforts put forth to instruct the youth in those applied sciences that have so much connection with the advancement of useful knowledge, we must allude to the means of spreading intelligence. Through the periodical press myriads of homes are reached, and thus

> "Each ray of brightness sent to aid
> In man's maturer day his bolder sight,
> All mingled like the rainbow's radiant braid,
> Pour yet, and still shall pour, the blaze that cannot fade."

The highly prized weekly repository of current agricultural thought, the illuminated monthly, and the grave quarterly, laden with the substantial products of the mind, all minister in this grand service. The department at Washington furnishes the tabulated statistics, by which hasty generalization from insufficient data may be corrected. Many advanced agricultural writers are giving to the public the ripened fruit of their life work.

Among the causes that have hindered hitherto the advancement of agricultural knowledge, is reckoned the isolation of the farmer. With all the independence of one who walks lord of his own domain, there is, from the necessity of the case, less of the polish that comes from attrition to those that press through the crowded streets, or move in the thronged marts, where business is transacted. The farmer's life is to a great extent away from society. Doubly valuable, therefore, to him is the farmer's club, or the meeting of the agricultural society, where, in the interchange of thought, not only pleasure is secured, good fellowship maintained, and social advantages promoted, but he may become better instructed in the mysteries of his art. The advancement of agricultural education through these associations cannot easily be computed.

The efforts of Maine to promote agricultural science, have certainly produced some valuable fruit. And I trust, gentlemen, that

we as members of this Board, may, in the discharge of our duty, not be wanting in what is justly required at our hands, being fully persuaded our great work, with pen and voice and influence, is to promote throughout the length and breadth of the State a better Agricultural Education.

LABOR AND CAPITAL.

By B. M. Hight, Member from Maine State Agricultural Society.

There is no design to discuss labor and capital in the aspect often debated, and yet seldom understood, as two classes, or representing two classes, where interests are opposite and almost of necessity antagonistic.

Perhaps it might be practical, and in some sense relevant to the object of our meeting, if we could show the real inter-dependence of labor and capital, and that the true use and advancement of one is the surest guarantee of the advancement of the other; that they are not antagonistic except as folly and selfishness have made them so; and that the cure of the ills which are charged now to labor and now to capital, is not to be found in a re-organization of society, but in understanding and applying the principles of justice and benevolence. But, as I said before, there is no intention to discuss this subject in such direction, but simply consider the necessity of capital to the farmer to supplement or rather to the complement of his labor; that his labor may not be hampered and in large degree lost, or profitless.

To suggest just what I have in mind, allow me to refer to one thing coming within my knowledge: In 1866, Messrs. A. & P. Coburn purchased near Skowhegan village, a run out farm of 100 acres. The soil was varied—clay, clay loam, sand, gravel and muck. At the time of purchase it produced about six tons of hay, and other crops in proportion, and would *poorly* pasture *two* cows and a horse. Lookers-on said it was bought on account of a splendid mill privilege on one side, and was to be cut up into house lots and streets; but these prophets were mistaken. The Coburns had farming and brick making, as well as lumbering "on the brain." By a liberal application of labor, stable dressing, muck, lime, ashes, and salt, bountiful crops were produced. The first year after the purchase there were harvested from the farm 668 bushels barley, 1,500 bushels potatoes, and 300 bushels of other root crops. The second year 75 tons of hay were cut, and

1,200,000 bricks made. The third year 100 tons of hay were cut, and about the same number of brick were made as the previous year. To-day it is one of the best hay farms in the town of Skowhegan. In 1869, conversing with Hon. Philander Coburn, he called my attention to a field of grass on his farm, and asked me what I thought of it? The answer was, "If I could have the handling of Coburn's pocket-book for two or three years, I could do as well or better on my farm." He replied: "I do not know about Coburn's pocket-book, but I do know that a man cannot make much headway in farming without something to do with." This contains the gist of the matter—the farm needs capital.

The fact is about this: A large majority of farmers have been, and are still obliged to a considerable extent, to rely on the native fertility of the soil, not being able to afford to use largely either labor or money in applying manures. All admit, that to raise and gather poor crops, costs nearly as much as to raise and gather good ones. High wages takes all the profit of the poor crop, while the good crops give a handsome balance.

Look at the situation from any point you choose, one fact stands out prominently; the real advantage of improved farming. The great want for this is capital. And till this is removed, it will continue a powerful drawback. To carry on his business the farmer needs capital as much as the merchant; but look at the difference in respect to obtaining it. As business is now done, it is rare that the mere farmer gets any accommodations from the bank. The number of farmers is small that have the amount of capital that could be used to advantage.

The need of capital is certainly as great to the farmer as to the merchant; but note the difference in obtaining it as a loan. A merchant, worth $5,000, can and will often borrow directly or indirectly, $10,000 or $15,000. He will give notes for goods, on three, four or six months; takes notes from those to whom he sells and has them discounted at the bank. In this way an enterprising merchant sometimes borrows three or four times his original capital. How is it with the farmer? One worth $5,000, seldom uses his credit to obtain capital to apply in farm operations. His credit is good, but the banks will not accommodate him, because he needs the loan for nine months or a year, and the banks can make more money on shorter paper. In legitimate operations the farmer cannot turn his money in the shorter time, hence he is not safe in giving three months' paper, for then most likely it must be

renewed or he must sacrifice something to meet it. There are two ways in which this difficulty may be remedied in part. First, a superabundance of capital seeking investment at a low rate of interest. Second, a better knowledge of farmers and their wants on the part of bank managers and capitalists, so they shall understand the necessity and benefit of the farmers using money in a better system of agriculture. Perhaps I shall be met with the common plea that as farmers are producers they should not be under the necessity of borrowing capital as men who are engaged in traffic as merchants; that all the bank the farmer should ask to discount to him is the earth bank of his own farm.

There is a certain amount of truth and force in the thought that the farmer is a producer. But I imagine that farmers are traders as well as producers. If I raise stock for beef and sell it when half fat, I am only a producer and a poor one at that. If I raise hay, corn, oats and barley and sell them to the lumbermen, I am a producer, though of doubtful economy, for I have not put them into the most profitable shape for shipping. Now suppose I feed out this hay and grain to stock and then sell the stock, I am both a trader and manufacturer. The stock and the grain are the raw material out of which beef and dressing are manufactured. For this reason I am warranted on the ordinary principles of business to borrow money from the bank. If I sell the stock and grain to the middle-men instead of fattening them myself on the farm, they borrow money from the bank and no questions are asked. Carry this thought a little further. It is not exaggeration to say that thousands of half fatted beeves are sold from our farms weekly. Would it not pay for the farmers to get them in ripe condition before disposing of them. Sometimes he has not the grain to do it, and has not the money to buy with, hence he must sacrifice the larger profit of raising. Sometimes when he has the material he lacks confidence to hold on and feed it out, because he has money to make out and he may not wait to take advantage of the market for the bank men will look coldly on his application to borrow; hence he must sacrifice on his stock to his own loss as well as loss of the community or consumer. To his own loss for it is well known that the profit of fattening animals is largely in the last month; to the loss of the consumer for it is not good economy to purchase half fattened beef.

We have suggested but a single aspect, and that a minor one, in which capital is essential to the farmer. Instances might be

multipled to an indefinite extent. Take one thing in the line of stock. While we do not intend to suggest that it is wise or profitable for the common farmer to go into the business of having fancy stock with fancy prices and thus go into competition with men of large wealth, we do think that the common farm stock may be greatly improved by the introduction of better breeds, such as shall give more profit on cost and cost of keeping. The difference in the cost of keeping a poor cow, who gives to her owner a net profit of twenty dollars per year, and keeping a good one who gives a net profit of seventy-five dollars per year, is very small indeed, while the difference is considerable to the owner's pocket. So in the matter of working oxen. It costs more, so far as feed is concerned, to bring up to seven feet a pair of steers of a breed that make tough, poor, beef, than it does to bring up to seven feet a pair of steers of a breed that make fat, tender, juicy, beef; and the profit in selling is very largely in favor of the last. So it is with any animal on the farm. The farmer *cannot afford* to have poor oxen or cows or hogs or sheep. But how many there are who are compelled for want of capital to have such stock, and thus the road is blocked to profitable farming; and though working hard, it is with tied hands, and in the words of the homely old proverb, they are compelled "To scratch poor men's heads all their days," or in the words of the wise man, "*The destruction of of the poor is their poverty.*"

Take as another illustration the farmer's need of capital to use in the renovation of run down farms, and in taking advantage of the suggestions of science and skill in improved methods of farming. I shall not beg leave to do so, but shall as a positive duty use the liberty of differing squarely with the author of "Brains in Agriculture," as he presents the subject in the volume of the Agriculture of Maine for 1873. He says, "In the three great sciences Medicine, Agriculture and Society, we find only the most meagre report of advance made." * * * "Nor is there the slightest reason for supposing that the case as here stated, will be greatly altered in the coming times. The laws that have been given to these two different classes of objects will remain as they are to-day, and the inference is forced irresistibly upon us that any very great advance in agriculture as a science, which has to do with living organism in the vegetable world, is no more to be looked for than is a similar advance in medicine, where duties are of a like kind in the animal world."

I do not know just what abnormal thought the writer, quoted above, had in his mind when he speaks of the "science of agriculture." But if he used the word science in the sense of *knowledge*, comprehension, information, truth ascertained or knowledge of facts explained or accounted for, then his statement "*that we find only the most meagre report of advance made in the science of agriculture*," is most certainly a great mistake. Advances have been made which are neither few nor small nor unimportant. To recall only some minor ones. In the matter of stock-breeding and raising. The knowledge gained in this and the phenomena rated and classed, and the results predicted, cannot justly be called a "meagre advance." I will not say it is a principle in nature, for such a mode of expression may give a wrong idea, but will say it is a fact of phenomena, that natural products are originated in the crudest forms and that to man's industry and perseverance is left the development of their latent excellencies. So that without exceeding the bounds of sober speech, we may say that some of the most wonderful and most necessary for man's uses of the things of creation, are stored in man's intelligences, to be brought out by his persevering industry. Nature's flowers are single; brains applied to "organic" life have brought forth the gorgeous products of the garden and green-house. Let one examine but one well kept flower garden, remembering that these are not natural but artificial products, and he will hardly say that agricultural advance is "most meagre." Our apples, pears, plums and peaches are the cultivated products of crude, tasteless and useless products of natural fruit. Is it only a meagre advance that has given us these luscious, useful fruits?

We know not where to stop when we enter this field. It may be that when we enter the field of agricultural science, we have to do with organic life, but it is organized life, in the form designed and best adapted to stimulate man's intelligent industry, to bring out these products which shall best conserve his own happiness and comfort.

As another illustration of the absurdity of saying that "the most meagre report of advances is made in the sciences of agriculture," take the wheat of to-day, and think what it is and the place it fills; and then follow it back through many centuries of changes in the hands of man till you reach the crude natural product, which may yet be found in upper Egypt entirely unfit for bread; then tell me, is it a "meagre advance" from one to the

other? If our friend who places agricultural science in such a deep, dark dungeon, and locks it there, throwing away the key—if he could be compelled to eat for a few weeks, of the wild, natural wheat of upper Egypt, he doubtless would have a more vivid and correct conception of the advance made in agricultural science. It cannot justly be called a meagre advance in knowledge of agriculture—what has been learned and settled of the constitution of soils, and the chemical constituents of manures and fertilizers—and hence how and for what crops to apply them. But we forbear, lest we seem to have lost sight of our original subject.

It is a painful fact, to which we alluded just now, in saying that the farmer needed capital to use in renovating run down farms. Very many of our farms in Maine are run down, and there is a necessity for them to be brought up. The process of depletion has in some cases been going on for a long time. But it has been the same process as a merchant exchanges his funds in the bank, drawing out faster than he puts in. Our farms have been drawn upon by cropping and re-cropping, and no adequate return made, so they have given out, exhausted. Now, if there is capital to purchase and apply fertilizers, and make use of the other means of recuperation which science and experience bring to us, the progress of restoring need not be as the process of depletion. But the first want is capital; capital for suitable tools, for fencing and underdraining; capital for manure, for the best and most profitable stock, and then capital to feed them till the farm is in condition to make return for the investments made. And such investments, if made judiciously, are safe and sure.

There is not a lack of knowledge, or rather of information, on matters connected with agriculture, but we do need capital. It has been said, that "Labor conquers all things." Perhaps so; but labor and capital rightly applied can make an agricultural garden of the hard soil in the hard climate of Maine. So mote it be.

THE DAIRY COW—WHAT SHE IS AND WHENCE SHE CAME.

By Dr. E. Lewis Sturtevant, South Framingham, Mass.

Throughout the civilized countries of the globe the dairy cow occupies an important and essential position. From her is obtained not only many of the luxuries, but we may almost say the necessaries of life; for so accustomed are we to the use of milk and its products, butter and cheese, that their deprivation would seem to us an overpowering misfortune.

The cow is the female of the genus *Bos*. Her province is to perpetuate the species and rear her calf, and the wants born of civilization concern her but little. Her milk is yielded but in small quantity, and that only for a short time from calving, and only in the presence of her calf. If the calf dies, the milk ceases to flow. In those countries of South America where the semi-wild cattle roam the pampas in immense numbers, milk is a luxury seldom indulged in by the natives, and when obtained, the cow is lassoed, and while securely held, a small quantity is extracted from the teats of the kicking and struggling animal; among the table lands of Columbia, it is only by allowing the calf to run with the mother by day, that the small quantity of milk can be obtained at night.

The dairy cow is an animal that has been trained through human art, to the production of milk. She is not only the female of her race,—she not only perpetuates her kind and rears her calf,—but she yields a large surplus for the supply of the wants induced by civilization. The flow, instead of being cotemporaneous with the presence of the calf, can be drawn and is drawn by the milker without reference to the presence of the calf. The flow extends over several months of the year; the animal is docile, quiet and intelligent. Her udder is better developed than in the semi-wild cow, her build of body and physiological functions are those conducive to a more economical preparation of those products which are derived from her.

Neither the cow nor the dairy cow is a native production of America. They were introduced from the old world. We have record of their being introduced in 1493 by Columbus, from Spain, and again in 1518, by Baron de Levy, at Sable Island, and off the coast of Nova Scotia. In 1553 the Portugese brought cattle to New Foundland and Nova Scotia; in 1608 the French extended their settlement into Canada, and carried with them various animals. Cows were brought to Virginia from the West Indies by Sir Ralph Lane, in 1610. Dutch cows were brought into New York from Holland in 1614, and again in 1625. Swedish cattle were carried to Delaware in 1627, and in 1629 about a hundred cattle were brought into Massachusetts, probably from England. New Hampshire received cattle from Denmark in 1631 or 1632. Virginia received cattle from Devonshire and Herefordshire, England, in 1711. In 1797 we have the first record of the importation of a Shorthorn. From these diverse breeds, have the cattle of this country originated. From this production our present cattle have been gradually builded up, I am happy to say of late years, with a large infusion of thoroughbred blood.

We find record of but few systematic attempts at breeding previous to the revolution. In the present century, the importations of thoroughbreds have been quite numerous, and their influence wide-spread, but it is to the earlier importations that we owe the animals upon which any attempt at improvement was to be made. At the earlier periods, New York and New England must have had the better dairy stock; and this also, coupled with a stronger genius for the importing of superior animals, partly the circumstance of location and climate, and in part the tendency of the stock from which the inhabitants were derived. In Florida we see indications in the cattle, of the Spanish stock from which they were derived, and in the Texan animal we have a similar resemblance. In New York we often see the black and white cow in their pastures, a strong reminder of the original Dutch stock; and the yellow cattle which a few years ago were seen in New Hampshire, quite likely could trace their ancestors back to the original Danes. In Maine, we have the assurance that the presence of a few Shorthorn bulls, but comparatively a few years ago, has produced an influence upon the stock of your State, which was wide-spread.

In 1869, according to the census, we had as a partial product from the dairy cow:

	Milch Cows.	Lbs. Butter.	Lbs. Cheese.
1850.....	6,385,094	313,345,306	105,535,893
1860	8,581,735	459,681,372	103,663,927
1870	11,008,925	470,536,468	114,154,211

In 1864, in the one State of New York, with 1,195,481 cows, we have given the production of 84,584,458 pounds of butter, 72,195,337 pounds of cheese and 29,631,530 gallons of milk.

According to the census results we then have for the production of the dairy cow throughout the United States, an average of 500 quarts a year, or adding to this amount twenty per cent., the proportion of milk sold in addition to butter and cheese made, we have 600 quarts. Upon a careful examination of all the records bearing on the milk yield of New York,* the best dairy State of America, it seems incontestable that the average for the dairy cow in this dairy district is not in excess of 1,350 quarts, and a probable average of but 1,200 quarts. From the same examination it can be stated as a fact, that the yield of superior dairies in this State will not average over 1,800 quarts, and the possible yield of superior dairies cannot well exceed 2,300 quarts.†

We can now summarize our results in a table. The yield of the cow for human needs is nothing. The yield of the dairy cow is about 600 quarts yearly for the country at large. The yield of the dairy cow for the best dairy districts is about 1,200 or 1,300 quarts.

Returning now to our original starting point, we find that the cow produces neither butter nor cheese for human needs, while the dairy cow furnishes an amount yearly which is of very high value. In the State of New York, each dairy cow yields about 300 pounds of cured cheese annually, or about 125 pounds of butter. These numbers then, with the proportionate quantity of milk required for a pound of cured cheese, 9.8 pounds, and of butter, 23 pounds, may be considered as appertaining to the native dairy cow in favorable dairy regions.

The cow may now be described, and it may be as well to described the Texan as any other variety. In stature they are medium, coarse and sleazily built, with large bone and horn. They are but moderately fleshed, and that flesh, in its natural and

* See Country Gentleman of Oct. 30, Nov. 6, Nov. 13, Nov. 20, 1873; article "Dairy Cattle."

† It will be remembered that we are speaking of the average for a series of years for the whole herd, and of numerous herds.

wild condition, when compared with our own good native beef is coarse, flabby and stringy. Savage and semi-wild in habit, they come into domestication reluctantly; yet in many instances when well tended and fed on our best pastures, and "finished off" on corn, after the manner of our good graziers and breeders, they yield a passable carcass of beef, but at more expense of food than those reared and fed in our own State.* Their udders are poorly developed, and they furnish little milk beyond the wants of their calves.

On the other hand, the native cattle of Maine and New England, which up to 1718 were a mixture of the Denmarks, the Devons, and probably black cattle brought over from the Spanish Main, are now animals of fair quality, improved by the Vaughan importations, the Prize bull, dating back to about the time of the revolution, and numerous importations of late years. They are of good size, showing considerable of the Shorthorn, Hereford, Devon, and of late years, the Ayrshire and Jersey cows. Their bones are fairly fine, their bodies are not very coarse, they feed with considerable economy, and yield a fair flow of milk. They are dairy cattle, far superior to the average of the country.

We have now seen the difference between the cow, as a natural production, and the dairy cow, the animal brought about by human care. Let us go still further and see whether the dairy cows differ among themselves. We take from Weckherlius the estimated yield of the dairy cow in different countries:

Switzerland	4560	lbs., or about	2120	qts.
Saxony	3780	" "	1760	"
Wurtemberg	3856	" "	1780	"
Holstein	2800	" "	1300	"
Hamburg	5440	" "	2500	"
Holland	4200	" "	1950	"
Belgium	4900	" "	2275	"
Prussia	3272	" "	1500	"
We add ourselves in the				
United States	1300	" "	600	"
New York State	2800	" "	1300	"

We will now take from the same authority a statement of yields by breeds.

* New York State Report on Texas Cattle Disease, 1869, p. 17.

Freesland breed	6548	lbs.	or about	3000	qts.
Allgau, Swabian Limburg	4652	"	"	2160	"
Hungarian Allgau	3040	"	"	1410	"
Large Swiss, Hofwyl	4560	"	"	2120	"
Hamburg, large Marsh cows	7800	"	"	3600	"
Highland cow	3080	"	"	1430	"
Holland, large Lowland	4200	"	"	1950	"
Voightland	3320	"	"	1550	"
Teeswater	4912	"	"	2300	"
Yorkshire	5124	"	"	2380	"
Devonshire	2816	"	"	1310	"
Suffolk	4208	"	"	1950	"
Herefords	2316	"	"	1075	"
Alderney	3860	"	"	1790	"
Schwytz	5764	"	"	2680	"
Uri and Hasli	4732	"	"	2200	"
Gunter	5056	"	"	2350	"
Murzthal	3220	"	"	1500	"
Ayrshire (Aiton)	4618	"	"	2150	"

We have in these tables evidence of the widely differing capacity of yield of the dairy cow, although these tables are of no value of themselves, as the figures are in the majority of instances not given from any average series of observations, but are individual conjectures.

To show the differences which may occur between the cows of a herd, I have examined the records of Waushakum herd for 1867, where I found that out of twenty-five native cows, the four best yielded 3037 quarts, and the four poorest 803 quarts of milk. The average of the whole herd being 2174 quarts.

As a maximum product, we have record of a yield, authenticated by the Board of Agriculture of England, of a cow belonging to the gaol at Lewes, which yielded in eight consecutive years, 9720 gallons, or at the rate of 1215 gallons per annum. In one year she milked 328 days and gave 1230 gallons, which yielded 540 pounds of butter, or at the rate of one pound of butter to twenty-two of milk.

These extremes, (the yield of the cow, nil, of this wondrous cow at Lewes, 4860 quarts for eight successive years,) are full of significance in the study of the dairy cow. Whence this difference; through what process has it been obtained? Why the

difference between the individual cows of the same herd,—between the yields of various breeds, and the average of various countries? If we perceive whence the dairy cow comes, and the methods through which these differences were obtained, cannot we then as a practical result, continue the improvement of such cattle as we have, by pursuing the same course?

The most obvious feature that strikes us as we review the cattle of the world, is that their dairy qualities depend far less on the feed which they obtain, than they do upon the care which they receive. Wherever we find dairy qualities appreciated there we find a good cow, and in such regions we invariably find the better cow in the possession of such people as have the greatest amount of practical intelligence.

Our next observation must be that in the best dairy cow of the several countries, we find a certain similarity of shape. Thus, in England, the old Yorkshire cow and the polled Suffolk; the Ayrshire in Scotland, the Kerry of Ireland, forming our judgment from those specimens which have been imported into America. The little Brittainies of France; the Maroillaise variety of the Flamand race in France. Where the production of beef and milk is combined, as is usually attempted on the continent, we find an approach towards the dairy shape, without the perfect attainment.

The dairy shape is the production of knowledge. It is the result of the practical appreciation of the breeder of known laws affecting animal structure. It is found that the milk is made from the food in the belly; a large belly is therefore desired. It is found that the milk is manufactured and stored in the udder; an udder most economical for these purposes is sought. Certain shapes are seen to accompany thrift; such shapes are immediately sought after. It is observed that cows of a certain shape give more milk from their feed than do other cows, and behold the discovery of a physiological law that when nutriment goes to one part of the body in excess, there is liable to be a deficiency in another part of the body. Thus the process went forward, until certain general shapes are now looked for in dairy breeds, irrespective of the race to which they belong,—shapes which are the outcome of human art, and which are not found in the unimproved races. Neither are they found in the meat-producing breeds.

These shapes are size of udder, with broad attachments, broad belly, and wide hip bones, long body and long pelvis, and a gen-

eral lightness to the forequarters. These shapes, being artificial, have been produced through human agencies, acting on plastic animal matter, in the direction to produce these results. In just so far as this action has been pursued with intelligence, has the dairy cow been brought to the highest perfection; and were equal skill brought to bear on our cattle, even of widely differing races, through the laws of breeding, we would find a striking resemblance in essential features. What has been sought for in dairy breeds is strikingly illustrated by the colation of points of six noted dairy breeds:

The Fifeshire, as described by Magne.
The Yorkshire, by Haxton.
The Jersey, by Allen.
The Suffolk by Kirby.
The Brittany, by Gamgee.
The Ayrshire, by Aiton.

The preponderance of points, where mentioned, is as follows:

Head, long.	Thighs, flat and thin.
Muzzle, fine.	Ribs, arched.
Throat, clear.	Pelvis, roomy.
Neck, slender.	Belly, large.
Shoulders, thin.	Legs, small and short.
Chest, deep.	Udder, large,
Brisket, small.	square,
Back, straight.	well formed.

How then have these points been obtained; or, in other words, whence the dairy breed?

The law of inheritance is that "like produces like." This is universal, never failing, and unchangeable. Whenever like causes an acting in a like manner on like material, there is always a like effect produced. The law of inheritance, notwithstanding its absolute truth, is interfered with by the presence of conflicting laws, which oftentimes disguise its phenomena.

Let us illustrate: No one can be found so ignorant as to deny the law of gravity. As a law, gravity is universal, never failing and absolute. Through its action a body dropped from a height, will reach the ground, and the line of direction to its fall will be a perpendicular. But suppose, through the action of a spring or otherwise a sideways motion should be given to the falling body; the downward tendency is not destroyed, but the perpendicularity

of direction is. Through the application of the law of gravity, uninterfered with by other forces, we could always determine the point from which a falling body has started, by drawing a line perpendicular to the earth, at the point of impact. But the flowing stream can be traced to its source in no such way as this, although its motion is caused by this same law of gravity. Its direction is continually changed through the resisting power of matter, although gravity overrules and the course is continually downward.

Inheritance is the expression of a law of forces; that as forces cannot be self-originating, the present force must be dependent on past force, and must partake of its nature. That forces may meet with opposing forces, which may determine its direction, and may even produce an equilibrium, we shall see, by again using our mountain stream as an illustration. Through the force of gravity it continually seeks a lower direction. If no opposing obstacles interfere, we have the waterfall. But the resisting rocks and earth change the perpendicular direction impressed by the law of gravity, to a downward direction only, and therefore crooks and turns, with perhaps the smooth lake and level reach now and then, where the motion is apparently destroyed, until it reaches the sea, and opposing forces have checked the downward flow, and gravity is represented but by weight. So much of the law of gravity which gives force of position, has been taken away by the conflict, and the force thus apparently lost, has sought other forms of action.

Through the recognition of the effect of opposing laws in the law of inheritance, we have for breeders use a new formula, 'Heredity with variation.' And it is by the skillful use of these two formulæ, that the breeder is enabled to form his cow in the most useful type. Inheritance like the force of gravity is the underlying law which keeps all in motion. It tends to restrain the race and breed within constituted types, through its continual presence and action. Opposing forces of inheritance and environment continually act to change the type of the individual, and through him, the race.

As inheritance is an expression of the law of forces, in the direction of vital phenomena, we may apply to it certain mathematical or mechanical processes; we may change the concrete forces by addition or subtraction of force; we may change the concrete force by changing its direction, yet still the law of

inheritance remains as a guiding thread, to restrain these forces within defined limits.

Under the opposing laws of inheritance comes very many diverse forces to modify the results obtained under the previous law. It is by the use of these laws that man is enabled to mould the animal form and function to his wishes. The knowledge of the law of inheritance is useful in directing us in the search for desired types in the first place. The laws governing inheritance, the laws governing variability, are the necessities to the breeder who seeks to retain a type already possessed, or to form a type suited to his wishes.

Selection, or the continual choosing of the animal which comes nearest to our desired form, is one of the most important, yes, the most important law to govern the breeder under the law of likeness. Through its agency the law of inheritance is retained in its highest power in order to prevent the race from deteriorating from its present condition; the occasional excellence which appears among certain ones from large numbers of cattle through the modifications caused by environment; and the strengthening of the orignal force of inheritance found in the animal by the addition of a desirable quality, all these agencies working together, have accumulative powers for modification and retaining anything in an animal that is desirable.

The wild cow gives no milk, as none of these artificial conditions are in operation to change her form and function. The law of inheritance, only as governed by environment, is in unchecked action, and the tendency is to restrain the cow within her ancestral types. Originally not yielding milk beyond the necessities of her offspring, until she exists under changed conditions, the yield of milk in surplus quantities cannot be expected.

In the dairy cow, we have the power of selection, under the guidance of man, interfering with the uniformity of progress of law of heredity, and changes ensue. It is probable that in the early domestication of the ox, the draught ox and the meat supply of a pastoral region, was at first the principal use sought from this animal. As familiarity with the race extended, the milk was found palatable, and certain animals yielding a slightly larger supply than others; such were kept with more care, than the general herd. We must have thus had, if my supposition is tenable, a gradual course of unconscious selection. As civilization became

more general, and the pastoral life of wandering gave way to the agricultural state; when homes were fixed, and the land held under distinct ownership, improvement must have become more rapid with the opportunities thus afforded for the increased acquaintance with the individual cattle, now possible in the small herds, formerly more difficult among the extensive grazing groups.

About a hundred years ago, we find breeding being pursued as an art, and conscious selection acting its part in the moulding of the dairy cow. Formerly selection was in large part unconscious; unconscious in the sense of an acknowledged attempt to benefit the cattle of the future. Then progress was intermittent, as selection carried on under no fixed plan, allowed the cow now to advance, now to retrograde in improvement. In the 18th century, aroused by the activity of mind which was so general during the Napoleonic wars, systematic selection began to be practised, and improvement in the dairy cow was very rapid. The same knowledge which allowed selection to come into use as an art, gave the knowledge of the law of likenesses in inheritance, and the changes brought about through selection were fixed by attention to pedigree.

Where selection has been continuous, and changes produced are fixed by attention to pedigree, we have what is called an improved breed. Where animals of the same lineage have been mated together for a long time, whether accompanied by selection or not, we have a breed or race. Where animals of diverse lineage are mated, without selection, or guidance under rules, the progeny are mongrels.

The Ayrshire cow is the type of an improved breed of dairy cows; the Devon cow, of a race; the so-called native cow of the United States, of a mongrel. These differences, produced under law, are accompanied necessarily by the following results:

The mongrel cow cannot have offspring resembling herself; i. e., she cannot transmit her excellencies in line, with any certainty. The race, transmit to its progeny, the qualities peculiar to itself. The improved breed, transmit its qualities like a race, but with the important addition that it has improved qualities to transmit.

Let us see what selection has done for the dairy cow. In the state of nature the cow gives no surplus milk. In the semi-domesticated races, as the cattle of the pampas of South America, of the Cordilleras, and of the plains of Texas, but very little milk, and that apparently contemporaneous with the actual presence of

the calf. Milk is so scarce as to be a luxury, and is not in sufficient quantity to be of importance sufficient for manufacture, as obtained from these wandering herds. In New York State, an average production of about 1,200 annually per cow, or 1,800 quarts in the average for superior dairies, or a possible production of 2,300 quarts for an average.

We have here for our contrasts a product of nil, and a possible product of 2,300 quarts, or an average of 1,200 quarts for cows kept under good food; but in one case without artificial attention to milking quality, in the other an intermittent process of selection, by which gradual and intermittent improvement has taken place. As grades in the dairy cows, brought about by the greater or less selection and care exercised, compare the products of the different States. Thus in 1870, Florida, with 99,000 cows, produced about 5,000 pounds of cheese and 400,000 pounds of butter, while New Hampshire, with 99,000 cows, is credited by the census with 2,323,000 pounds of cheese, and 6,756,000 pounds of butter. This product of 464 times as much cheese, and six times as much butter for New Hampshire over Florida, is partly determined by climate, but largely upon the different conditions of farming, through which the personal care necessary for improvement has not been exercised in the one case as completely as in the other.

We have now intimated what selection has done for the dairy cow, and somewhat of its importance. We have seen that, as indeed we all know, wherever the care used in selection has been the better, there we have found the better dairy cow. What then will be the effect of a more careful selection, united with the fixing of the quality obtained by attention to pedigree?

Fortunately this statement can be answered by reference to statistics of a herd of thoroughbred cows. In a careful statistical essay delivered before the New York State Agricultural Society, in January, 1873, the writer has determined the difference between the same grade of native cows in New York and the same grade of Ayrshires, as 700 quarts yearly. That is, compare a herd of average natives with an average herd of Ayrshires, and 700 quarts will represent the difference, or the same difference will occur between superior herds of either. In this 700 quarts we then have the measure of the value of pedigree added to selection in this case. That is, the process of knowledge has been enabled to create a difference between the wild cow and the dairy cow of

about 1,200 quarts through selection alone, continued unsystematically through untold centuries. The attention to pedigree or systematic selection and fixing of points obtained has increased the average product by 700 quarts within less than a century.

The dairy cow came then from the application of a common-sense knowledge to practice. It came through the unrecognized plasticity of animal nature. The improved dairy breeds have come through the same course of action, applied understandingly. The improved dairy breed is but the product of the same laws which have formed the dairy cow, but more understandingly applied. The best cow in your herd derived her superiority over the poorest cow through the operation of the very same laws, but modified and governed differently by circumstances which were under the control of man. Let man recognize his control over circumstances, and getting knowledge, apply it, and the native dairy cow can have added to her the improved quality of a breed.

Let me illustrate that the average native cow is not giving as much milk as she might, by reference to the records of Waushakum Farm. Of eight native cows nnder very high feed, and each kept for three years, and selected from thirty-five cows, the average annual yield per cow was 2,179 quarts. Of eight Ayrshire cows, under a lower feed, and each kept for three years, and selected from seventeen cows, the average annual yield per cow was 2,809 quarts. It is thus seen that although the native cows had been improved by unconscious selection from unrecorded time, and crossed with improved breeds of late years, (for these were grades) yet animals of approved pedigree under less feed, yielded a larger flow of milk.

What then must we do to obtain the dairy cow in an improved form? We must farm according to rational principles. These are to first obtain that breed, or that kind of no-breed cow, which shall be adapted to the land, or to the circumstances which are to surround her. A few general principles will apply here,—principles which are the outcome of experience. These are, that a cow should not be too large for her pastures and the food she is to obtain. Another is, that unless an approrpriate treatment is continued, a superior cow at a large price, may not be as profitable as an inferior cow at a low price. That is, that under the worst of treatment, the superior cow is no more profitable than the inferior cow, and as there is loss in either case, the low-priced

cow represents a less loss of capital. Still another is, that a superior cow, under reasonable treatment, is always the more profitable cow, no matter how cheap a poor cow may be picked up. A poor cow, under ordinary circumstances, does not yield a product equivalent to the expense of her feeding and care. It is always the superior lot of a herd which pays the profit, no matter their cost, while the poorer cattle are supported by the better ones. A system of weighing the milk at each milking, and recording the daily weight, a system very easy in practice, is of great use, enabling the farmer to dispose of his unprofitable cows upon the discovery of their unprofitableness. When the system was introduced at Waushakum farm, about eight years ago, our surprise was great to find that neither we, nor any of our men were able to select the most profitable cows in the barn—those shown to be such by the figures. The cow which gave a large flow for a short time, was usually considered the superior of other cows, whose flow was nearly as large, but continuous.

The next idea which it is wise for the farmer to follow is to never sell his best cows while in their prime, but to use these for breeding. It is a noticeable feature, that a Massachusetts drover can go to Maine and select the best cows from your herds, at a price but very little higher than you ask for your scrubs, while the same man can buy plenty of the scrubs from a Massachusetts farmer, but cannot buy his pick from the herd, at a price which will yield him any profit.

By retaining your best cows for breeding, you are putting in practice the law which has created the dairy cow out of the wild cow, and are in the line of improvement. You have to use a bull, however, to obtain offspring from this cow of yours. Be careful to select, each time, a bull from a milking family of cattle, and you are applying this same principle of selection with greater force. Do you wish still better results? Then follow out the teachings of wisdom, and as you have seen what pedigree added on to selection has done for the yield, try the same course yourself. If there is a thoroughbred bull in your vicinity of the right quality, continually use his blood and grade up to him, for by so doing you are utilizing the labor of generations of breeding for a particular result, and as reflection will show you, are pursuing the right course. If there be no thoroughbred bull near you, accessible and of the right kind, purchase one; for the gain to be

obtained is large and immediate, and the cost of a bull divided up among a number of cows, is not very large, and the outlay will be repaid in a short series of breedings.

Let me summarize, on account of the importance of the subject:

Weigh your milk, and know what your present stock are worth.

Continually breed from your better cows, and continue your weighing of your daily milk yield.

Always use a thoroughbred bull of a dairy history and dairy type, and continue your weighing of your daily milk yield.

By so doing you will become, according to all the teachings of wisdom and experience, improvers of your stock, more successful farmers and accordingly more prosperous.

What then is the dairy cow? She is the product of art added on to nature; and whence she came, was by conscious or unconscious workings towards a desired end. The moral is clear: to further improve herds of cattle, apply the experience gained from the past.

TWO LECTURES ON DAIRY FARMING.

I.—Needs of the Dairy.

By L. B. Arnold, Rochester, N. Y.

There are a few people who follow dairying for the pleasure of it. To some it is a very agreeable task to care for dairy cows and milk, and make butter and cheese. The number, however, of those who really delight in the business of dairying, is not large. They form the exception rather than the rule. Most people engage in dairying for the sake of profit or anticipated profit; gain in some direction, forms the great inducement for men to pursue dairying as it does other avocations. If the dairy could not be made profitable, the number of its votaries could be easily told. As profit is what dairymen are looking after and laboring for, it will be well, in speaking of the "Needs of the Dairy," to recount carefully some of the circumstances which contribute to the dairymen's income.

In considering the Needs of the Dairy, the quality of food and its cost are among the first and most essential elements to be reckoned. The profits in dairying come from the excellence of its products. Poor goods cannot be sold for more than the cost of production, if indeed they reach so high. There is good reason to believe that no inconsiderable share of the annual products of the dairy is sold by the dairyman, at a price that will not cover the cost of production. This is true of all that kind of butter sold in the large cities as "grease," and of cheese, which, at this time, does not reach ten cents a pound. As the prices of land and labor now run, a pound of butter ought to bring about twenty-five cents to repay cost. But grease goes from fifteen to eighteen cents, while good to fancy butter will bring from thirty to forty cents, and as it costs no more to make the good than the poor butter, the difference in price makes all the difference between loss and profit. The quantity of food to be furnished for the dairy should be such as to contribute to excellence; it must, at least, not stand in the way of excellence by reason of objectionable flavors or other detrimental qualities. While it must be acknowledged, superiority in dairy goods is chiefly due to the skill of

the dairyman, it is also true that the quality of the food supplied to the cows producing the milk, has a modifying effect. The best food for the dairy is green grass, young, succulent, and tender; such grass as is grown upon a rich and moderately dry soil—a soil which would be called neither wet nor dry. Good milk and butter and cheese, can be produced anywhere, and on any soil, where cows can be kept healthy and comfortable; but that soil and climate which will produce grass, fresh and green, for the longest time during the year, is the best. Anywhere in our latitude, fresh green grass can be had spring and fall. It is mid-summer and winter which most interfere with the operations of the dairy. If the soil is easily dried and parched, grass becomes dry and scanty early in the season, making a long space between fresh grass in the spring and fresh grass in the fall. If the soil is retentive of moisture, the grass will grow and keep green nearly the entire season, making the time between fresh feed spring and fall a very short one, sometimes almost blotting it out. Maine, as a state, is well calculated for dairying in this respect. The rich soils in the bottom lands along her streams, and the rolling surface of her uplands, are remarkably tenacious of moisture, without being wet, and the grass keeps growing and remains fresh so long that the dairyman has but a short mid-summer season to provide for, compared with what occurs in many other places. But that season, whether long or short, should be provided for, so that there shall be no lack of good milk-producing food. To allow cows to shrink in their milk in mid-summer, is fatal to profitable dairying. At the time of producing her young, the vessels conveying blood to the udder become greatly enlarged, so that the quantity of blood supplied to that organ is, at that season, much greater than usual. This unusual determination of blood to the udder furnishes the material for the large flow of milk at that time. As the distance from the time of coming in increases, it is natural for these blood vessels to gradually contract, supplying the udder with less and less blood, till at last milk ceases to flow. The fuller the blood vessels of the cow can be kept, the slower will be the rate of contraction of the arteries connected with the udder, as it naturally makes them an active source for conveying to the udder, the surplus nutrition to be disposed of as milk. High feeding, therefore, from first to last, with rich and succulent food, contributes to an abundant and prolonged flow of milk. But very different will be the effect if the supply of food is scanty. The

nutrition will be taken up to support the body of the animal, and there will be no surplus to crowd toward the udder; the action of the arteries in that direction is diminised and they contract rapidly, never to be enlarged again till the occurrence of another birth.

When scanty feeding has been continued long enough to cause an increased shrinking of the lacteal arteries, and a diminished flow of milk, high feed afterward will not bring back the former flow, for the reason that the lacteal arteries have become too small to carry blood enough to the udder to make an increase of milk out of. The milk may be increased in richness but the quantity cannot be much improved. To fail in providing an abundance of good milk-producing food in mid-summer, or when grass fails, is to fasten a diminished flow upon the herd the remainder of the season that will be pretty sure to neutralize all profit. I insist, therefore, that it is one of the most urgent needs of the dairy, to be prepared for bridging over the usual summer drought with some milk-producing food which shall prevent the flow of milk falling below the natural decrease. It is not enough to provide an extent of pasture so large that the feed will grow faster than the stock can consume it, and in this way, have a surplus on hand to meet the exigencies of July and August. It is better to be sure to have a full than a scanty supply even of such food. But a stock of food thus grown in advance will be trodden down by the daily tramping of the herd, and when the dry time comes on, it will have become old and dry and woody, and will digest so slow that cows cannot consume enough of it to keep up their milk. The generous provision of the dairyman in providing such a supply will serve his intent in part only. It will not prevent a premature shrinking of milk that cannot afterward be recovered from, and his profits for the season must be cut down to the extent of the shrinking which has been occasioned. What is wanted is green, succulent food, ready for soiling whenever a drought begins; something that will keep up the flow of milk—orchard grass, clover, oats, fodder corn, or if these cannot be had, then wheat bran, oil meal, cotton seed meal, or any mill feed that can be had, to keep the milk up till grass in the fall brings relief.

The question of food for the dairy has a great many bearings. This question lies at the foundation of all successful dairying, and is not decided by the simple fact that a farmer can furnish food enough for a certain number of cattle to subsist on. It must be

in a proper condition; it elements must sustain certain relations to each other, and its cost must be considered. The condition in which an animal receives its food has very much to do with the effect of that food upon the animal consuming it. If raw potatoes are fed to shoates they can only digest enough too keep them in fair running order. Raw potatoes will not fatten pigs, for the reason that they are so hard and slow of digestion that barely enough can be digested to keep them along Boil the potatoes and pigs will fatten on them, because about four times as many can be digested when cooked as when raw. A cow can digest raw potatoes rapidly. She can digest all green food rapidly; but in respect to some other foods she stands in the same relation that the pig does to raw potatoes. A cow can digest as much grass in an hour as she can common hay in three hours, and as much as she can of straw in four or five hours. A cow can neither give much milk nor fatten on food so hard to digest, because it takes all her time and strength to consume enough to live on. There is a great loss in feeding any well ripened fodder to dairy cows, especially when in milk, for the digestion of such food in its raw state is very incomplete as well as slow. This is very clearly shown in the experiments of Philip Lazelle of Chautauqua county, New York, recently repeated with much notoriety by L. W. Miller, in which three pounds of meal per day served the same purpose as twenty pounds of hay (or all the cows would eat) though the hay contained more than twice as much food as the meal. The labor of masticating and digesting the hay, and the loss from imperfect digestion, took up one-half its value or more.

To make milk production profitable, cows in milk need green food, or such concentrated food as will digest easy, so that they can completely consume three or four times as much as they require for the support of their bodies. Well matured forage, and all such as contains much woody fibre, had better be reserved for some other than milking animals, or, if it must be fed to them, it is better to endure the expense of cooking and steaming, than the loss entailed by slow and imperfect digestion.

It is an item well worth the consideration of dairymen, to see that the proper relations exist between the elements of the food to be consumed. One kind of food goes to make up flesh, and another to support respiration—to produce heat and fat. These elements in food sustain certain relations to each other which are

different at different seasons of the year. For example, in the summer and whenever it is warm, it is found that cattle consume one of flesh-forming to four or five of respiratory or fat-forming. In cold weather the proportion of respiratory matter consumed is greater—about as one to five or six. These proportions should be observed or waste occurs in feeding. To feed pea or bean meal with clover, is to waste flesh forming matter, since albuminoids exist in both in excess of the proportion in which cattle use it. It would be much better to feed fodder corn with clover, since the corn contains an excess of respiratory matter—starch, gum, sugar and fat—or clover may be supplemented with corn meal. If fodder corn is the principal food it should be supplemented with some food rich in albuminoids, as bran, oil meal, barley or oat meal, rather than corn meal, which, like the fodder corn, has an excess of heat and fat-forming matter. There is a vast amount of valuable material for food annually running to waste by badly balanced foods. It makes the manure heap rich, but farmers cannot afford to enrich the manure heap with any food which their cattle could appropriate. This is especially the case with the dairyman whose balance sheet, at best, comes out at the end of the year so nigh even, that such a leak in the use of his provender may turn the balance to the wrong side.

Along with the economical use of food for the dairy must be considered the cost at which it can be produced. If the cost of keeping a cow, when economy is observed, will outrun her income after deducting labor, dairying must be abandoned. The price of land is the most variable element in the cost of producing food. The labor of producing and manufacturing may be set down, as a rule, at one-half the price of the products—supposing a medium quality of goods be produced. To illustrate: suppose it takes five acres to summer and winter a cow, and suppose all her proceeds will bring $60 a year, and that $30 a year pay the labor of producing the food and manufacturing her milk. These are fair averages, and if we consider them uniform, the cost of food and the profit of the dairy will vary with the price of land. Reckoning interest at six per cent., the use of the land, at $50 an acre, would charge the cost of food $15 a year; at $100 an acre the use of the land for producing food would be $30 a year, leaving the dairyman no profit above the price of his labor. At $150 an acre the use of the land would be $45 a year, making a loss to the dairymen of $15 per cow, or compelling him to work at half price.

These estimates which show the bearing of the price of land upon the cost of feed, are based upon the old time practice of grazing and foddering. The improved practices of modern dairying figure a little different. By soiling with fodder corn and clover a considerable part of the summer, and cultivating a surplus of this kind of food for winter use, the land required to keep a cow a year may be reduced to three acres. The extra cost of labor for soiling and raising winter food is paid for, and usually more than paid for, in the increased product of the cow, thus decreasing the cost of food by the use of two acres a year. Israel Boise and son of Marengo, Ill., have reduced the keeping of a cow to two acres a year by soiling and purchasing feed, the increased product more than paying for the extra labor and feed, the product being 300 pounds of butter per cow a year, for a dairy of 100 cows, whose gross income varied last year but a fraction from $100 a cow.

The advantages of soiling and high feeding are really greater than is generally apparent at first view. The farmer is apt to look upon the time and trouble of delivering forage to his herd in summer as an irksome task, and to let it slide by until he is driven to it to prevent his cows from starvation. He does not see his cows gaining much by the extra feed, and he often feels that he is performing a great deal of labor for a little income. But when all the results are counted they look differently. In the first place, the flow of milk is kept from dropping down any faster than by the gradual inactivity of the lacteal glands, occasioned by the increasing distance from the time of calving; the same quantity of milk is richer by high feeding than low feeding; and the whole time of giving milk is prolonged. To illustrate the effect of soiling upon keeping up a flow, I will state a little experience I saw in the fall of 1872. That was rather a dry season in the State of New York. Upon the first of September of that year, I visited several factories in the valley of the Mohawk, and found the average yield of cows which were depending on grazing, was thirteen pounds of milk per day. The dairy of the Hon. Harris Lewis, located in the same valley, and situated essentially the same as those of his neighbors, except that he soiled with orchard grass, was giving at the same date twenty-two to twenty-four pounds per day of richer milk than those not soiled. He was getting at least ten pounds of milk per day more than his neighbors—a difference that would more than pay the whole cost of keeping and trouble.

WATER. One of the Needs of the Dairy is good running water —water that is pure, sweet, and convenient. Of this, Maine appears to have an abundance. Her valleys abound with living streams, and cool crystal springs burst from her hillsides and leap with hurried flow, like ruptured arteries. So far as I have seen the waters of your State are inviting to the dairyman. I do not know whether they are hard or soft, and indeed it does not matter much. If I could have my choice in the selection of water, I would prefer to have it soft. Hard water is esteemed full as good for cheese as soft. In butter-making, hard water is thought to give to butter a somewhat opaque look, while soft water gives it a semi-translucent appearance. Very hard water—such as contains some objectionable mineral matter in solution, is sometimes unsafe to use for washing butter in. But so far as flavor is concerned, I have not been able to discern any appreciable difference. Admonition against the use of stagnant water seems hardly necessary here. In many places stagnant water is the greatest obstacle to successful dairying, as the use of it by a few cows, will carry infection into the milk of a whole factory. Wherever water stands in swamps or pools it is to be sedulously avoided. Nothing but pure running streams or spring or water from wells, such as is fit for human use, should be used for dairy cows.

Water should be convenient. It is not enough to have water where it can be had only once a day. Whenever a cow becomes thristy, if water is not immediately accessible, her milk suffers. I have seen this tried on several occasions. Where water is to be had only at the yard, or at one side of a large lot, cows will often go thirsty for several hours before they will take the trouble to go away one side after it, and their milk becomes affected both in quantity and quality in consequence. Water, therefore, should not only be good and abundant, but it should be accessible with the least possible trouble to the animals.

Cows. One of the crying Needs of the Dairy is better cows. The difference between good cows and indifferent ones seems to be appreciated by only a few. It often occurs that one-half of a dairy barely pays its way, while all the profit, if there is any, comes from a few of the best cows. The money made by dairying always comes from the good cows. It can come from no others. To illustrate how income and cost compare in the case of good cows and common ones, I will state a circumstance which occurred

in Herkimer county some twenty years ago when cheese was low. A young man having a dairy of forty cows which were accounted good ones, took five of his best cows and five of the poorest and measured their milk at intervals through the entire season, so that he could determine the relative part which each played in making up the returns of his dairy. He figured the cost of keeping at the then current prices, at $35 a year per cow. His whole dairy being accounted one of the best, the difference between the best and poorest was not very wide. The five poorer cows made $30 worth of cheese and the five best made $40 worth—losing $5 on the first five, and making $5 on the second five, above the cost of keeping. There are very few dairies in which wider differences than this do not exist—few, indeed, which do not have some cows whose profits figure up with a minus sign. The above comparison is not strictly just as it costs more to keep a good cow than a poor one; the result, however, is not far from the truth. It is but a small share of the food of ordinary cows which is converted into milk. With the average cow, probably four-fifths of what she eats, goes to supply the warmth and waste of her body —only one-fifth to make milk. Let us make another illustration which shall be more to the point. Take, for example, a dairy of twenty-four average cows, and suppose them to be fed on hay. They will consume twenty-five pounds of hay each per day, or 600 in all; and that each cow converts five pounds of hay into fifteen pounds of milk, which will make one and one-half pounds of cheese; or the twenty-four cows make thirty-six pounds of cheese out of the 600 pounds of hay. Now suppose we take cows that will give twice as much milk as the former lot. They must eat just as much as the previous cows to support the warmth and waste of their bodies, and twice as much to convert into milk. They must consume thirty pounds of hay each per day, and twenty such cows would eat the same amount of food as the first supposed dairy—600 pounds in all—and would make three pounds of cheese each per day, or a total of sixty pounds instead of thirty-six as in the former case. The comparison would stand thus:

No. cows.	lbs. hay.	lbs cheese.
24 consume each	25 per day, total 600;	make 1½ each per day, total 36
20 " "	30 " " 600;	" 3 " " " 60

Here, it will be seen, that the food used to support the bodies of four cows in the first case, has, in the second case, been converted

into dairy products giving a large profit. This comparison is not altogether hypothetical. I have seen even greater differences than this, made by changing common cows for better ones. A. G. Ford, formerly of Fairfield, N. Y., now of Lima, N. Y., by reducing the number of his cows as above indicated, and keeping nothing but first-class cows instead of common ones, raised his annual yield per cow from 400 pounds cheese to over 700—a rate of increase considerably higher than in the case supposed for illustration. A. L. Fish of Winfield, N. Y., raised from 400 pounds cheese to over 800 pounds cheese a year to the cow. But Mr. Fish's high figures were obtained by high feeding as well as selection, while Mr. Ford's were reached only by selection of cows.

There is vast field open for improvement in selecting and raising dairy stock, and those who occupy it best will make the most money by dairying. The ultimatum of good cows is far from being reached. The "Old Creamer" of S. D. Hungerford of Adams, N. Y., is not the last cow to give 302 pounds of milk in three days, nor the two cows of Mr. J. Percival of this village, the last to make 480 pounds of butter apiece in a year. The development of extraordinary milkers comes from skillfully combining the best feeding and the best training with the laws of hereditary descent. It must be the work of time, involving much watchful care and patience and intelligence, and with these all working together, there is no fixing a limit to results.

Dairy Buildings. Among the Needs of the Dairy are good buildings, suitable for carrying on the various operations required. Among the first I may name those for taking proper care of the cattle. Immense losses annually have occurred in the old dairy districts by reason of exposing herds to the cold, both by compelling them to stand in the bleak winds by day, and open stables by night. One of the most efficient elements in milk production is comfort for the cows. No matter how much food may be forced into them, cows will not give an abundance of rich milk when made uncomfortable with cold. As the people of your State are entering upon the business of the dairy, I would most respectfully urge them while arranging buildings for their animals, to avoid the cold structures which have elsewhere been so much in use, and build with the purpose of securing warmth. There is great economy in warmth and comfort for a herd of cows. They not only

give more milk and last longer and do better every way, but it costs very much less to keep them. In many instances where cows have been kept in barns made by covering frames with rough, unseasoned boards, which in due time have drawn apart and left cracks, through which the wind and snow found admittance to the patient herd, I have seen one-third of the hay required to winter a cow in these old barns saved by covering the frame anew with boards seasoned and matched. The colder the cattle are kept the more it costs to keep them. It takes a great deal of rich food to keep up the animal warmth of an exposed Siberian, and the man at the equator but little. It will make a corresponding difference with the fodder of the dairyman, whether his barn represents a frigid or a temperate zone.

In the introduction of the factory system the pioneers made a similar error in the construction of factories. They were at first built by siding up with one course of boards and battens. This allowed the temperature inside to rise and fall with every change in the outside air. Whether milk is to be manufactured into butter or cheese, this easy change of temperature works badly. In setting milk for cream to rise, it is not so essential that the temperature of the room should be very low, as it is that it should not run up and down. Such changes hurry the decomposition of the milk as well as hinder the rising of the cream. It is also well known now that the cheese room should have a uniform temperature ; that the best flavor cannot be developed in cheese which has a variable temperature while curing. We may therefore lay it down as a rule in the erection of dairy buildings whether designed for the cows themselves, or for manufacturing their milk, that the walls in every case should be tight enough to control the temperature within.

Good apparatus is as necessary as good buildings. This is true whether applied to the farm or the factory. But I have already detained you too long to dwell upon this subject, either to describe or discuss, further than to say that the best which can be had is the most profitable.

I have occupied your attention long enough, I know, but there is a point or two about which I desire to say a few words before I close. One of these is skill in manufacturing and how to obtain it. It is a fact with which everybody at all familiar with the dairy is cognizant, that something of skill is required to work up milk profitably ; that a little skill, or the want of it, converts

milk into gilt edge butter, or grease; or high or low priced cheese. A few steps aright, or otherwise, will develop either one or the other. Without skill in manufacturing, dairying is a failure. It matters not how much milk is produced, or how good it is, or how little it costs, unskilful manufacturing will wipe out everything in the way of profit. The art of manufacturing, therefore, is a fundamental Need of the Dairy. I cannot of course stop now to dwell upon the various points which constitute good or bad manufacture. I can only exhort you as you seek profit, to secure the very best skill within your reach. Do not even be satisfied with present attainments. Dairying is a progressive art. Improvements in it are the order of the day, and he who does not avail himself of them, will soon find himself in the rear. Manufacturers should have the most ample provisions possible for associating and discussing the facts and problems relating to their art. Every valuable item gained by one should be known to all. No single individual can discover everything that can be known about so comprehensive an art as butter and cheese making. Each should therefore help the other along by mutually imparting and receiving. Such meetings as these are what tell in the way of improvement. I get a fact from you, and you one from me, and the two suggest a third, and we are all the wiser for having met. The advance which has been made within the last fifteen years, leading to the present high character of American dairy products, is due almost entirely to associated investigation. It is the most efficient lever ever employed for moving the cause onward, and one which I can assure you will be most serviceable to you in building up a dairy interest in your State.

I have gone over but a few of the many points essential to success in the avocation of Dairying. It is impossible in an hour to do more. The business of Dairy Husbandry has a thousand bearings. There is ample room in it for the most capacious intellect and the most active energy. It is very different now from what it formerly was. Time was when it was more of an imitative art. We could follow prescribed rules and learn to work by imitation only. But now it has become a great competitive industry, full of changes and complications, and we are called upon to study causes, and to know why we do thus and so. We have to call in the wisdom of the learned and invoke the aid of science at every step. Nor is this enough. A sound discriminating judgment must everywhere be used. It must often come into

play ahead of science and all our experience. Modern dairying is emphatically an intelligent calling. So much is good sound sense called for in every operation in the dairy from the care of the farm to the marketing of goods, that I think, in conclusion, I may safely say that *common sense*, from entering into and underlying every other need, is itself the *greatest Need of the Dairy*.

II.—Cheese Making.

To be successful in cheese making the milk used must be good. It is as impossible to make a first class cheese out of faulty milk, as to make first rate cloth out of coarse wool. It is true, that dairymen have become very expert in covering up in cheese the faults which existed in the milk, but the faults are not thereby removed, they are only hid for the time being, to reappear when age and exposure to unfavorable circumstances shall overtake it.

But I imagine there will be little in the way of successful cheese making in Maine, on account of bad milk. The freedom from bad water, and the abundance of sweet pasturage which her hills and valleys promise, look flattering for the production of excellent milk, both for butter and cheese. The most I have to fear on account of the quality of milk in Maine, is from your long cold winters. About half the year is a long time to fodder; and if the provender for that long season, should happen to be late cut hay—such as is generally considered best for horses—cows will fail in flesh, and the bare and projecting bones of cattle so common every spring in all the northern States, would find no exception in Maine. This makes an unfortunate state of things in a herd of dairy cows. The flesh lost in the winter must be made up in the summer. The nutrient elements in the food which would otherwise go into milk to be converted into cheese, will go to build up the wasted flesh, making the milk poor and the yield of cheese scanty, all the first half of the season. Cows when recruiting in flesh always give milk defective in casein, for the reason that that kind of material is being taken up to form muscle and tissue. It takes a larger quantity of milk for a pound of cheese, and the cheese is not so good as when the milk is richer.

The quality of milk varies too with the quality of food from which it is made. All the elements of milk are diffrent when cows are fed upon green grass, from what they are when fed upon ripe

hay. When fed upon the latter, the fat in milk is white and hard, consisting largely of stearine, and is insipid. The cheesy matter too is also hard when formed into curd, and the cheesy fermentation by which the curd is converted into cheese, is slow and difficult to be perfected. When green grass is the food, all this is changed. The fat is high colored and aromatic, and the cheesy matter soft and easily and quickly converted into rich and nutty flavored cheese, and all its nutriment is easily converted into fat and flesh so that the animals readily thrive upon it. But cows cannot be fed on green grass all the year in Maine, but they can and should have an approximation to it in the form of early cut hay, so that they may give good milk in the foddering season and come out in good flesh and vigorous in the spring.

Assuming the milk to be good, the next step is to get it to the factory in good order. This could be very easily done if the producers understood the nature of milk a little better than they do. All that is necessary to do, is to milk it and strain it in a cleanly manner, and then carry it to the factory in vessels so open at the top, that the odor peculiar to new warm milk, may have a fair chance to escape. It will get out of the way readily if it is allowed half a chance; but unfortunately it seldom gets a quarter of a chance. This thing called animal odor, which means the smell in milk that resembles the perspiration of the cow, is one of the worst enemies the factory cheese maker has to contend with. It is a very small thing, and to most dairymen, it seems too insignificant to be worthy of attention, and hence it goes unheeded, and the connection between its presence and its results is generally lost sight of.

It is not fit that I should go into minute details in regard to this singular odor, but it may be worth while to state some general facts in regard to it which have a practical bearing. It is a very fœtid oil, volatile at ordinary temperatures, but condensible into a liquid by chilling. It is so very strong, that a drop of it the size of a pin head, gives off an extremely offensive smell. This oil is the product of certain changes which take place in the body of the animal, while the milk is being formed, and the same changes continue to go on in the milk after it has been drawn from the udder, and they continue to go on, and the oil which gives rise to the odor, contines to be formed so long as the milk remains warm, or at common temperatures. This fact is not generally recognized, because when the milk stands open to the air,

the oil escapes as fast as it is formed, and does not accumulate in the milk. As you are introducing cheese making on the factory plan, I wish to impress this fact of the continued formation of odor after the milk is drawn, because it is an item essential to your success. It is a matter which can be very easily determined. Place some warm milk in a vessel and cover it up, and after standing, say three hours, hold your head over the vessel and remove the cover. You will get the unmistakable smell of animal odor. Let the cover remain off long enough for the odor to pass away, and then cover the milk again. After another three hours try for odor as before, and you will be sure to find it again. Repeat this experiment at intervals as long as you please, and you will find the odor to be constantly forming and becoming more intense, long after the milk has become sour and loppered. Taste of the milk after it has stood covered twelve or twenty-four hours, and you will find it to have an animal *flavor*, as well as an animal *odor*. Such an experiment, which anybody can make without any scientific training or apparatus, ought to be sufficient to satisfy any reasonable man, that the production of the offensive odor is constant and rapid, after the milk has been separated from the udder, as well as before. And now if you wish to demonstrate the effects of this odor upon the preservation of milk and its products, take two vessels from the same mess of milk and cover one closely and leave the other open; examine them from time to time and you will find the milk in the open vessel to remain sound about twice as long as that in the covered vessel. Now if cheese is manufactured from milk with the accumulated odor in it, it will decay prematurely, just the same as the milk did by an accumulation of odor from being covered. This fact is being demonstrated every year all over the country, in the experience of almost every cheese maker. And strange as it may seem, the study of all concerned in the business of cheese production is, how to preserve cheese in spite of faulty milk, instead of trying to remove the fault from the milk before making it into cheese. It is so much easier and safer put milk in proper condition before the cheese is made than to mend the difficulty afterward, that I cannot help wondering why dairymen will not take the trouble to understand this fact, and act on it. There is seldom anything in milk when it first comes from the cow, to which a cheese maker need make any serious objection. It is what is developed in it afterwards that stands most in his way. It is true, however, that milk fresh from the cow, is

not in its best condition for cheese making. It is better to let it stand open to the air a while, till the gas and cowy odor pass out of it. But in taking milk to a factory there is no need of waiting for this to be done. It is only necessary to have an opening in the top of the carrying can, and they will go out of their own accord while on their journey to the factory. If ample provision for this is made, there is no necessity for cooling the milk at the dairy before starting. Milk well ventilated will receive no injury on its journey to the factory from the fact of its being warm, but on the contrary, will improve all the way. The jarring of the carriage will hasten the changes which, to use a dairyman's phrase, "ripens the milk." Gas and odor will both be rapidly developed, but they will pass out of an open topped can and disappear, and there will not only be no accumulation, but what was originally in the milk when first drawn, will go out with them, making the milk all the better for cheese for a journey of two to five miles. When it gets to the factory, if it is to be kept, the manufacturer should be provided with the necessary means for cooling. But if it is to be made up at once, there will be no need of cooling, unless the temperature should be higher than the one at which he wishes to add the rennet. I know that what I have been recommending is contrary to generally received opinions, and contrary to custom, but I know too, that I am right.

Now let us look at the way milk is generally treated in getting to the factory. It is strained into the carrying can as it is drawn, and when the milking is done, the cover is put on to the can and away the team goes to the factory. There is not only no chance for odor and gas to get out of it, but all that forms on the way by reason of the constant agitation, and that is a good deal, is added to the stock started with, so that the second estate of that milk is worse than the first. Upon lifting the cover from the can upon arriving at the factory, a strong filthy smell of cattle's breath, greets the nostrils. This quickly passes away, but the milk is full of odor. It is what dairymen call tainted; and if made right up into cheese as the morning's milk usually is, the taint is carried into the cheese to its injury.

Now how easy this difficulty could have been obviated by simply making a hole in the cover of the carrying can for the emanations to escape. Ventilation should always be provided for in building the cans. With a view to this, the cans should be cylindrical in form, so as to have broad tops. In the centre of

the cover there should be cut a hole five or six inches in diameter, (or as large as the size of the cover will allow,) and the hole covered with coarsely perforated tin or wire cloth, with the centre of the cloth a little depressed. When a tube of tin, two inches in length, is set around the outside of this hole on the upper side of the cover, and soldered fast, the ventilator is done. This is the best ventilator ever provided for a factory can. It is effectual, durable, and gives no extra trouble in cleaning; and is so cheap, that any tinman would be glad to put it on without extra charge for the sake of selling the can, and, one other important item, it is free from any patent claim, it being a device of my own.

RENNET. We will suppose the milk is now at the factory, and having been carried in a well ventilated can, it is free from the animal odor it contained when first drawn, and free of any accumulation on the way, and is in nice order for making a first-class cheese. It may be warm, but that does not hurt it, because it must be warm to make cheese of. Animal heat is not injurious like animal odor. Though many people confound them, they are entirely distinct. Animal heat is no different from any other heat, and does no more hurt or good than any other heat would do, under the same circumstances.

The milk will require warming to bring it to the right temperature for adding the coloring, if any is used, and the rennet. The particular mode of warming the milk I will let each one devise for himself. So far as the resulting cheese is concerned, it will make no difference how it is warmed. This operation can only be a question of convenience or economy. But the rennet it may be well to look after a little. The first step in cheese making, after warming the milk, is to coagulate it—that is, to separate the cheesy matter from the watery part or whey. For this purpose, in this country, rennet only is used. The query may arise with you, why is it necessary to use rennet only for this purpose? Cannot something else be used to curdle milk, and rennet be dispensed with? Yes; there are a dozen things which will curdle milk as readily as rennet, and some of them quite as cheaply. Alcohol, alum, and acids are among the list. The first two make a very perfect coagulation, and the third act with great promptness, especially under considerable warmth. But the simple separation of the curd from the whey is not all that is desired to make good cheese. Rennet, you know, is obtained from the stomachs of

sucking animals, and contains gastric juice. The active agent in this juice is a ferment which acts like yeast; in fact, it is a *digestive yeast,* and it brings about a digestive action in the milk and curd with which it is mingled. It is this digestive yeast on which the cheesy fermentation depends, and by which curd is converted into cheese. But the cheesing process is not wholly due to the influence of the digestive yeast in the rennet used. There is a variable quantity of the same agent in milk when it comes from the cow. In perfectly healthy milk it is quite small; in a feverish condition of the cow it is larger; and largest of all when cows drink stagnant water. In the latter case there is so much of this agent that milk sometimes coagulates of its own accord, so to speak, while it is in a perfectly neutral condition. Several instances of this kind have come under my observation in which tests have been applied to determine its neutral condition. Neither alcohol, alum, nor acid contains any of this digestive yeast, and hence they have no influence in inducing cheesing. Hence if acid or either of these coagulating agents was used alone, the cheesing process must be very slow, because it must depend on the little digestive yeast in the milk, and on atmospheric influences to carry the process forward.

The agency of rennet in curing cheese is now being pretty well understood by dairymen, and is being acted upon in controlling the curing process. All other circumstances being the same, the more rennet there is used in making a cheese the faster the curing goes on. In the State of New York there is twice as much rennet used in making a given weight of cheese as there was twenty years ago, and the consequence is the time of maturing is very much shortened. The cheese of to-day is ripe and gone long before that of twenty years ago was decently cured. The quantity of rennet to be used must, therefore, be controlled by the purpose which the cheese maker has in view. If he wants a cheese "soon ripe and soon rotten," let the use of rennet be lavish. If he wishes cheese for use three, six or twelve months in the future, he must leaven it lightly. But there are other effects accompanying the use of rennet than the plain work of curding the milk and curing the cheese. Pure rennet has but little flavor or odor, but in our present mode of using it, we do not get it pure—that is, separated from everything else. When the dried stomach is macerated in water there soaks out of the membrane a considerable quantity of mucous and other animal matter, which

are entirely distinct from the agent which coagulates and digests milk. This animal matter has a strong odor, and to it is due the strong and disagreeable smell of rennet steepings. When a rennet skin has been hung up in the open air for a year or more, a considerable per cent. of this animal matter is consumed by the oxygen in the air and disappears, and the steepings from it are less offensive than the steepings from a fresh or green stomach, and this is one reason why old rennets are better than new. The animal matter thus carried into the cheese, in time undergoes putrefactive changes, which give bad flavor to the cheese. On this account the great amount of rennet now used in cheese making, renders green stomachs very objectionable, from the larger amount of animal matter they carry into the cheese. The age of the calf whose stomach is used has a modifying effect upon the resulting cheese. The stomachs of young calves are the best and also have the greatest strength. The fœtal calf living upon the blood of its mother, the character of its secretions and excretions is determined by the quality of its mother's blood. When it assumes an independent existence, and lives upon milk, and breathes for itself, both secretions and excretions become altered. When this change has been brought about, and the calf is fairly under the influence of its new diet, which generally takes four or five days, its stomach makes the best rennet. It will make more and better cheese than at any time before or afterward. The dairyman can readily determine when this change has occurred by noticing the evacuations. The action is always good, and the strength is but very gradually impaired, so long as the calf lives wholly upon milk. But as soon as it begins to live on other food than milk, its character changes rapidly, deteriorating in value for cheese making.

The manner of preserving the stomach also has an influence upon its strength and quality. The method of preservation which will give the best opportunity for the waste animal matter it contains to pass away, must evidently produce a rennet of best quality. There is no way that I know of in which the membrane is so well exposed to the purifying influence of the atmosphere, as when one end of the stomach is tied tightly with a string, and then blown up like a bladder, and hung up in the air to dry, salting only the ends which are gathered up with the strings. Another good way is to cut the stomach open, cleanse and salt lightly, and spread the membrane out on a clean smooth board.

The dry board absorbs the moisture and it dries quickly. Before it becomes dried so as to adhere too firmly it should be loosened from the board and occasionally turned. It is a good way also to salt lightly and stretch on a crotched stick or bow, but they will dry sooner on a board. The changes which occur in the rennet skins when thus exposed, increases their strength considerably. A year's exposure to the air makes the strength about double. The poorest method of preserving is packing in brine. This allows of no change by which strength is increased, and all the odor and animal matter is retained to be carried into the cheese. A part of the strength soaks out into the brine, and unless the brine goes with the rennet, its original strength is abated to that extent.

The application of rennet varies with the quantity of fat, the temperature, and other conditions of the milk to which it is applied. An abundance of fat increases its power,—a deficiency abates it. Heat hurries its action up to a certain point, and then kills it. Cold retards, but never destroys, even by freezing. In fact, it gains strength by repeated freezing and thawing. The influence of every variety of taint, whether occasioned by using bad water or bad food, by worrying or oppressive heat, is to multiply the action of rennet, especially in curing. All acids on the other hand, though they quicken coagulation, retard curing. The use of rennet must be regulated by these general laws, and by them can be controlled the time to be occupied in manipulating the curd, and the ripening of the cheese. It will be at once understood that skim milk, and such as borders upon sensible souring, require more, and tainted and feverish milk, less rennet, than milk in its ordinary condition.

The average temperature at which rennet is applied to milk in making cheese for shipping, is about 82°, and rennet enough is applied to have signs of coagulation become apparent in fifteen minutes. This will allow the manipulations to go on at a rate rapid enough to get the curd in the press in about five hours, and will cause the cheese to become ripe enough to ship in twenty-five to thirty days, if the curing room has a temperature of 70°. If the air in the make room is cooler than the milk in the vat, it is important that the vat should be covered so that the top of the milk and curd shall not become cooler than the middle and bottom. Should the top and the bottom of the contents of the vat, be at

different temperatures, the curds will ripen unequally, and no after treatment will bring them to be alike. The part which gets ahead by being warmer, will keep ahead of that which has fallen behind by being cooler, and if one goes to press just ripe enough, the other will be too green. And if the whole is held in the vat till the greenest part is ripe enough, the more advanced will be too ripe, and this, in either case, will make an imperfect cheese. It is very important, therefore, to guard against the practice which too often obtains, of letting the top of the vat cool down while waiting for the proper time to cut the curd. To avoid waste, cutting the curd is best postponed as long as it can be, and not become too hard to have the cutter pass through it readily. The advantage of this is, the cream does not escape so readily. It becomes more permanently attached to the curd, and more of it is retained in the cheese. In regard to the manner of cutting the curd, two practices are common. One is to do all the cutting at one time, or without any intermission in the labor, and the other is, to do it at intervals. Excellent cheese is made by both methods, but the preference is on the side of short intervals in the cutting. The reason for this is, that by continuous cutting till the curd is fine enough, the whey comes out of the lumps of curd so rapidly and they shrink so fast, that the cream is crowded out with the whey, and loss follows.

Besides the points here indicated in cutting curd, the manufacturer has another important purpose in view; it is to enable him to raise the temperature of his curd without injury. In the manufacturing process for producing the best cheese, it would be better if the work of preparing the curd for the press, could all be done at one uniform temperature. The advantage of a uniform temperature is, that lumps of curd would ripen in all parts alike—a very essential point. In the present mode of manufacturing we cannot do this, but we labor to come as near it as we can. The large amount of rennet used in cheese making, compels a low temperature for adding it to the milk, and it becomes necessary afterward to raise the temperature so as to shorten the time of ripening the curd. In doing this it is necessary to heat gradually and cut the curd very fine, otherwise the difference between the inside and outside of the lump, would be so great as to materially injure the cheese. By cutting fine and heating slow, this difference is reduced to a minimum, and ripens every part of the curd so nearly

alike as to secure excellence in the result. To secure an even and uniform rise of temperature, simply heating and cutting are not enough. Stirring the curd must be done. It is impossible with any apparatus now in use to warm a vatful of curd evenly without stirring, since the heat cannot be applied to every part of the vat alike. The stirring must be done with great care, so as to avoid any violence to the curd, especially in its softer stages. Every motion which borders on severity wastes the substance of the curd. In fact it cannot be stirred at all without waste, and the amount thus worked off is proportionate to the briskness of the stirring. The less stirring the less waste, is a motto among manufacturers. The usual degree to which the curd is heated is 98°, but the precise degree is not essential. The lower the temperature the longer the time required to ripen the curd, and of course the higher the heat the shorter the time, provided it is not high enough to kill the active power of the rennet. Nor is there any particular time in which the temperature should reach its highest point. It may be longer or shorter to suit the views or convenience of the workman, but this fact will always remain, the longer in heating the more stirring will be required, and consequently the more waste.

Manufacturers have a variety of ways for determining when the curd is ripe enough to remove from the vat, or to draw off the whey. I shall mention but one and that I consider the best one—to wit, the hot-iron test. When curd is supposed to be about ready to dip, the maker takes a thimbleful or so in his hand and squeezes it into an elongated shape, and then presses one end of the lump against an iron which is hot enough to make water simmer. If the curd is not ripe enough to dip, it will not adhere to the iron. When it is sufficiently mature, it will not only stick to the iron, but will draw out in fine threads. It is regarded as at the right stage when the threads of curd will draw out to one-half or three-fourths of an inch in length. If longer than this, it is too ripe for making the best cheese. As salting and pressing consist mostly of merely mechanical operations, I shall pass them and close with a few words upon curing.

The production of the best quality of cheese depends very much upon the finishing touches put upon it in curing. It is a very easy matter to spoil the best curd in the world by defective curing. To cure properly a certain degree of warmth is desirable

for each variety of cheese made. A whole milk cheese requires one temperature, skim cheese another, and half skims and cheese from tainted milk, require each a special warmth. Whole milk cheese require a heat of about 70° and requires it to be unvarying. To allow the heat to run up and down, is to change the entire character of the cheese. Curing cheese is like raising bread; if the dough is a little too warm or too cold, the resulting bread is either sour or clammy. It is spoiled if it is not kept at the right temperature. It is exactly so with cheese. The curing is a fermenting process, and the character of every fermentation is always changed by a change of temperature. Take three cheeses in the same vat and let them all start off to curing at 70°. After they have progressed awhile, let one be raised to 80° and another sunk to 60° for a day or so at a time, and then let them come back to the heat of the third one, which you may suppose has been constantly at 70°. Let this be repeated for four or five times in a month. Do you suppose these cheeses will all be alike at the end of the month? If you do you would surely find yourselves greatly mistaken. They will be so unlike that you would have no idea that they were ever made from the same vat of milk. The one which has been up three or four times to 80°, will be off flavor in one direction, and the one which has sunk to 60° as often, will have lost in another way, while the one which has continued at 70° will have held its flavor perfectly, and will have made the most progress.

The more cheese is allowed to vary its temperature in curing the more will its flavor suffer. It is a very glaring defect in our system of cheese making, that our curing rooms are so many of them so shabbily built as to allow the temperature within them to run up and down with every change of the outside air. It makes a fruitful source of loss to the pockets of producers, and depresses the character of American cheese.

To guard against this, curing rooms should always be built with double walls made with matched boards, and it is better to first side up with ceiling paper, both inside and out, breaking joints on the studs, and running the paper up and down. When this is ceiled over with matched stuff, it makes a perfect dead-air space, which protects both against heat and cold, and renders the temperature nearly uniform. A good many of the factories which have been built within the last few years at the West, have been

constructed in this way, and the manufacturers have been able by means of such rooms to cure cheese so perfectly, as to bring their goods into high repute. If, while you are erecting new factories in Maine, you will take the precaution to provide curing rooms in which you can maintain an equable temperature, you will thereby contribute essentially to high quality in your goods, and save yourselves much trouble and regret in the future.

PAPERS AND LECTURES,

PRESENTED AT THE SEMI-ANNUAL MEETING OF THE MAINE BOARD OF AGRICULTURE, AT

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SHEEP HUSBANDRY, AND LEGISLATION FOR ITS PROTECTION.

By D. M. Dunham, Bangor, Member at Large.

In Sheep Husbandry, as in most other branches of farming, there are some clouds, yet most clouds have a silver side; and it rests largely with the skill of the husbandman to place himself upon the bright side, so that the clouds may be to him a blessing instead of a curse. It is often urged that the prairies of the West and South are so much better adapted to keeping sheep than the rugged soil of Maine, that we had better let them raise our wool and we build mills and manufacture it; or, better still say they, send rum and tobacco to the half civilized races of South America and Africa, and import wool for a very small margin above the cost of transportation. These and similar arguments might have some weight if we raised sheep for wool alone, but the silver side of this cloud shows that a well selected flock of sheep for mutton, will pay to keep for mutton alone, and we then get the wool besides.

Another cloud in sheep husbandry is the destruction of the flock by wild beasts upon the sea-coast and northern parts of the State. The bright side of this cloud is not so apparent, but probably will be found by the hunters in their keen relish for hunting the game. But the blackest cloud of all, is the destruction of the

flocks by dogs, and this not only requires, but emphatically demands, immediate special legislation—legislation which shall not only lessen the number of dogs, but create a fund from which those losing sheep by dogs may be remunerated. It is not enough that we have a law by which the owner of a dog may impose a tax upon his own dog and spend the tax for his own benefit, but we should absolutely insist that dogs shall be taxed and that the tax shall constitute a fund to pay for sheep slain or injured by them. If we ask of the legislature bread in this direction and they give us a stone, let us hurl back that stone, to the general smashing of political slates, and keep the stone rolling until it grind to powder political rings, and they be numbered among the things that were; if we ask of them fish and they give us a scorpion, let that scorpion be nursed into a hydra-headed monster with a thousand stings, which shall be used upon the back of every legislator who shall even attempt to barter away the birthright of the people, and the hissing of this scorpion so scatter false representatives that the people may easily take the spoils which so justly to them belong.

In 1859, in Iowa, large numbers of farmers petitioned for a law to protect sheep from the ravages of the dogs; but the bill was ridiculed beyond measure, made sport of, and finally defeated. Soon after, the State Agricultural Society distributed throughout the State, blank forms of petitions to the legislature, to enact a law against the worthless curs that infested the country. A circular was also issued, under the same auspices, setting forth that a bill had been presented to the previous legislature; that it had been made the butt of brainless lawyers, and had been literally laughed out of the house, and calling upon farmers to rise in their majesty, overwhelm the legislature with petitions, and compel them to protect this growing interest from the ravages of dogs. The petitions fell thick and fast upon the next Assembly, representing fifty-three counties, thirteen agricultural associations, and over three thousand people. Upon no other subject were so numerous petitions presented, and, in obedience to the apparently expressed wish of the farmers, a law was enacted, of which the following are the principal features:—To register every dog with the township clerk; to pay one dollar for every male, and three dollars for every female dog; to post up a list of registered dogs in each township; to put a leather or metal collar on every dog, with the number; all dogs without such collar a nuisance; fine

not exceeding fifty dollars to kill or entice away any collared dog; lawful for any person, and made the duty of every policeman, constable, &c., to kill any dog not registered; lawful to kill any dog worrying sheep or other domestic animals; fine any officer ten dollars for neglecting to enforce the law; all funds accruing to be set apart as a school fund, to be paid to the township district treasury; took effect by publication, being deemed of immediate importance.

The petition out of which grew this law, set forth that hordes of worthless curs infested the country to the serious detriment of the wool grower, and they prayed for a law to protect sheep against them. The dog law, while it did not mention sheep, would undoubtedly have proved an immense protection to them, if it had been executed. The tendency of the law was to diminish the number of dogs, and of course the less dogs the less danger. During the few months the law was enforced, many an uncollared dog met an untimely death, and school districts that were short of funds became suddenly plethoric in the treasury. The towns and cities did not hesitate to enforce the law; while the agricultural districts, for which the law was pretended to be made, treated it with magnificent scorn. The first thing in the next legislature was to introduce a bill to repeal the dog law, and the law was repealed. The law had all the odium that could be attached to it without any direct benefit to those who met with losses by dogs, and it is not strange that they wanted it repealed. Probably the discussion on this law was similar to the discussion of a dog law at our own capital a short time since, called by some the "short tailed yaller dog law," and treated with that low lived ridicule and scorn which shew that they who ridiculed it were not fit to make laws, and unworthy of the respect of anybody assembled for that purpose. It is a very wrong idea to think that if we have not sheep ourselves, that their protection is of no importance to us, for we are directly interested in every industry and especially in that which is so indispensable in every household. Stockholders in railroads will be likely to advocate buying our supplies at the west, that it may make business for them; owners of cotton mills will recommend very largely the use of cotton as being much cheaper and better adapted to our wants, and importers will tell us that it is folly to manufacture in this country, as foreign goods are so much better and cheaper. But it is the true economy to supply the wants of the farm from the farm,

and in no branch of husbandry can so many wants be supplied as from the sheep-fold. It furnishes us with the best and healthiest of meat at any and all seasons; furnishes us with the best and only clothing suitable to be worn in our climate, and is a fountain from which we may draw a little money at any time, and may well be called the farmer's bank.

An average of families upon a farm can use to good advantage, in cloth and meat, the product of twenty sheep. If they have not the sheep, the supply must come from some other source—something must be raised to sell to supply this necessity. If we raise horses, we must wait from five to seven years before the horse is fit to market, and then the market price of a horse is fixed altogether by fancy, and if money is to be raised, at no time will a horse bring at a forced sale more than half its ordinary value. Raising oxen is better, but if we raise them for beef we must wait from four to six years before they are fit to market, while a flock of sheep is continually discounting. There has been no time for the last twenty years, but a well selected flock of mutton sheep would pay more clean money in proportion to the feed and time in taking care of them, than any other domestic animal. A suggestion worthy of our careful attention is, that the march of improvement in breeding throughout the world, has been continuous and rapid in the last twenty years, and that only unremitting effort and persistent care can be rewarded with success; while spasmodic energy, followed by periods of disgust, as prices of wool fluctuate, must lead to failure. The facts of supply and demand show that a constantly increasing quantity of wool is needed for the consumption of the world. It is evident that many more sheep will be required ten years hence than are now in existence. Steam navigation and railroad extensions are constantly opening new markets, and creating new wants in half civilized communities. We must make progress still in sheep husbandry, but should make haste slowly. Study the local and personal conditions of success, and strive to connect the business indissolubly with some system of crop rotation and permanent farm improvement. There is no country whose agriculture is progressive and profitable in which sheep fail to act a prominent part, and I am satisfied that ours can be no exception. Profit is the golden beacon which guides the farmer's course. Like other men he is propelled by the pecuniary motive with the power of a

locomotive, and to direct him in a certain course it is only necessary to show him that it will prove profitable.

Is it profitable to keep sheep and why? Because the great antiquity of the business is presumptive evidence of profit. Shepherds figure in the earliest history. Its extension among nations of all degrees of civilization, and its retention in countries the most populous and wealthy, illustrate the universal belief that there is money in it. The covering of the sheep has ever furnished clothing for man; and its flesh is ever an important item of the food of man, becoming jucier and richer in the domain of high cultivation and epicurian taste. Anywhere and everywhere the sheep will live and thrive, and, with proper care, pay more for the labor and capital invested than any other mode of farming. There is no animal in which there is so little waste or so little loss. With a well selected flock the increase will pay for keeping, leaving the fleece for net income, and at the lowest price for wool, it will make a handsome dividend. Of course it will not do this, if the flock is bought with no other consideration than because it is cheap, and the butchers allowed to yearly select the best lambs, making the farmer believe that it is more profitable to keep the poor ones and improve upon them, than to keep those already fitted for the market. We cannot glut the market, nor will there be any long time that the market will be depressed below a point of profitable production. On the contrary, it is certain that no farm product goes less below that point than wool and mutton, especially for Maine farmers. A statement was made in a late English journal, that while the sheep of Great Britain had doubled during the last hundred years, the price of wool had also doubled and the price of mutton quadrupled. If that be true in other countries, how much more is it so in our own, where we import a very large part of the wool used, and that with a tariff nearly equal to the cost of foreign production; and if true of our country, how much more so of Maine, with cheap grazing lands, a home market for wool and a market for mutton, only limited by the quality of the article produced?

One of the greatest mistakes that we as a people make is in our imports. Instead of paying enormous sums for foreign articles of clothing with corn, wheat and provisions, only in part, and the balance in gold at a ruinous rate of premium, it behooves us to compel other countries, by manufacturing for ourselves, to buy our produce with gold. Instead of importing annually millions of

pounds of wool to feed our machinery, it becomes us to make adequate preparation to increase our flocks, and grow wool enough for our own people and a balance for exportation, to clothe the other nations of the earth. The marvelous increase in importations shows the steadily increasing demand for woolen goods. We may allow the unhappy votaries of fashion to dress extravagantly, and the so-called rich to live luxuriously; but the millions who earn their bread by the sweat of the brow, may clothe themselves with home manufacture, and feel a pride that not the highest fashion or greatest wealth can purchase or enjoy. The hardy, trusty millions who till the soil, dig our minerals, man our vessels, and stand at the loom and the anvil, these love liberty; these are men who perform the duties of an American citizen and support with dignity the life of an American freeman; these are the true wealth and nobility of our land; these are the men upon whom we must depend for reformation from the unparalleled extravagance of the present time.

We must manufacture at the fireside all those things which are so necessary to comfort and the importation of which is so heavy a drain upon our finances. If every family in our State had a spinning wheel among its household gods, the effect would soon become visible, not only on our foreign trade, but in securing us that independence which is so comforting an element in our being. From all this learn the profit of sheep husbandy. Let us grow our own wool; let us manufacture it for our own use; let us become independent of foreign governments and sister States, and add at once to our power, wealth and comfort.

ON RAISING NEAT STOCK.

By Peter W. Ayer, Freedom.

Now-a-days much is said about the impossibility of raising beef in competition with the great west, and much more might be said in the same direction if we are to go on in the old-fashioned way of doing it—that is, giving the calf milk from six to twelve weeks and then scant pasturage till cold weather sets in, when the lean creatures are brought to the barn and fed as cheaply as possible. But I will not describe the manner for you all know it well enough. Let me say something about how to breed good steers and oxen. First, you must begin right by selecting the best cows possible, of good size, heavy chested, broad backed and hips, with nice straight limbs, sufficiently large to carry a heavy carcass, and if a good milker all the better—and to wind up where I should have begun, the dam must have a clean, handsome head, with full but mild eye, for no other is fit to breed from. Now to select a bull is a matter not so easily disposed of for several reasons. First, because the best breeders very much disagree whether you should use a Shorthorn or a Hereford, and possibly some other kinds. But having decided what kind to purchase, put up with nothing but a first-rate one. The same rules should be adopted as in selecting the cow, only more care should be used especially in the hair and skin. The hair should be fine and thick; (all thin haired animals are tender) the skin should be soft to the touch, supple as a glove, but not thin and wafery. In selecting a bull every person should have in mind the oft repeated remark of Mr. Hall Burleigh, the noted Hereford breeder, that "an ill-bred thoroughbred" is the worst animal a farmer can breed from, for no well bred one fails to show his blood in his looks.

Having obtained your breeding animals, imagine your calves a few hours old. If possible, in cold weather, see them as soon as dropped, lest they get chilled. They may be left with the dam from twelve to twenty-four hours, according to their strength. If left longer, they may get too much milk, and it is far better to

give too little the first week. One half the milk from a decent cow is enough for the first three weeks, after which it may be increased, so that at five or six weeks it will take the whole with profit, unless the cow be a great milker. Meanwhile middlings or shorts and oatmeal should be given in small quantities with what hay or grass they will eat. This treatment should be continued until the calves are at least six months old, after which they may be gradually weaned, but not without some additional feed, such as roots, unless they can be turned into an extra nice pasture, where they may remain until cold weather and hard frosts, or in other words, so long as they thrive well; always handling them enough to keep them tame and handy. When brought to the barn some roots (turnips or beets) should be given each day to make the hay digest better and keep them constantly growing. Four quarts of any kind of roots is enough the first winter if the hay is good. When the grass begins to start they should have a taste of it, but not expected to get their living on it, until there is something to live on; which seldom happens until about the first of June with us. From that time little attention is required until October, when they should begin to get into the fields, not over the fences but through the gates, and allowed to shorten the heavy second crop somewhat; when, in a few weeks at most, they must be housed nights, at which time a few pumpkins won't hurt them at all if well cut up. The second winter's treatment should be like the first, except they will do well enough on poorer hay and coarser fodder, provided two or three times as many roots and some shorts are given, sufficient to keep them constantly growing. As warmer spring weather comes along the coarse fodder is discarded for good clean hay.

The calf or steer is now two years old, and this summer's feed should be as good as the last, and the following winter's feed should not be diminished, but rather increased, in flesh-forming substances. At the age of three years they should, with this care and feed, be good ones, and measure from six and a half to considerable more than seven feet. During the coming summer, viz., after three years old, more care should be taken that the pastures be good, for the chief aim is to keep them not only growing but increasing in fatness each season until they go to the shambles. The next winter, in addition to good hay and roots, some meal should be given in small quantities with great regularity. This I consider of more importance than is generally

attached to it. Now, at this age, (four years) your steers are fit for anything, provided you have not neglected their education, which should never be lost sight of from the beginning. If properly handled, such steers, though very fat, may have earned their living for the past year or more, and you have two chances to turn them to customers, if not more, viz., the butcher, the quarryman, and the fancy ox-man, such as William Warren, George E. Shores, W. P. Blake, Hall Burleigh, Ebenezer Littlefield, and many others I might mention, who are willing to pay a fancy price for fancy steers.

Perhaps by this time you would like to know if we have raised any steers in this way, what they amount to, and who has done it. For illustration, I shall not confine myself to any locality, but begin with a pair bred and trained by James Read, farmer for J. P. Putnam, Esq., of Winthrop. At the State Fair at Lewiston, in 1874, the second premium was awarded to his steers, then three year olds, after having done the work on Mr. Putnam's farm at least one season, and at that time were put to the heaviest load of rocks on the ground and drew it handsomely. At the close of the fair they were sold to Nathan Wellington of Albion, who in one year's time increased their size from seven feet one inch to eight feet, and won the first prize at the New England Fair as well as at the State Fair the present season, and then sold them for $340, or an advance of more than $100, and having performed considerable farm work in the bargain. Messrs. Coffin and White of Thorndike, are perhaps the most noted raisers of nice cattle in Waldo county, and have at the present time six steers that will average more than eight feet in girth, and their aggregate weight exceeds six and one-quarter tons, and when I tell you that the best pair are but three years old and girth eight feet and two inches and weigh 4,300 pounds, you will readily see that good feed is not thrown away on them. Ebenezer Littlefield of Belfast, has a pair of four year olds that girth seven feet ten inches, and weigh 3,900 pounds, that will challenge smart competition anywhere, having won the blue ribbon at the State Fair in 1874. J. W. Low of Winterport, has a very fine pair of two year olds, measuring six feet ten inches, for which more than two hundred dollars were offered at the Monroe fair. One more pair I will speak of, raised by Mark Palmer of Thorndike, and sold in the spring of 1874, at two years and one month old, for two hundred and ten dollars.

COMMERCIAL FAILURES—AND AFTER.

By George E. Brackett, Belfast, Member at Large.

We are in the midst of hard times. We meet a friend or acquaintance from a neighboring town or county and to the query, "how are things," comes the invariable answer: "Business is dull,—times are hard." And so it is all over the country. The forced and unhealthy business condition necessarily caused by the late war,—an inflated currency, a greed for speculation, and the over-production of manufactures, having reached its height, the reaction came and we are now gradually settling down to our normal condition let us hope—to a firm and secure national financial basis. Such a state of things could not be brought about without producing great changes, hence we have had sudden collapses, strikes, great failures both of individuals and corporations, and the business interests of the country have been shaken to their centers. The failures of business men in Maine have been more numerous than ever before. During this year, for the nine months ending Sept. 30th, ninety failures in Maine had been reported, with liabilities of about one million of dollars; and it is asserted, with truth I have no doubt, that these failures are due largely to an expansion of credits for the purpose of inducing business—in other words, inflating by issuing a "promise to pay" for the purpose of paying previous promises to pay. Of course the fatal result of such a course to either an individual or a nation is only a question of time, and that time is upon us. Many manufactories have closed or are running on short time, wages have been cut down, thousands are out of employment, and the prospect is dark for hundreds and thousands of unskilled workmen and mechanics who, during the last dozen years, have crowded into the cities and manufacturing towns largely from the country, leaving, in many cases, the homesteads and farms vacant or short-handed.

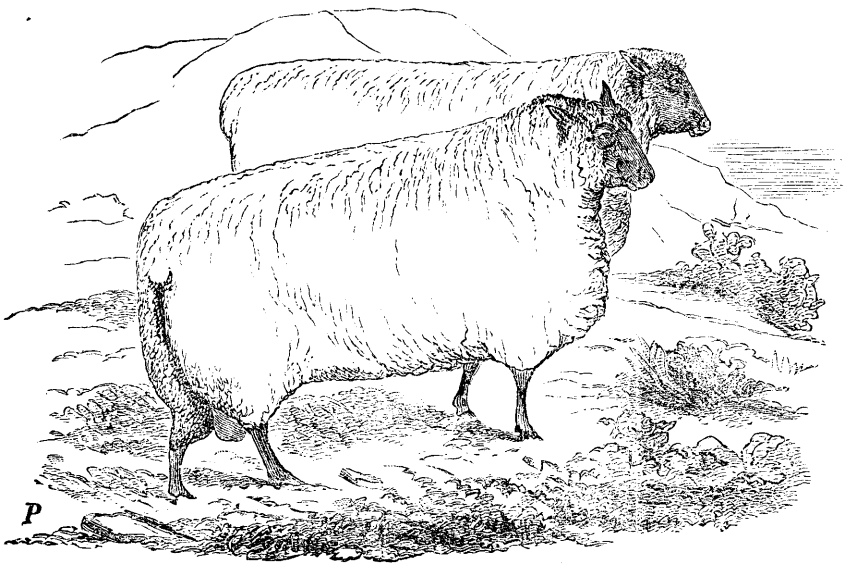
What next? Why a reversal of this order of things. Our salvation and the salvation of hundreds—nay even their daily bread, depends upon the current being changed. They must go back to

the farms. Old mother earth has never yet proved niggardly in making sure returns to her children. No matter if banks burst, fortunes are lost, or swindlers reign, the soil has always promptly paid its annual dividends to those who have invested therein. The promise is not so large and glittering perhaps but it is safe and sure, and no one who cultivates rightly need starve or suffer for want of life's necessities. Well then the answer is, go to farming. There is land enough and to spare—fine, fat, luscious soils, all over the country, waiting to be tickled by the cultivator's hand. And it means plenty—food for the individual and for the nation—a production of which there can never be an oversupply and which is always in demand. And in our own good State of Maine are plenty of opportunities. Many a farm lies untilled to-day, and many a farm house is empty because of the temptations which have drawn away the sons and daughters, and the fathers' too, in pursuit of some glittering false promise of an easier life or sudden wealth—riches without labor, in the cities' crowd. Yes, there are plenty of claims waiting to be worked and no man young or middle aged, with health, need starve or scrimp in the city. A few hundred dollars will purchase a fair farm, or at least give a claim to it, and a few years of prudence and economy will pay off the mortgage. And even for those who have no capital there are fertile fields waiting to be cleared in the rich Aroostook, almost without money and without price.

I have no sympathy for the man who clings to his condition in the over-crowded town or city and bemoans his fate—out of work, and poverty and destitution staring him and his family in the face, when there are so many opportunities for improving his case. And especially if he has a family growing up subject to the temptations of the day. Take them into the country, buy, beg or hire a farm, and put them where they will have more than an even chance to become respectable citizens, instead of growing up to help swell the army of do-nothings which are the bane of society and which furnish the material for the dissolute classes of humanity. We need this thing ventilated—this idea explained and fully brought before those classes whom it would benefit. Ministers of the Gospel need to preach it, newspapers to print and spread it abroad, and philanthropists and well wishers of the human race to uphold and recommend it to the people. But to be practical. It isn't an impossible or such a hard case for a young or middle aged man with a family to earn a farm and a

home. Even suppose he is unable to buy and pay for the necessary tools and stock to start operations. Suppose a farm costs $1,000, and that sum will purchase quite a respectable farm—say of fifty acres, fair buildings, some good tillage, twenty-five acres or so, a little woodland and more pasturage. A little economy and determination will enable him to support his family and pay $100 per annum and interest on the mortgage, and in less than ten years the whole ten notes will be paid and the farm his own—and worth twenty per cent. more than when he purchased it, if he is a true, real worker.

How to do it? One method which I have seen successfully carried out is to sell the hay from the farm. Nearly all our farms in Maine are naturally hay farms, and although I do not generally recommend selling off this crop, yet here is a case which is an exception to the general rule; and even here I would not sell except so far as the soil can be kept in as good or better condition while so doing. Ten tons of hay per annum ought easily to be spared from such a farm and still keep quite a little stock. It is wonderful how a provident man can manage to secure fodder suitable for his stock if he wants to turn hay to pay his debts and is in earnest about it; and it is wonderful too how he will manage to supply fertilizers to his fields to take the place of the hay thus sold off. There are so many sources from which manures may be drawn and fertilizers obtained, that none of us are aware how great is the storehouse. Why, even a top-dressing from the roadside "wash," applied to mowing fields, may add ten or twenty per cent. to their productiveness in five years. So where there's a will there's a way, and a man who reaches the age of 35 or 45 years and finds himself the owner of a farm worth $1,800 or $2,000 the result of his own labors, besides supporting a family, may consider himself fortunate,—that he has been successful in his calling and in life, and is it saying too much to claim that he may be thus fortunate? It seems to me not at all unreasonable; in fact, I am knowing of many cases of the kind. And it seems to me that in this direction lies our duty as an organization—that we make a specialty of this question, and by discussion and recommendation, endeaver to create a right public sentiment and turn the tide in the right direction. Our deserted farms and farmhouses demand it, our over-crowded manufacturing localities deserve it, and our duty as representatives of the agricultural and industrial interests of Maine remains undone if we fail to exert our influence for the right, and give forth no uncertain sound.



TWO SHROPSHIRE LAMBS,
Weighing respectively 120 and 130 lbs. Owned by M. H. Cochrane,
Hillhurst, Compton, Quebec, Canada.

SPECIALTIES IN FARMING—MUTTON RATHER THAN WOOL.

By Samuel Wasson, East Surry.

We should pursue specialties if we would make farming in Maine a success. We should pursue such specialties as are the most natural to her appointments, and the least open to competition. Chief of these, are Milk and Mutton. These are the supporting pillars of her agriculture. The great industries of the world are solving the problem of success, by lopping off all interlocking and chafing branches, and prosecuting their business on a narrow-guage special. So Nature has plotted the whole face of our continent, and marked out its special agricultural areas, and geological groups, like the squares upon a checker-board. Here is the granite, there the gold; here the area with the productive capacity for milk and mutton, there for wheat and wool.

While the whole territory of the State lies within the dairy or milk-making zone, the productive capacity of the acreage of the sea coast counties is for the production of mutton, rather than milk; their areas are natural sheep ranges, rather than dairy pastures, especially when measured relatively to that of the interior counties. The specialty of my theme, is the *growing of mutton*. "A goose saved Rome." A mutton sheep is to be the agricultural saviour of Maine. Spread out before us is a territory of 21,000,000 acres of "rocks, hills and knolls confusedly blended," a random area, with special physical conditions. The characteristic features of its surface form, the quality of its soils, the kinds of vegetation, its pure waters and bracing air, are each a special witness to testify that our future farming prosperity is dependent upon the development of a mutton growing industry. Between sheep and soils there is a reciprocating action; the soils feed the sheep, and the sheep enrich the soils. In the palmy days of our agriculture, every farmer had his flock of sheep. Thirty years ago, there were, on an average, seventeen sheep to each farmer; thirty years later, less than seven. In 1840, there were half as

many sheep as improved acres; in 1870, one-fourth as many, or but one sheep to every eight acres; whereas, in England, there are as many sheep as acres. The same proportion would give to Maine 2,700,000 sheep, or to each of her 60,000 farmers nearly forty more than they now have.

Giving the census statistics the credit of making one error offset another, and they show since 1840, the decrease in the product of wheat to be in exact proportion with the diminution in sheep, showing that there is an intimate relation between the growing of wheat and the keeping of sheep. Why, of all the domestic animals, is the sheep that of which there is earliest and most frequent mention in the ancient writings? Why were they intimately associated with the earlier civil and religious institutions? Why was the first employment of man that of a "keeper of sheep," unless their "golden feet" were of intrinsic value to the agriculture of the world. Western Asia is supposed to have been their original habitat. From this centre they have spread over the civilized world, and influenced by climate, food and treatment, have divided into numerous varieties, differing so widely that none can tell which is indicative of the original type. It has been said that the domestic sheep originated from an animal extremely wild by nature, inhabiting the mountainous parts of Corsica and Sardinia. So it is Darwinian to say that "man sprung from the monkey;" but for all such conjectures, we have no *aping*. Nor would it be of any real advantage to the practical man to know whether these numerous branches have all sprung from some one primitive stock, or whether more than one wild species have commingled to form the many breeds. The lingering traces of the dark brown in many of them, indicate that the original color was brown or black, and that the change to white has been the work of skill and time. There are more than one hundred and thirty races and sub-races. In all ages, has the sheep been a prominent representative of rural husbandry, and it is noteworthy as it is true, that that the animal best suited to the condition of man in his nomadic state, should be the most profitable and necessary to the highest condition of improved farm culture—so necessary that its loss "would produce an irreparable chasm in the comforts and solid utilities of life."

The sheep first brought to this country—now naturalized into natives—were from England and Holland. They were long-legged, narrow breasted, light-quartered, coarse-wooled, roving

and wild. They could run like a fox and jump like a deer. Even now, the descendants of that old-fashioned "breed" of sheep, can "2.40" a mile with ease, and win "second money" with an express train, every time; nor can you make them docile, no more than you can civilize a Modoc Indian. Its "agin" the "naturs" of each. Their wool—about two pounds to the fleece—was suited for the coarser fabrics, only. Their flesh, with its abominable sheepy taste, was no favorite article of diet, even the carrion crow made wry faces over it. Sheep were imported by the Virginia colony, as early as 1609. The Dutch West India Company introduced them about the year 1625, but they proved to be too much of a temptation for dogs and wolves, for it is recorded that in 1643 there were but sixteen in that whole colony. They were kept upon the islands in Boston harbor as early as 1633, and two years after there were ninety-two in the vicinity of Portsmouth, New Hampshire. It became the universal practice in the days of homespun for a farmer to keep a number sufficient to clothe his family. In 1793, the first merinos were imported by William Foster of Boston. They were wholly unappreciated, were given to a gentleman to keep, and he, knowing nothing of their value, "simply ate them," and a few years after was buying the same class of sheep at $1,000 per head. The native sheep of to-day, are perfect fac-similes of the originals, marred by all the faults, and as strongly individualizing them, as if reproduced by the marvelous process of "heliotype."

The popular breeds in this country at the present, are the Leicester, Cotswold, Oxford, Down, Saxon and Merino. The first two are known as long-wooled; the next two, middle-wooled; the last two, as fine wooled. Another classification is the coarse Cordova and Donskoi wool for carpets; the wools of Saxony and Silesia for broadcloths; the strong middle wools of the Southdown for blankets; the merino wools of France, Vermont and Michigan for delaines; the longer and coarser wools of the Cotswold and Leicester races for worsteds in their thousand applications; the wools of Lincolnshire for alpaca fabrics; and, lastly, the precious, silky Mauchamp wool for shawls, and the Angora for velvets.

Few farmers, and fewer sheep-owners in this country, understand pracically the difference between breeds to be kept for *wool* and breeds to be *killed* for mutton; or that while "wool-growing may be successful in the midst of primitive, almost barbaric practices in culture, mutton production involves arts of

husbandry the most advanced, and a knowledge of animal physiology the most enlightened." Those breeds which assume superiority as producers of wool, are the Merino, Saxon, Silesian and Lincoln; while the mutton-producers are the Cotswolds, South Down and Leicester.

Which of the mutton breeds is the best adapted to our climate, our botany, our agriculture, would puzzle any farmer to tell, who has not by a skilled observation, tested their comparative merits. Each one of these breeds is somewhat local in its habits and characteristics, and no one of them is fitted for adaptability over a very wide range of country.

Here let us inquire where the wool is raised that clothes the world. The latest estimates available place the production of the wools of the globe at 1,610,000,000 pounds, or one and one-quarter pounds to each inhabitant, calculated upon an estimated population of 1,285,000,000 people.

The amount set down to each country is as follows:

England	260,000,000	pounds.
Germany	200,000,000	"
France	183,000,000	"
Spain, Italy and Portugal	119,000,000	"
Australia, South America and South Africa	157,000,000	"
Russia in Europe	125,000,000	"
United States	95,000,000	"
British North America	12,000,000	"
North Africa	49,000,000	"
Asia, at a very general estimate	470,000,000	"

In the manufactures of carded or clothing wool, from statistics collected, the leading countries of the world stand relatively thus: Prussia, first for men's wear; France, first for women's; England, fifth for men and women's wear; the United States, sixth for men and women's wear.

The importations of foreign wool for 1871, represented in cash, were $9,900,000, and for wool manufactures $43,000,000, or nearly $53,000,000 for foreign wools and woolens. Chief among the wool exporting countries, which are supplying our market at less prices than we can possibly afford to grow it, are Australia, South Africa, British India and South America. In 1805, Australia exported but two hundred and forty-five pounds; in 1870, 56,000,000 tons. In nineteen years South Africa's has doubled, and

British India's increased twenty fold, while the yearly importation from Europe, Buenos Ayres and Mexico, is 50,000,000 pounds.

In South America, the sheep pastures or ranges, are measured in leagues instead of acres, and carry flocks of from 14,000 to 6,000,000 sheep. It would not be an over-estimate, to say that there are 100,000,000 acres, clad in ever-during verdure in the valleys and grassy slopes of the Rocky Mountain system, where wool-bearing sheep may flourish with undisputed sway. The extent of grazing land in Colorado, Wyoming, New Mexico, Utah, Arizona, Washington, Idaho, Dacotah and the Indian territories, aggregate more than 625,000,000 of unsold and unsettled acres, or including those in Alaska, a sheep range having an area equal to that of our State fifty-two times multiplied; and this vast unoccupied territory is yet to become an ever-during verdure park for millions of the finest and best of wool producing sheep. Texas, more than seven times our area, and the southern half of the Pacific slope, possessing decided advantages over us in a soil needing no manure to fertilize it, and a climate which does away with the necessity of feeding artificial food in winter, present odds with which we cannot compete. It is said that the vast territory, lying west of the Mississippi, is so admirably adapted to wool growing, that it can soon produce it as cheaply as cotton can be grown, which at the breaking out of the rebellion was grown at about seven cents a pound, while in Maine the cost of growing a pound of wool is not less than five times as much; while the wool grown by the half-civilized shepherds in South America, or by the convicts in Australia, whose compensation is nothing beyond their cheap subsistence, can be delivered at the ports of shipment for from thirteen to sixteen cents a pound. Where sheep have to be fed, it requires nearly two quarts of corn to make an ounce of wool. Do you ask—why not shut out pauper and convict grown wool, by imposing a tariff? My answer is, that for the special benefit of Eastern wool-growers, protective tariffs are numbered among the "things that were." 'Twas "an ill cure." The only protection against the vagabondism of misnomered "protective tariffs," as destructive as a "Mill River" disaster, is in the sense, and grit, and pluck, and faith of such sheep farmers, as believe in their business, give their personal attention to it, and are of too stern a metal to be banished from their wits by the "dead flies" in congressional ointment. Circumstances, long time, have foreshadowed the coming of this

present time, when our farmers must invest, and invest largely in sheep-husbandry; not in such breeds as are primarily wool bearing, but mutton yielding. There are breeds which will give a fair fleece of medium wool for home use, and a large yield of mutton, with its marrow-and-fatness, sweeter to the palate, digestible with facility, and more nutritious, than almost any other variety of food.

Will farmers be wise and "trim their sails to catch the breeze?" Circumstances beyond their control, have induced a condition of things, which render wool-growing a profitless enterprise; but the same condition is increasing the demand for good mutton, for which we possess a belt of country that can produce it, with satisfactory margins of profit, while it is naturally secured against competition from cheap or convict labor, and where changing, shifting, sandy ground-work tariffs can neither inflate nor depress. There is a growing taste for good mutton. As illustrative of the increase in mutton eating—the sales in Brighton market have increase in twenty years from hundreds to thousands; and in New York, where a few years since sheep were slaughtered for their pelts and tallow, more time is required of the butchers to supply the demand for it, than for all other meats. In "beef-eating England," the statistics of the meat markets show that mutton, rather than beef, is the favorite food. "If everybody goes into mutton raising the markets will be glutted," says one. So said the horse breeders when railroads were to be projected; but in proportion as the railroads have been increased, the horses have increased in numbers and advanced in prices. But everybody will *not* engage in mutton growing. Soil, situation and circumstances, have circumscribed its boundaries, besides it is an artificial product, while that of wool is a natural one. There need be no entertaining of caution, while Maine has sixteen acres of improved land to one sheep—Vermont eight, Ohio eight, and the entire United States but a fraction more than five sheep to each improved acre, while in England, with as many sheep as acres, the price of mutton is greater than in any other market. It is of *prime* mutton that we are speaking, which like a "Jack-a-lantern," is oftener heard of than seen. Such a product, commanding a prime price, is no fortuitous or chance product, but is the combined result of study and skill. The carcasses to be seen so often in the huckster-shops, thin, lean and blue, with fibres so toughened that with the cooking its mastication is only a physical

possibility, bear no more resemblance to good and nutritious mutton than does a pea-pod to a pulpit. Until within a few years, we never had any of the real mutton sheep to eat; the old native stock was poor, and the Merino was infinitely worse. Good mutton, such as is superior to other meat in the production of vigorous muscle, can be raised much cheaper than beef or pork. Extensive experiments furnish the data to show that seventy-five pounds of food (be it hay, corn or turnips) will make as many pounds of mutton as one hundred pounds of the same will of beef. When ready for the butcher the "fifth" or waste quarter—the offal parts of the sheep—will be three per cent. less than that of an ox or cow. By this showing, the weight of food required to produce 730 pounds of beef, would make 1,000 pounds of mutton, which at the same market price for both, say ten cents per pound, would be a gain of twenty-seven dollars in favor of the mutton. But the returns of the New York markets show mutton to be worth from two to five cents a pound more than beef.

Physiological experiments show, that mutton is more nutritious, digests more easily and assimilates more readily to the system, than any other meat. Chemists find that one hundred pounds of beef in boiling lose twenty-six and one-half pounds, or one-fifth part more than mutton; in roasting, the loss in beef is thirty-two pounds, or a quarter more than mutton. Thus while it is the most nutritious meat it is also the most economical, for in the preparation for the table there may be a saving of no mean consideration over and above that of beef. A well-fattened sheep will produce a pound of fat meat which will go as far to support life as a pound of pork, and that, too, more free from all those objectionable properties which belong to pork From the excellence and wholesomeness of mutton as an article of animal food, from its being more appreciated, and being of better quality on account of the improvement of the quality and fattening of the sheep, mutton is fast becoming one of the staple articles of food, and already ranks by the side of beef, as of equal dietetic value.

It is stated on good authority that consumption is less prevalent among Jews than all other people, and is a fact that the Jew never eats pork, but always beef and mutton; and when we consider how largely the integrity of the health depends upon the quality of the food, this immunity from this terrible disease, whether owing in part or wholly from the abstinence of the use of pork, furnishes a sufficient hint of the sanitary value of these two

kinds of animal food, beef and mutton, as articles of daily diet. Important, also, as this is to the physical health, none the less so is i to the mental and moral culture, which is greatly diminished in its inherent force and outward vigorous application, because embarrassed and fettered by the restraints of an infirm body. In these days of Christian civilization and increased knowledge, the means for cheaper and more wholesome methods in every department of living should be constantly improving, and whatever tends to this should be generously fostered and produced in abundance.

At present a large proportion of the mutton killed is consumed in our large towns, cities and manufacturing villages, but when our farmers acquire a taste for this kind of meat and begin to understand that the use of more fresh and less salted meats is more conducive to their health, and to learn that the eating so largely, as very many of them do; of pork, especially of salt, fat pork, does not constitute a healthful diet, or a very wise economy, they too will appreciate the greater value of mutton,—will become large consumers of it, and will more frequently go to the pasture for their daily meat than to the pork-barrel in the cellar.

Let us discuss this subject of mutton raising from that standpoint which conduces to a higher standard of cultivation or more productive farms. The name of sheep signifies fruitfulness, abundance, plenty. For these many years, the available fertile elements of our farms have gone to market without an equivalent fertilizing return. Every pound of wool or butter, every bushel of beans or potatoes, every load of hay or straw, have taken away a determinate quantity of the phosphates, potash, and nitrogen of our soils, without an adequate return to supply the depletion, until the *active* elements of the soil have become so reduced in quantity, that satisfactory crops cannot be grown, or in common farm talk, the "farm is run out, or worn out." Over-cropping and insufficient manuring will "run out" a farm; but just how it may be *worn out*, is not so clearly seen. The farms of Old England, which had been cropped for centuries before America was discovered by Columbus, show no signs of *old age*. On the contrary, her average yield of wheat, which in the days of Queen Elizabeth was far below the lowest average ever touched by the wheat fields of Maine, ($6\frac{1}{2}$ bushels per acre) by an improved system of farm culture, has been increased to more than five bushels to one, or to a higher average than Maine in her most prosperous

wheat growing year ever reached. Her *old* fields, instead of being "worn out," or "run out," are increasing constantly in productiveness. British farmers and writers declare that "*the sheep is literally the basis of English husbandry, that they have become an indispensable necessity, as there is no other means of keeping up the land.*" The highest authorities in France say, "the agricultural industry of France cannot dispense with sheep."

The secret of success in English husbandry is in *turnips* and *sheep*, those two "magical words at which the earth unlocks her treasures to the British farmer." The turnips make mutton—the mutton makes wheat. In no country, in proportion to the extent of territory, has the breeding and keeping of sheep been so extensively carried on as in England, and no country in the world can boast of more agricultural wealth. Strip *our* agriculture of its doubtings, false notions and *can nots*, and no comprehensible reason remains why the keeping of sheep would not bring the productiveness of the soils of New England farmers up to the high standard to which it has carried those of Old England's farmers.

As improvers of run-down pastures, sheep are no less efficacious. Calculations show that the old pastures do not and will not carry more than three-fourths as much stock as they did formerly. Where sixty acres were ample, now one hundred acres barely suffice, which is equivalent to computing a loss of two acres in every five acres. Horned cattle, especially cows in milk, soon graze out the available phosphates—the bone-forming and milk-supplying element—and with the cropping out of the phosphates, the succulent and nourishing grasses give place to sour grasses, tap-rooted weeds and coarse herbage. Many of these, which hunger can hardly compel a horse or cow to eat, are eaten by sheep with avidity. It is found by actual test, that sheep will eat some one hundred and forty kinds of herbage which other pasture-fed animals refuse. Of all the domestic animals, sheep are the most indiscriminate feeders, as well as very close feeders. They nip the shoots of almost every shrub and weed and extirpate many kinds in a few years. It is said that by sheep-feeding pastures, their productiveness may be increased five per cent. *per annum*, or brought up to carry double the stock in twenty years. But their usefulness in improving pastures, is not restricted to that of weed destroyers; their manure, which is in a highly concentrated form, is minutely divided and evenly distributed over the soil surface, where it suffers no waste, while it possesses in

the highest degree the requisite essentials to restore to the soil the phosphates which it loses by depasturing with cattle. This, in England, is so well understood, that they turn it to greater advantage by feeding them with oil cake when in pasture to give their dropping an additional value. They are powerful digesters, not only converting the driest and coarsest herbage into food, but destroying the vitality of everything they consume; and thus they do not, like cattle, scatter foul seeds behind them, while from whatever is eaten they extract more nutritive matter than any other animal.

In England and Ireland the landholders are not the farmers, the lands being in "domains" of from 10,000 to a 1,000,000 acres, which are leased out in farms varying in sizes from 300 to 1,200 acres. The lessees or farmers pay for these a rental of £5, which with taxes and repairs, swell the rent to about $30 an acre. One would suppose that those tenant-farmers, paying yearly for the bare lease of the soil, a sum exceeding the average value of American farms, must practice the most rigid economy to get a bare subsistence for themselves and their families. But it is conversely true, that most of them live comfortably, while some of them live in a style of great elegance.

Such is the soil-invigorating power of sheep "that a pasture sufficient to feed 1,000 sheep the first year, as a result of their own droppings, will feed 1,365 the next year, or four sheep will highly manure one acre of land per year." A still more recent authority estimates that one hundred sheep in fifteen days would enrich an acre of land sufficiently to carry it through four years' rotation. This comports with an Italian proverb, that "a sheep is the best dung cart;" the truth of which, in the name of science, is to be founded upon a discovery that thirty-six pounds of sheep excreta are equal as a fertilizer, to one hundred pounds of ordinary farm yard manure, being richer in nitrogenous substances than that of the cow or horse, ranking next in ammonia, and richer in the phosphates than guano or the droppings of fowls; while at the same time they exude a "yolk" from the pores of the skin, containing a large amount of potash and other alkaline matter, of which they throw off a large amount in the course of a year. It is estimated that if all the water in which the sheep of France are washed could be secured, the potash it would yield would be sufficient for the consumption of France. Admitting—not because it accords with truth, but for argument—that the growing of wool

or mutton does not *per se* declare any dividends—in plain Anglo Saxon, that it does not pay, still the restorative influence of sheep in reclaiming deteriorating lands make them an *indipensable* necessity, as they are the only security for continued fruitfulness, even in our most fertile States. Most of us remember when Genesee flour was the almost universal brand to be found in our markets; then came the "Ohio round-hoop." Both "have passed away," while their producers, by a neglected sheep husbandry and otherwise improvident agriculture, have been driven to face the setting sun to find their bread.

It is said that certain portions of the West, where sheep were regarded as a nuisance, produced wheat so abundantly as to compel the opening of railroad lines for the single purpose of transporting their teeming harvests, that now *the rails are torn up for want of traffic.* How to stop deterioration, and *how* to reclaim impoverished lands? is of all questions, simple or compound, the most gigantic with which farmers have to grapple; for none of the aids of science in supplying imported, artificial or commercial manures, be they from the guano beds of the Pacific, sewage from the cities, potash from the Strassfurth salt works in Germany, or in granite rocks; phosphates from bones or beds of apatite, nitrogen from the atmosphere or the plains of Chili, can supply the primal necessities of the soil, or give continued enrichment.

Let us come nearer home where the farms are growing worse, and their very acres "cry out" "its all for the want of sheep." Hitherto, sheep husbandry in this State, has been pursued exclusively with a view to the production of wool, mutton being a mere incident, and manure hardly a matter of consideration. The character of our sheep husbandry has been determined by the demand of manufacture, and the number, by every phase of tariff, from that which stimulates into *manias,* to that which "strikes down at a blow." Nothing in this unstable world, so changeable in its sunshine and storms, as this so-called "protective tariff."

In 1861 we had 21,500 sheep. Under the stimulus of the war demand, and the premium on gold, in 1866, the number of sheep had increased to 42,000,000, and the wool crop had increased from 55,000,000 pounds to 155,000,000. In 1867, notwithstanding the tariff cut off two-thirds of the importation from the Argentine Republic, the great competition of our wool growers, a combination of causes produced such a depression of prices, that during the autumn and winter of 1868, more than 4,000,000 of

sheep were slaughtered for their pelts and the "small medicum of fat that could be drained by hydraulic pressure from their juiceless carcasses." When it is seen that our advantage is in the production of mutton, what care we for sudden vascillating tariffs?—they cannot agitate, or make uncertain.

For the growth of this, our soil, "a rough land of hill, and stone, and tree," is preëminently fitted. Upon our rugged and ragged suffface, the full variety of herbage grows which their nature requires. Our granitic soil will give hardiness of construction, and strong muscular development, with solidity and sweetness of flesh. Our climate, with its winds, sharp and dry, atmosphere pure and bracing, give that greatest of blessings—good health. Then, as to the pecuniary advantage, these mutton sheep become a medium whereby the potatoes, barley, turnips, hay and coarser products, can be worked up into a high priced marketable article, with little risk of prices declining below a paying standard; in other words it yields a present profit, and insures future fertility. I am not unmindful of the aversion of farmers to step aside from the old beaten path, nor of how strongly they are "wedded to their ways," but these days of "clipper ships," railroads, telegraphs and machinery, are working a great revolution through all departments of industry, and striking out new paths to better ends. Steam inter-communication is passing old things away, and is writing out new lessons upon the dial plate of traffic, supply and demand, which such as waste their energies in "rowing against the tide," never can profit by. In these days of extraordinary transition, he, whose eyes are downward, like "Bunyan's man with the muck rake," becomes a *snag* in the current of passing events, catching such "drift-stuff" only as may float across him.

We, as farmers, are prone to accuse our soils and situation with dealing unjustly by us, when the true state of the case is that we have lost our own *status* in the whirlpool of life's activities. Blot out steam, tear up the rails, destroy the labor-saving machines, *and wheat and wool would grow again in Maine.*

> The "good old times" their round would run
> Of hog, and hominy, and homespun,
> The wooden plow, and spinning wheel,
> The scythe, and sickle, and threshing flail,
> And we'd ride again, as in olden day,
> In that staid and venerable "one hoss shay."

But, burlesque aside—and all fellowship with cant, which dwells upon the degeneracy of the times, and would wipe out these days

of labor-saving machines, gas light, telegraphs, and lightning express trains, to revive the days of "hard tack," slow coaches, two shilling postage, tallow candles, and tinder boxes, tasteless now as the fabled Dead Sea fruit.

Rather awaken a higher ambition to fulfill the requirements of modern civilization, which involve newer and wider necessities, and to learn that cheaper transportation and improved machinery have more to do in directing the avocation of farming to a paying and successful termination, by determining what products are profitable, and what unprofitable, than those who have not given this subject, in all its bearings, a careful consideration, have been want to suppose.

Steam and the telegraph not only have brought the great continental hemispheres within whispering distance of each other, but are rapidly changing the physiogomy of the business world. To meet the present homogeneous condition in all our material enterprises, thrust upon us by new competition in business life,—a competition as suggestive and as keen as it is instructive and intelligent, avoid spasmodic efforts

> "To gain the summit at a bound,
> When we should reach it step by step,
> And climb the ladder round by round."

A forced or hurried change from wool to mutton is neither advocated nor desirable. When the time comes, as come it has, for a resort to the growing of mutton as one of the staple products of the State, to so avail ourselves of all the advantages of our position as to make every present cloud show a "silver lining," the change must be carried out deliberately and systematically.

In conclusion, were I to plot a plan for a sheep-husbandry beginning, the outline would in substance be this:

First and foremost, is an enclosure, having a substantial sheep-proof fence. I say "sheep-proof," for they can squeeze through a hole equal to a cornered congressman. When enclosed, they are under the more immediate eye of the owner, are less wild, and are not so exposed to the pure *cussedness* of mutton-loving canines, each of which down to the "yaller dog" and poodle, has a natural hankering to serve on the *sheep tasting* committee.

Second. Begin a flock with sheep which have not learned the gymnastic art of jumping; for nothing in this impious world of

ours, will *sinner a saint* so quickly as a thoroughly educated flock of breachy sheep. One who can watch and run after sheep, fully imbued with "free love" ideas of independence, and the agility to back them up, and not *tumble* "from grace," need take no "heed lest he fall." Starting aright at the outset, and with uniform training, it is surprising how quiet and peaceable any flock can be made.

Third. In the selection of breed, my choice is the South Down; whatever the breed, it should be of indubitable purity. With pasturage succulent and abundant, the Cotswold is to be preferred on account of size and weight of fleece; but in districts of scanty pasturage, or bushy and rugged grazing ground, the South Downs have a better adaptation. They will thrive in pastures and escape deterioration under careless practices, where the Cotswold will not. They are remarkably prolific, are excellent mothers, and are producers of fair quality of "middle" wool. Their flesh sweet, tender and juicy, and commands prime prices in the mutton markets.

Fourth. Where the keeping of sheep to be *killed* for mutton is to become a business, the moss-covered custom of keeping upon barely thriving rations, is the rankest specimen of folly. The poorest property a farmer can invest in, aside from a "2.40" horse and a Shanghai hen, is a flock of meadow hay sheep. For every starved-through flock, the owner, during the spring months, must run an ambulance and a hospital.

All of the plowed crops, aside from such as are required for family consumption, should be cultivated with special reference to their nutritive power to produce the largest yield of meat at the least cost. These crops are oats or barley, beans and turnips, which should never be marketed in a crude or raw material form, but only after being converted into mutton and wool.

During the milder months the "lunk-headed," the tunneled-shaped, and otherwise defective lambs, should be marketed; keeping the deep breasted and capacious hind quartered ewes for breeders. Use only thoroughbred males of that breed, and those selected with care, though not necessarily the highest or fancy priced, unless you are a breeder of thoroughbred stock. Remember that too close breeding reduces size and produces a finer wool than the parent stock. Too close inbreeding is unsafe, unless in the hands of the expert, and then not always a success. How we admire those master spirits of the renowned breeders who have

fashioned, moulded, and improved all the valuable qualities of our domestic animals. They have reared to themselves monuments of honor more lasting than those of marble.

Housing-time should commence with the "falling of the leaves," be this is golden October or the drizzling days of November. The habit of delaying "housing" until pelting storms and pinching hunger have driven sheep to the barn is an exceedingly short-sighted one; it is mutton murder in the first degree. No animal has a more vigorous digestion, or can more readily turn fodder into meat and fat, but it must have something from which it can produce these. Not even a sheep can bring something out of nothing. They must have good food and the best of care, or with their low nervous system and small supply of blood they go down very quickly. A sheep has a very small brain and but four or five pounds of blood, and possesses no force or power to resist misfortune, and having little nervous force, it wastes no energy in action, but eats and rests and turns all it eats into profit. This explains why sheep will fall away and die off so quickly if neglected. Neglect now will be irreparable by and by.

The shape of sheep for mutton should be

> "Broad in the ribs and long in her rump,
> With a straight, flat back and never a hump;
> Wide in her hips and calm in her eyes,
> Fine in her neck and thick in her thighs."

For mutton making there is a magazine of wealth in the illimitable quantities of inedible fishes which frequent our coast-wise waters, in the residuum of the oil establishments, the cured chum of our porgie and herring factories, awaiting only for old fogy legislation to *go to seed* and *dry up*, and for a skilled transmutation from *fish* to *flesh*, to make our entire State a paradise for mutton sheep. We feel that this is one of the grand resources of the State, and that legislation in regard thereto is preposterous and shamefully neglectful.

Can our farmers profitably raise and fatten sheep for their mutton? We have no hesitancy in answering the question decidedly in the affirmative, and we have no doubt but that the larger part, if not all, the mutton required for the market—both now and for a long time to come—can be supplied on our home farms, and at remunerative rates. When we consider the nearness of our markets, the great benefit to the land, the amount of labor and cost of keeping and the growing necessity for mutton husbandry,

we are satisfied that there is no product of the farm, one year with another, which returns a better remuneration than the sheep; and when a practical view is taken of the conditions and circumstances of our agricultural interests, it is difficult to conceive why this form of husbandry has fallen into such shameful neglect, for there are but few farms or farmers within the limits of this State but would find in it a mutual advantage.

CONDITION AND WANTS OF AGRICULTURE IN WASHINGTON COUNTY.

By H. T. Porter, Pembroke.

Having been requested to prepare a paper on the condition and wants of agriculture in this county, I have decided to make a brief allusion to the organization and progress of our Society. On the 16th of October, 1841, the farmers of Washington county, impelled by a belief that the interests of agriculture would suffer without the fostering care of some organization for its encouragement and support, held a meeting at Calais, and appointed eighteen men whom they requested to act as a committee in the several towns where they resided, to solicit subscriptions of money, as a fund to be distributed the next year in premiums, and report their doings at a meeting to be held in Dennysville on the 13th of the following month. They also selected a gentleman to deliver an address at this meeting on the subject of agriculture. The men who acted on this committee, represented a stretch of country extending north and south from Topsfield to Trescott, and from the waters of the St. Croix westward to the town of Crawford. Their doings were reported at a subsequent meeting held in Dennysville, when a constitution was adopted, and the society organized under the name of the "Washington County Agricultural Society." At the first meeting of the trustees and standing committees held the February following, $344 was set apart from the funds of the society to be apportioned in premiums by those committees. Thus commenced the first organized effort as an aid to the farming interest of this county. At the time alluded to above, much of the land of this county was covered with dense forests. Lumbering was one of the chief industries of the people. Hundreds of men made an annual exodus from the mills and shipyards and the farms of the frontier to the upper waters of the Machias, the St. Croix, and Denny's river, as well as to many of the smaller streams. There they passed the winter months in profitable employment, and returned in the spring to

spend the short summers at home, and when winter returned, to live over again the scenes of the year before.

A third of a century has elapsed since the birth of this organization, and it has made persistent effort through years of peace and war, and has never failed to hold its annual meetings; and it is a fact conceded by those who have been careful observers of its workings, that it has been productive of good results to the interests of agriculture. The society has done its work well, and occupies a respectable rank among other organizations of the kind throughout the State. In all these years the harvest of nature's first great crop has been gathered. The lumberman's axe and the relentless scourge of fire have scathed the forests, and finally the gales of 1869 destroyed the greater portion of what remained.

Since the date of our first agricultural meeting, lumbering has nearly passed out of the catalogue of occupations, but the masses have not bent their attention toward winning their livelihood from the soil of our own county. The Great West, with its broad prairies, and California, with her fruitful hill-sides and fertile valleys, have drawn largely from the hardy and vigorous sons of this section of the Pine Tree State. The stores and the counting-houses in town and city, have called to their more popular employment many of the farmers' sons. The fisheries and the merchant service have each demanded their share of recruits, and the quota has been promptly filled. The pioneers of farming often cleared more land than they could keep dressed or in a state of cultivation that would render any profit to the owner. The boys, as we have seen, did not remain at home and help cultivate these acres which their fathers had reclaimed from the wilderness, but went abroad to other employments which promised to be more congenial to their tastes, or to lands where the husbandman was said to be rewarded with more abundant harvests; and the consequence is, our own agricultural interests have been too much neglected.

Now we want something to counteract this disposition to emigrate; something to bring the farmers together oftener, and in such a manner that, at their meetings, their actual necessities may be freely stated, and methods suggested for remedy. We have been able to show at the fairs held by our Society, that we can raise good crops of hay, grain, vegetables and fruit. Having shown that these crops can be raised and ripened successfully, with the fact before us which requires no argument to support, that the yield per acre is greater than in the more favored regions

of the West, but one other requisite is essential to success in this branch of farm industry—and that is, to know how to prepare acres enough; to understand the nature of the different kinds of soil, what crops are best adapted to each, and how to supply lacking elements, by the application of proper fertilizers, etc. We want a better practical education for our sons, that they may understand more of the nature of their business and the principles which govern it, that they will not be obliged to follow entirely in the footsteps of their fathers, but be better prepared to accept the truths revealed by the light of science. We want more organized effort in the form of societies, clubs and town fairs, where farmers can compare their productions, make known their methods of culture, and each one be benefited by the experience of all the others. Farmers should form a Board of Trade or a Producers' Exchange, and meet the buyers on even terms and with equal information as regards the demands for their productions, and the prices at every important market in the country. They might then have some voice in regulating the prices of their productions by controling the supply, and would be likely to be rewarded by a fair equivalent for the capital and labor invested in raising their crops.

We want men to cultivate smaller farms. I call to mind farms containing from sixty to one hundred acres, on which the amount of hay harvested each year does not exceed fifteen or twenty tons, and this amount is gathered from thirty or forty acres of land, when the same might be raised on six or eight acres. The owners say they must have a great deal of land for pasture; but I believe it is false economy to allow stock to roam over great tracts of land covered with stumps, rocks and rubbish, with stagnant water lying upon the surface, overrun with weeds and wild herbage, when one-third of the amount cleared, drained and seeded down with nutritious grasses would furnish more feed than the whole, and allow the animals some time to rest and fatten. There are thousands of acres of grazing lands around us which we want stocked. We want farmers to sell more cheese and butter and beef, and less hay and grain and potatoes. We want them to feed the root crops out on the farm, that the soil may no longer be impoverished. It is nature's own plan, and if followed would lend a verdure to our farms not now remarkable. We want cheese factories at the corners where four ways meet, to help our farmers start out on this "new departure." We want farmers to keep

more hogs and fewer dogs. We want men to engage in sheep husbandry, and cover these rugged hill-sides and wasted pastures with flocks of Leicesters and Cotswolds and Southdowns; then we want our legislators to make laws for their protection. Then the farms will have more backbone and more endurance, and after twenty or twenty-five years' cultivation will not be like a squeezed orange, but will grow more fruitful as age increases. The profits to farmers are not all acquired by digging and delving from daylight till dark. There is as much in good management as in hard work, and we want men in the ranks of the farmers who will take the time to keep accurate accounts, weight and measure, compare and make statements for future reference and for the guidance of others. Then we want, as our Canadian cousins say, the Legislature to "*grant us better terms,*" and we look to the Board of Agriculture for important aid in that direction. Until the wants which I have enumerated in this brief paper are supplied, the farmers of Washington cannot enjoy the full benefit of their labors.

SUCCESS IN FARMING.

By B. M. Hight, Member from State Agricultural Society.

In a quiet, pretty village of our State, there once stood a modest, unpretending Academy. Its Trustees (composed of "Honorables," "Reverends" and "Esquires,") came to their annual meeting overflowing with enthusiasm for the prosperity of their Institution. In their speeches they declared, and by their votes unanimously resolved, that it was their sacred duty to patronize this their foster child, and to use their utmost exertions to secure for it the patronage of others, until their zeal would seem to defy all opposition, and secure its prosperity against even a chance of failure. The meeting is now adjourned, and with it all interest in the cause of education is for one year dismissed. These annual paroxysms continued, until, in spite of such strenuous efforts of the Trustees, and to their complete astonishment, the school closed, never more to open. Thus I fear it is, that through a lack of practicability, very much that is excellent in our agricultural societies is lost to the masses of our farmers. It is true, that at our meetings we find our educated farmers, our wealthy farmers, our successful farmers, who discourse truthfully and interestingly upon their broad acres with Eden-like culture, their prize farming implements, their ample barns stuffed to the ridge-pole, their cellars heaped to the ceiling, their nicely appointed stables and sheep-cots alive with choice breeds, and of the wonderful returns of farm labor. Our doings are carefully reported, published and circulated. The poorer farmer who represents the masses, commences to read the recorded facts, soon closes the book with a long-drawn sigh, and the reflection, "had my father or dame Fortune bequeathed to me two hundred acres of good land with one hundred dollars in money for the improvement of each acre, and implements, buildings and stock to match, I too could talk of successful farming, instead of being obliged to keep my head above water by throwing aside every avoidable comfort, and by working myself and mine

to the very last degree of endurance." Oh! "there is the rub." There is altogether *too much hard work done on our common farms in Maine*, and if to one of this class I can suggest any new ideas or enforce one old one that shall be of use, I shall be amply rewarded for my trouble.

Regular and proper working hours are not observed on most of our farms. The mechanic has his prescribed hours for labor, the manufacturer is tied to his bell rope, and almost every other pursuit has its allotted working hours. But on most farms ambition alone decides the hour for commencing the operations of the day, while its close is determined only by the inability to continue. Early and late is the motto of the ambitious, and if middle age does not find him old and broken down, he may thank an iron constitution, and flatter himself with the more than doubtful compliment of having abused one of Heaven's choicest blessings. No man has a better right to be unnecessarily prodigal of his own strength than to waste any property committed to his care by another, and the practice for the most part defeats its own object, *thrift in business*. We may rest assured that if steady labor during seasonable hours does not meet with success, the cause of failure must be looked for elsewhere,—perhaps in faulty planning or disadvantageous execution. What would be thought of the carpenter who should set about erecting a house with no definite plan either on paper or in his mind? Yet it is no unusual thing to see men of our calling commence the day's work with no settled scheme, and therefore end it with no obvious results. Such hard but haphazard workers spend a very large proportion of their time in shifting from one unfinished job to another, in running from house to barn, from barn to field. I can best illustrate my idea of advantageous labor by giving an extreme case of the opposite. An acquaintance of mine was a hard-working farmer, but was compelled to leave the business in disgust. I have been credibly informed that he would yoke his oxen, wind the chain around the yoke, and walk beside them to his plowing with his plow on his shoulder. He is now a hard-working milk peddler.

It is very evident that no amount of hard labor can compensate for such disadvantageous modes of operating, yet thousands of our farmers are to day throwing away their strength in a precisely similar manner for lack of a little brain force.

The evils of physical without mental labor, like other evils, are sure to repeat themselves; the comparatively meagre returns of such labor added to the necessity for mixed farming imposed upon us by our climate, renders such farmers necessarily very niggardly in expenditures; so when harvesting (the climax in farming) arrives, they are over prudent in procuring help, and are consequently compelled to work themselves and theirs at unseasonable hours and with unreasonable severity, and from early dawn to the breakfast hour, from the breakfast table to the dinner hour, from the mid-day meal to the lamp-lighted supper table, the perspiration pours in almost one continuous stream.

The course soon sends the boys with "weak stomachs" or "broken constitutions" into other business, and the farmer, unless he have a constitution stronger than a Samson with hair a rod long, is an invalid for life. In all this it will at once be seen that not only has there been a most useless waste of strength, but a criminal violation of the most obvious laws of health. For to begin with, the meals are swallowed half masticated, and while the system is fatigued; and no time for quiet is allowed the rest of the body while the stomach is laboring to digest its illy prepared contents. Now I am told by physicians, that it is about as difficult for the stomach to digest food when the system is exhausted by *labor* as by *disease*, and if this be in any degree correct, how can so many of our hard working farmers live out half their days? The only reasonable answer that can be given is, that the otherwise wholesome employment in some degree counteracts these pernicious practices; but the stone drag will not bear everything, and the iron constitution must eventually succumb to such enormous impositions. In the second place, the practice of cooling off too suddenly when heated, and freely perspiring, is fraught with immediate danger to life, and seldom fails sooner or later to induce disastrous consequences.

Dr. Wilbur of Skowhegan, the late Surgeon of Board of Enrollment for our Third Congressional District, informs me that in his physical examination of men, a very large proportion (three to one) of those examined were farmers, that a very large proportion of those rejected as unfit for military duty were suffering from organic disease of internal organs, and that an unexpectedly large proportion of these diseases were of the lungs, and especially of the heart. In conversation with him upon the subject, his reasoning ran thus: "In all exercise, physical or mental, the acting

organ is subject to more or less wear, in proportion to the amount of labor done. The office of the blood is to take up the worn out rubbish and dump it into organs designed to expel it from the system, and to carry around the material for repairs. The lungs, the liver, bowels and kidneys, throw it off in the breath, the fæces and the urine, but the most powerful as well as safe excreting organ is the skin, which throws off the debris in the perspiration. Then in extraordinary exertion the blood must redouble its circulation in order to perform its offices properly. This imposes an increase of labor on the heart, the lungs must work harder to keep the blood pure, and the excreting organs to throw off the effete matter from the system. Now suppose cold to be applied to the skin; that organ is contracted and the circulation driven from the surface. The blood (surcharged with poisonous debris) is still sent out in torrents, and must go somewhere to make its deposits, and where shall it, where can it go but to some of the internal organs? This it does, and tenfold duty is laid upon the already overtasked organs. Temporary oppression and congestion follows, and unless the organs are stronger than the internal arrangement of a freight locomotive a succession of such indiscretions must end in organic disease." Three hard working farmers within one and a half miles of my residence have fallen victims to heart disease within three years.

We have now seen some of the evils resulting from excessive farm labor, and the question naturally arises, "How can it be avoided?" It will, I think, be conceded that it *is* avoided by very many thrifty farmers, and no good reason can be seen why it may not be by others. First, we try to cultivate too much land. Let us take for example our mowing: there are two fields, one contains twenty acres and has a burden of half a ton to the acre; the other contains ten acres, with a burden of two tons; it will cost to mow, rake, cure and house the crop from the small lot, about two-thirds as much labor as it will to harvest the larger; the product of the lesser is about three times that of the larger. The same principle will apply to nearly all of our crops. But this is not all. We pay a tax, and are losing the interest on the cost of the extra ten acres in the large lot, and all this extra expense is incurred for the rare privilege of slaving ourselves to death. It may be said, we have the surplus ten acres, and what shall we do with it? In answer; turn it into grazing, where it will yield

some profit, or sell it and apply the culture which has been bestowed on it for the improvement of what remains.

There are other matters in connection with this question. How shall we make farming pay?—which is well to notice. This implies that it does not pay, or not so large in proportion as in former years That is true; but take the latter proportion, for it is evident it does pay something. It may be a fact that our farmers do not realize as large a net profit as in the first half of the present century; then, throughout the country, with slight exceptions, the course was "general farming," as many practice it now. Grain, potatoes, wool, lambs, beef and poultry, were the main products sold; these, they claimed, all paid a profit over cost then. Do they now? It is often asserted that they do not, and with a tolerable share of reason. And why? Because other localities can and do supply these articles in our market cheaper than it costs us to grow them; at the same time as large a breadth of our land is still used to grow them as when competition was limited; and, to this extent, we have been standing still in the midst of general progress. The knowledge of such facts would give little encouragement, if there were no remedy available; but it is presumed that there is. It is true many farmers can do something in the line of market gardening, with fair and sometimes large profits in favored localities; others in fruit raising, and I presume my brother Brackett will tell or advise you to go into associate dairying. Yet the main question still remains—What is best to be done with the bulk of our farm lands, and what crops and stock will pay? Hay is a paying crop and not liable to wide competion. It is now our main selling crop. The true way to improve it is by liberal manuring, early cutting, and fall feed none at all. Of course top-dressing is open to the old objection, viz: "escape of valuable gases"—a big humbug which has cost the farmers dearly. When the valuable salts are in solution they penetrate the soil and invariably find absorbents to hold them. Give back to the land in top-dressing a portion of the value of the hay taken off. One-third of the hay will pay for securing, one-third will pay for marketing, ground rent and profit, and the other third returned in manure, will keep the land up to its original fertility, so that many crops of hay may be produced without resorting to the plow. It is poverty, not time, that thins out grass. Retain a fair portion of what it yields, return the balance in manure, and the grass will thicken instead of thinning out.

As to stock for dairying, I presume my brother Percival by all means would recommend the "thoroughbred Durham cow" as the best, and my brother Burleigh would in all seriousness recommend the Hereford, and I presume Drs. Boutelle and North would in all candor and honesty recommend the Jersey. But in my candid opinion it is the *feed* quite as much as breed which gives quantity and quality. As a general rule the cow which eats and properly digests the most will give the *most milk*. Large size, compact form, a healthy constitution and a full feeder, I prefer to long pedigree—of Jerseys, Brittons or Skerry.

Sheep will pay; at the same time much of the success of the wool-grower depends upon the winter management of the flock. Sheep are animals which pay their owners better for good care and keeping than any other stock usually kept on a farm; but if fed with a stingy hand or neglect, they pay perhaps as poorly as anything. The proper and the most profitable mode of feeding for breeding and store sheep, is that which will develop in them the highest degree of bodily vigor. Every wool grower will find it for his interest to provide warm, spacious, and well ventilated sheds for his flock, with convenient access to pure water. In regard to the question, "How often should sheep be fed?" a difference of opinion among good managers exists. While one believes that twice a day is sufficient, another thinks it is desirable to feed three or four times; but the most important point, I apprehend, is to feed regularly, whether twice, three or four times a day.

I believe it will pay to raise colts by a judicious selection of well-bred, good sized mares and stallions, (I have no fellowship with these little ought-to-be trotters). But let us breed for *style*, size, and *speed* combined, then we have a horse sure to sell and fit to drive or work.

Without further noticing specialities that may be made profitable, the object is attained if it leads to *thought*. Every farmer who will think, and determine to switch out of the old ruts to practicable experiment upon his thoughts, will with a fair degree of certainty find out what will pay best in his case, as much depends upon soil, locality and circumstances known only to himself; but each may confidently start from the same stand-point—that he cannot compete with more favored rivals in mixed farming. Yet I believe it good economy for every farmer to raise, even at a seeming loss, all that are necessary for consumption in the family

and on the farm. In this country there are very few who do not have to labor in some way for a livelihood. Then one of the most important considerations which should occupy a young man when he is about to prepare himself for the active duties of life, is a choice of a profession, trade or pursuit, which is best suited to his genius and capacity.

Is it not surprising that so many get completely mistaken? But sometimes circumstances control inclination in such cases. They must choose the next best. Many, however, who are left to choose, enter upon the study of law and medicine, or engage in merchandise, who are far better qualified to handle the plow. Many young men entirely overlook the pursuit for which they are fitted, and hence few succeed. It has often been a matter of supprise to me that so many able bodied men, who have been brought up in the country, should abandon the cultivation of the soil for the precarious business of merchandise, law or medicine. Agriculture, when properly attended too, if it does not lead to large fortunes, generally affords the means of independence, while success in the professions is uncertain.

It will be conceded by every observing man, that the two popular professions, law and medicine, are overstocked. It is true that some make hits, but where one hits a hundred fail. In too many cases many enter these professions from a mistaken appreciation of their own talents; many from a foolish pride—from a foolish notion that a practicable farmer or practicable mechanic is less respectable in society. But in the words of the Poet,

> "Honor and shame from no condition rise;
> Act well your part, there all the honor lies."

There is no reason for the question, "How can we make farming pay?" It always has paid, and always will pay, and *that* in proportion to the intelligence, energy and industry applied. The farmer whose day's work is done when the sun sets, but half works his farm. Mind is as necessary as muscle. In leisure hours read, think and plan for your business; none requires it more,—none will pay for it better.

The establishment of Agricultural Colleges, Boards of Agriculture, County and Town Clubs, indicate that tillers of the soil do not intend to be long in the back-ground. In their theories of farming, it shows the drift of thought—that there is a growing impression that more light is needed on the subject of husbandry.

A STATE INDUSTRIAL EXPOSITION.

By George B. Barrows, Fryeburg.

A State Industrial Exposition, should include specimen products from every branch of industry, and of all such raw material as the hand of man may profitably use—thus embracing every source of wealth in the State—and differing from a mere exhibition, which is only a show, without reference to its completeness.

In many respects its objects are the same as if it originated with an individual or an association, but as it occupies higher ground and has a wider range, its opportunities are larger and its responsibilities greater. There is the same design of bringing buyer and seller together, of affording the skilful manufacturer the best chance for displaying honest and faithful work, and of informing the merchant where he can find desirable equivalents for his money. So also where the number of practical operators is limited and the amount of available capital is small, a judicious display of raw material whether by one or many, will frequently persuade capital and labor not otherwise occupied, to make use of it and thus develop idle resources. As the strength of a State and its relative rank and standing depend upon its population, the desire that it may be increased is very natural, and always found to exist; and no more ready way can be discovered of drawing settlers into a country, than by an attractive display of its resources. The same method also proves effectual in restraining emigration, serving as a stimulus and encouragement to the inhabitants to make the most of their present opportunities, and holding out the prospect of a brighter future. To the citizens of the country and to strangers from other lands, no more valuable school of instruction can be furnished, thus to see the wealth and power of a State, without traversing its territory; and among its treasures of thought and labor, to find objects for the profitable recollections of a lifetime. Self knowledge is regarded as absolutely essential to the progress and improvement of mankind; and

it is no less so for a State, and in no other way can it be so satisfactorily obtained as by the one we are now considering. Let a State set in order its material strength and wealth and make a public display of it, and it must stand or fall by it in its own estimation, as well as in that of the world at large. Thus can it learn its own defects and weakness, or its strength and capacities; and thus derive lessons of value from the criticisms of its friends and enemies alike.

Formerly, nations were in the habit of attempting to maintain their relative positions even in time of peace, by some brilliant military display—a review of a grand army, or the manœuvring of a great fleet, and thus perhaps have succeeded in warding off some meditated attack, or in making an advantageous alliance. While in these later days the practice is not entirely abandoned, it is nevertheless true that nations are relying more and more upon the development of internal life and strength. We have seen within a few years the great International Expositions of England, France and Austria, with their world-wide fame—springing no doubt from selfish but honorable considerations; and yet probably mainly prompted by the conviction that it would not do for them to lag behind in this peaceful race of empires.

The next year will bring as we trust, the whole world as admiring pilgrims to another shrine of peace and progress in our country; and while foreign visitors will receive a rich reward for their expenditure of time and money, we believe that the lapse of a century will not efface the benefits which will remain with us.

While it may be said with truth that occasions of such magnitude belong only to nations, and to the centuries: it is the fact, notwithstanding, that States like our own are not entirely debarred from similar opportunities and benefits. A State comparatively new, with a large territory, much of it unsettled, and resources not yet developed, requires some special effort in its behalf that might be unnecessary in older and more populous States. Some of the Western States recognizing this fact, have not been content with exhibitions of home products on their own soil: but have distributed far and wide samples of their cereals and other crops, and have sent specimens of their fruits such distances as their perishable nature would allow; receiving, no doubt, from this trifling expenditure a hundred fold return.

It would probably be impracticable in this State, to hold Industrial Expositions oftener than once in five or ten years; and as

their management as independent organizations would be attended with great expense, it would be more desirable to make use of machinery already in operation, and therefore if found practicable it would be well to unite with the annual exhibition of the State Agricultural Society—the society only being necessary for the sake of the exhibition. There are, however, some objections to such an union, which ought to be considered, only requiring that perhaps to be removed. As now constituted, its annual display cannot properly be called a State exhibition—the materials of which it is made up come principally from its immediate locality, or from a few large towns and cities conveniently near by rail; while the larger part of the territory, inhabitants and interests of the State, have no part or lot in it. While it is not to be denied that such an exhibition may give some degree of satisfaction to those who attend it, being good as far as it goes, it is nevertheless true that each year brings a keen sense of disappointment to our own citizens, and of dissatisfaction to visitors from abroad, on account of its incompleteness, and its failure to represent the varied interests of the State as a whole. An opportunity is thus afforded to those who are disposed to be uncharitable, to affirm that this is a fair specimen of the State, and the best exhibition that could be made. It is a prevailing impression, that if the balance were struck at the close of each year's labor, it would be found that the State as an independent existence, derives little or no benefit from its annual exhibition. The honor and dignity of the State ought not to be impaired by an association undertaking to represent and sustain both, which only succeeds—probably innocently and unintentionally—in exposing its nakedness, and bringing upon it a reproach which is not deserved.

Only a brief allusion will be made to a criticism often heard—that too much attention is given at these exhibitions to the horse, and to the single quality of speed, thereby overshadowing if not shutting out many other branches of more importance. In proof of this, it is stated, that sometimes more than half of the premiums are paid for trotting horses; thus giving ground for the inference that this is the largest and most profitable branch of husbandry in Maine, and that the State, through the agency of its consolidated authority, declares it to be the most worthy of encouragement. We trust that it may not be regarded as an unfriendly hint, to suggest that the Society has clearly established an exclusive right to use for its device the image of the fabled Centaur. Setting

aside the conviction that this one-sided preponderance attracts a certain element of disorder that requires a large force of repression, and also repels another element of substance and respectability, whose absence cannot well be sustained: the admitted fact remains, that this inequality is at war with the true principles of all Expositions, whether State or National—that every industrial interest should be recognized, and exactly in proportion to its importance.

The particular time chosen by this Society for its annual exhibition, cannot but be regarded as unfavorable to its own interests; and were it merged in a State Industrial Exposition it would be still more detrimental to their united existence. During the month of September the occurrence of the State Election, and the coming of the equinox with its gales, and rains and cold, are of themselves disturbing causes sufficient to derange the very best laid plans of wise men. The chief objection, however, to this month, above all others, is upon the agricultural side. At this time very few crops have been harvested, and therefore they are not ready for exhibition; and farmers, universally, have absolutely no leisure to give to such occasions. There is no month of the year when they are more busy, or so closely confined at home: as then comes the pressure of the harvest, which allows no delay, but requires attention just then. The selection, therefore, of this month, and of such a part of the month, involves as a necessary result a meagre show of field and garden products; a small attendance of farmers and farmers' families, and the tolerable certainty of unpleasant or uncomfortable weather.

The brief duration also of this exhibition would be entirely inadequate to meet the demands of a great organization that had undertaken to reach out over the whole State for its contributions, and to afford a large part of its population an opportunity for their examination. When the time is thus narrowed down to three or four days, a considerable part of it is spent in coming and going; in preparing articles to be shown, and in preparing them to be removed; and but little quiet, undisturbed time remains for a deliberate and careful inspection of whatever there is worth seeing. No State Industrial Exposition could possibly be a success if thus limited in time. Modifications and amendments in some of these respects, would unquestionably be of great service to the State Society remaining in its present condition; and were the proposed union effected they would seem to be absolutely indis-

pensable. If through the Board of Agriculture, or some other agency, an arrangement had been made by which the agricultural industries and the mechanical industries should agree to unite in a single Exposition—based upon the one idea of promoting the welfare of the State—it is altogether probable that the former would have somewhat the precedence on account of their larger extent, and from having already under their control so many existing organizations. However this may be, these associations so useful and efficient in the past, can attain a higher degree of efficiency and usefulness by new combinations and unions.

As at present constituted, the State Society has no real foundation—it rests upon the sand—it has comparatively no constituency, and there is nothing of the representative character in its composition. If it could be made up of component parts, having a distinct individuality of their own—if it could stand upon the lower and subordinate societies for support, as the State does upon the several municipalities—and if the representative idea could be introduced into its internal structure—new possibilities would be within reach, and an improved order of things could be established.

That something may be accomplished in this direction, it is suggested that we begin with the towns, operating through the medium of Farmers' Clubs or Town Associations, or any industrial union that may exist—proposing that they organize for the purpose of sending contributions from their localities to their county agricultural exhibitions—holding Fairs of their own, if they wish—but always first, and for the sake of collecting and sending their best things to the County Society. Then at the County Exhibition let each town have its own department by itself—thus giving opportunity for comparison, and better still for competition—exciting a wholesome rivalry, working not for the promotion of selfish ends, but for the honor and credit of one's own town. Let disinterested experts be chosen for judges, and then so far as may be practicable, let everything which receives a premium be sent or repeated at the State Industrial Exposition—observing the same rule there, by giving Counties or the several County Societies distinct departments of their own. By this method a spirit of peaceful rivalry would be aroused, which would secure full and choice contributions from every part of the State, and as a direct result a large attendance of interested spectators. A flag, or a parchment, or honorable mention even, for some things, would be

more highly prized, when received in a contest where sixteen Counties enter the lists, than the award of a large sum of money.

To make this arrangement, it would be necessary for the Board of Agriculture to confer with the several societies, to this end; and to endeavor to bring the exhibitions of the County Societies into September, or the first of October, not interfering with each other, so that the State Exposition could be held before the middle of October. By this plan the State Exposition would secure ordinarily more favorable weather, and a larger attendance, and certainly a full and complete collection of the several industries of the State; while the County Societies even, if unfortunate in their time, or the fullness of their show, would suffer much less comparatively than the larger organization. The change, also, would be for the advantage of the farmers—as the man who could not leave his harvest to travel a hundred miles in September, to go for a few days to the State show, could at that time go ten miles for a single day to his own Fair—and then with his harvest finished, he would be much more likely to go in October to the State Exposition. Without doubt a week or ten days would be considered none too long for the continuance of the Exposition; and thus financial disaster would be averted in case of unfavorable weather for a day or two—opportunity would be given for the several members of a family to attend at different times—large crowds would be prevented by distributing the people over several days—a smaller number of persons would be required as assistants —and while the receipts would be increased, the expenses would be diminished. Whenever this new departure shall be entered upon with deliberation and determination, it may be reasonably supposed, also, that our railroads will respond to the awakened enthusiasm and patriotic impulses in behalf of the commonwealth, and will transport men and materials upon unusually favorable terms. It has already been suggested, that the sum expended by the State Agricultural Society in advertising its annual exhibition, would send a competent agent over the length and breadth of the State, who would address the working men and the capitalists, and persuade them to advance their own interests by thus promoting the higher welfare of the State.

There is room for further suggestion, and a variety of details might be considered; but without doubt they would receive appropriate attention, as they develop themselves in the progress of the

undertaking. Should any one entertain the idea that the creation of a large and strong organization will weaken those already existing, to them it must be said with all confidence, on the contrary the direct result will be to strengthen them all; and its own prosperity will only be in proportion to their success. To the State Society, the plan proposed offers a way of escape from an accumulating debt, and from the impending shadow of the coming year. It requires but little prophetic skill to predict: that the excitements of the Presidential contest, and the attractions of the Centennial Exposition, will so engross the attention of our citizens, that but little time or money will be expended upon home exhibitions, presenting no unusual attractions. With reference to the County Societies, it may be said: that had this plan no other merit, it might rightfully claim commendation on the simple ground of the communication of new vitality to them—strengthening them from below, linking them together, and making them influential parts of a greater whole—and establishing such intimacy of relations, as to require a representative from each county on the board of managers controlling the State Exposition.

The principal reason, however, why the Board of Agriculture should earnestly consider the project of holding a State Industrial Exposition, is, that it may preserve a consistency of action and record. Nearly fifteen years ago, with this object in view, it gave its Secretary instructions to arrange with the several county societies the time of their annual exhibitions. The breaking out of the war prevented this first step, and its continuance checked subsequent movements; otherwise the completed work would have been already in successful operation.

The approaching year brings a new era in our national life; let us signalize it by an onward movement in State progress, by a tardy fulfilment of a reasonable expectation.

PRACTICAL EDUCATION—AND THE AIMS AND METHODS OF THE MAINE STATE COLLEGE.

By Charles F. Allen, D. D., President.

Imperfect and defective as our system of education may be, under its influence have been moulded teachers that have taken the most prominent positions of usefulness and renown in every State of the Union. Maine teachers are found alike in the Gulf States and on the coast of the Pacific. Older States, with more costly appliances, and better endowed institutions, are supplied, to a great extent, with educators who have graduated from our High Schools, Seminaries and Colleges.

Whatever criticisms are made upon the system of education hitherto followed, or upon the agents in the work, in all we should recognize the success that has been attained and the good that has been accomplished. With a wise conservatism we should defend every valuable portion of the inheritance transmitted to us against the rash zeal for reform that would tear down the venerable edifice to reconstruct an ideal palace with modern improvements. Nor is it alone in the demand made by other States for Maine teachers that the advantages of our system and methods of instruction are seen. The percentage of illiteracy is less in Maine than in other States, and the ignorance is mostly confined to the foreign population that swarms in our manufacturing towns.

But with all the praise that can be lavished on the present condition of the schools in our State, there is ample ground for improvement; and it may be profitable to review the principles that lie at the basis of successful and practical education.

Teaching is a science which embraces in its scope the whole nature of the child, and which has respect to the physical, mental and moral laws of our constitution. The design of instruction is the development of the faculties in the individual, and his adaptation to his relations to society. The principles of education are to be found in mental and natural sciences, in economic and social law. As a distinctive science, teaching selects and arranges these principles, and thus furnishes a sure basis of procedure. It has

therefore the same reason to be called a science that medicine or jurisprudence can claim.

Teaching is an art, by which one well skilled is enabled to select and apply the best methods of imparting instruction and culture, and can thus train successfully those committed to his care. Like every other art, successful teaching is learned by imitation and practice. Claiming the high dignity of a profession, teaching becomes more noble in its position, and demands the most careful preparation on the part of all who would enter upon its responsibilities. While so many are ready to promise easy access to all the mysteries and privileges of any science, by some new and royal road, the public faith is staggered, and meets the excessive drafts on its credulity with a sullen protest. Thorough scholarship cannot be obtained without long continued application and wisely directed efforts; and these come not by mere chance.

While to a certain extent a general education in the principles of all studies is to be sought, so that a broad and noble foundation will be laid, and the faculties of the mind symmetrically developed, we should remember that the fields of knowledge have become so widely extended that it is impossible to be proficient in every branch of study.

Some discrimination is necessary. All studies are not equally important; and the same studies are not of equal value to all students. There are two ways of procedure in the work of education. The one seeks to discipline the faculties and to habituate the mind to pure abstract truth, without any regard to the application of this knowledge to useful ends. In this course those studies are selected which appear best adapted to expand the intellect and strengthen the mind by the contemplation of truths that are to be received by reason alone. Those who employ this method disregard the qualities of things and the training of the perceptions, and seek for the mere exercise of the pure intellect. They delight in a philosophy that promises to raise us above all the actual and useful combinations of real life to the regions of positive and ideal science.

The other course seeks for the attainment of knowledge that is available in the actual life of the individual, and a preparation for such action as will minister to necessities, supply wants, mitigate distress and procure comforts for ourselves or for others. Pure science is taught not for knowledge as an end, but to acquire better agencies for procuring valuable results. The knowledge is

applied to useful purposes. Such an education would discipline the mind by the study of that which when learned will be of direct use in after life. By this method we study the mind, that we may better use our faculties; we study nature that by the knowlege of her laws we may attain a higher vantage ground in our life work.

The theory of Plato was, that knowledge is to be sought for its own sake, not for any advantage it might confer, as the miser loves money, hoards it and gloats over it, without any regard to the good he might do with it to himself or others. That the exercise of the faculties is not to accomplish some outward object, but to develop greater subjective faculties.

The theory of Bacon is, that our faculties are means, not ends; that we know to do, and are not to limit all our efforts to know. Knowledge is power—power manifest in useful results—or what he significantly calls fruits.

In the course of study that has come down to us by prescription, there is much of the former theory. In the reaction against it, there is danger of making a false criterion of what is really practical, as if everything useful was to be measured by a money standard. A practical education does not confine the student to those subjects which have a pecuniary or exchange value; nor to the attainment of those qualifications which prepare one to make money. Anything that will make a man useful in society, that will benefit himself or others, and that will make him fruitful in good works, comes within its appropriate sphere; any knowledge that cannot be made to subserve some practical result is alone rejected.

A narrow basis of education is often laid in home training. Instead of employing the faculties of children in those exercises that broaden and deepen the mind for great and useful action, the laudable curiosity that prompts to profitable investigations is checked by the stolid indifference of the parents. Would the young know the names and properties of the plants that surround them in their daily walks, they are told not to meddle with poisonous weeds. Do they gather rare stones for a cabinet of minerals, they are assured there is no money in such work. If natural phenomena attract their attention, and they are eager to know the causes of these events, they are silenced by the withering adage, "Children must not ask too many questions." Parents carry their mistaken notions into the common schools, and insist that whatever lies beyond their own narrow comprehension of utility is

impracticable; studies of greatest utility are discarded, and the whole energy is wasted on some low and illiberal aim. To complete the process of intellectual malformation, the student is placed in some course of special training, to be sharpened off for some limited sphere of activity. To one thus educated, a few rules are the whole capital stock of knowledge in his chosen profession; and what is lacking in the breadth of comprehension will be made up in the depth of self esteem.

There is a tendency in all professional schools to reduce everything to one dull level of mediocrity. All are to be stretched on Procrustes' bed. The mind is to be cramped into the model pattern; or some slim individual is to be elongated till he can reach the measure of the stature of the regulation ordinance. The uniform of the institution is not caps and coats of the same pattern and trimmings, but mental habits of the same dimensions. The products of the educational mill come forth stamped with the image and superscription of the presiding genius. With such an education, the individual goes forth to the routine of daily reiterated performance of the same tasks, in the same manner, till the whole nature is shrivelled up into mere mechanical, unconscious action. Such a course of study is sometimes called a practical education. But it is not education in the true sense of the word.

True practical education takes those studies that are to be of the greatest use to the student in after life. It seeks to form a complete manhood, and trains in the use of thought for thought, in words for words, and in acts for acts. It is a sad waste of time and brains to devote term after term to mere intellectual exercise, without acquiring any appreciable amount of useful knowledge. The lauded value of certain studies for discipline alone, the cudgelling of one's brains over puzzles that are of no use when solved, and the hiding of information in dark recesses, that the pupil may become dextrous in hunting for the secreted treasures of knowledge, will hardly bear the test of common sense. In the race he gains not the prize, who runs uncertainly, or for mere exercise. In the combat of life he wins not who fights as one that beateth the air.

The scientific principles accumulated in the process of education are not to be considered as so many ascertained facts, that are to be stored up as useless furniture of the mind; or mere showy ornaments, to be exhibited for vulgar admiration. Each principle planted in the deep furrows of a well cultivated mind is

a seed thought, which is to germinate, grow, blossom and bear the fruit of useful action. Or like the Banyan tree, which with its foliage and fruit, sends down branches to root in new soil, and to grow up to sturdy columns, endowed with vital energy and the same progressive tendency. Practical education prepares us for ends beyond ourselves; and therefore those studies are selected which will best qualify the student for the greatest amount of good, honest, manly work, whether that work is in the realm of mind or matter.

The great mass of the people must procure their subsistence by manual labor; and the provisions for public education should have reference to their essential wants. To the great majority an advanced, practical education must be essentially scientific; and however important may be considered the study of ancient languages, we have no right to turn the highest efforts of public schools in one channel in order to fit a few pupils for some so called learned profession. The liberal education, demanded by those who are to transact the business and develop the resources of our State, will take a more practical form.

There has alwas been a desire to escape the necessity of daily toil; and it was early ascertained that the brain could be more productive than the hand. Those whose energy of character made them preëminent, availed themselves readily of the labors of others. The separation of the governing class into a distinct order, and the vested rights of nobility, fashioned in old times an organized system of oppression. Feudal lords subordinated to higher seignors, and they at last to a monarch, formed a pyramid of tyranny, which with its heavy weight crushed the laboring people down into the earth as menials and serfs. The philosophers of olden time had no word of cheer for the toiling mass, the common herd of workers. Scholars despised those who used their intellect to make the work of slaves more productive. Said the Roman poet, "I hate the profane vulgar, and drive them from me." Archimides apologized for allowing his genius to be turned to any useful inventions. Seneca thought it an insult to attribute to a philosopher any share in the invention or improvement of a plow, a ship, or a mill.

The impetus given to scientific studies by the philosophy of Bacon, and the emancipation of the English people in the seventeenth century from crowned and mitred tyranny, has not been so complete as to eradicate all the prejudices against productive

labor. It is still considered among the learned, that the highest culture adapted to the industries of life has no right to be called liberal; and the bachelor of arts looks down on the bachelor of science as one of inferior order of scholarship. The whole tendency of our higher forms of education is turned in favor of unproductive professions.

Having selected studies of practical utility, which have a direct bearing on our future usefulness, we should seek the most appropriate methods of conducting our researches. The docile spirit of childhood, which receives information on the mere authority of teachers, is accompanied with an imitative spirit and a restless activity, which induce the pupil to work out the principles announced and illustrated, and thus to make them his own—for axioms unapplied are but imperfectly appreciated. Too often in the school-room this process is forgotten by the teacher. The restless activity is suppressed, and the memory is crammed with ill-digested rules and principles.

To a certain extent all successful teaching is practical. That is, the scholar is directed in the practice of what is to be acquired. In primary studies the pupil is not taught principles and rules of procedure by precept, but by exercise; for no teacher would follow so absurd a method as to rely on explanations or directions while teaching a child to read or write. No principles of reading, however clearly presented, no theory of penmanship, however accurately determined, will make a good reader or writer. We learn to read by imitation and exercise, we learn to write by observation and practice. The continued practice of an art will alone successfully teach the principles of the science.

In more advanced studies, practical methods are often neglected by teachers in our common schools, and consequently there is but little result from a great outlay of money and time. There is a sad want of brains in forcing the student to commit rules of arithmetic, tables of reduction, methods of permutation and alligation, principles of duodecimals and obsolete ways of casting interest, trying to teach what not one in a hundred will have any occasion to use out of the schoolroom. When the pupils, wearied with the unprofitable efforts, and disgusted with the half understood perplexities, leave the school, they cannot add a column of figures with accuracy, certainty and rapidity, for lack of appropriate practical teaching.

In the study of grammar there are still greater absurdities per-

petrated and perpetuated. Trying to force our language into classical formulas, and learning methods of the logical analysis of a sentenee, before the correct forms of words and sentences are understood, is certainly discouraging work for immature minds. The results of the study of English grammar are so unsatisfactory that constant changes of text-books are made; each new author striving for originality, at least in the nomenclature employed; and claiming that his phraseology will reveal to the perplexed student all the mysteries of speech. Teachers grasp these books, unmindful that the real difficulty is the want of a practical method of teaching grammar, not of new text-books, and a new phraseology of the principles announced. The study of grammar should, by systematic practice, enable the student to construct elegant and correct sentences, instead of repeating a jargon of constantly changing names of classes of words and clauses of sentences. The graduate from our high schools should be able to avoid the barbarisms and grosser errors in syntax when he speaks, and to write a page of English without such grotesque blunders as are often seen in the written examinations of the candidates for admission into our colleges.

In natural history, we can hardly imagine any good, live teacher, listening to memoriter recitations from some learned text-book. We find these teachers placing the objects themselves and not their description in the hands of the pupils. These teachers train the perceptions of their scholars to notice the exact outlines, the minute peculiarities, and the full details; they train the judgment to compare, to arrange, to classify; they train the reason to infer with certainty, and they train the imagination to soar with steady and sustained flight till it reads the very thoughts of the Creator.

From the object lessons in the Kindergarten schools, through the different exercises in our common schools, to the tasks assigned in the laboratory by the college professor, science is taught successfully by practical education, if anything is really learned by the student.

In literature, as well as in science, nothing really valuable is gained without systematic practice. In the hands of a practical teacher, the study of rhetoric is something more than learning the names of tropes and the definitions of taste and style; and English literature is more than biographical sketches of dead authors.

I do not undervalue the advantages that result from the training of the memory by accurate recitations of the words of a text-book.

I know the importance of the exact enunciation of axioms, principles and rules that embody the concentrated wisdom of the past, but these alone are dry and useless bones, unless clothed with live muscles, developed by healthy exercise.

In more advanced education, for those who are to engage in business, agriculture or manufactures, there is need of some opportunity besides that afforded by our high schools designed to give a general education, and by colleges adapted to the education of literary men, lawyers and ministers. No enlargement of the number of studies in our high schools is practicable; nor would this meet the demand of those who are to be liberally educated and trained in science and the useful arts. The industrial college is not a rival of our high schools, academies, or seminaries. Something is needed by which the graduates from our high schools, that are to be leaders in business enterprises, guides in industrial pursuits, and intelligent agents in developing the resources of our State, may go forward in their education and find as ample opportunities as have hitherto only been afforded to unproductive professions.

The industrial college is to be no mere professional school to fit students exclusively for any one department of business, where the art of farming alone, or any other art, engrosses the entire thought. But it is to be a college with ample facilities to lay the deep foundation of liberal culture, especially adapted to the utilities of life. Nor can this culture well be received in a department of any ordinary literary institution, when the whole *animus* is in another direction, away from practical studies, towards the classic and literary culture, where the scientific department is a concession made to popular demand, and where the students and the attainments made in this department are considered of an inferior grade to those in the classical course. In the future development of American industry large advances are to be made in the application of science to agriculture and the mechanic arts—and the liberally educated must take the lead.

The education must be practical, by affording to the students incentives and opportunities to combine the actual practice with scientific principles. To teach to do, as well as teach to know, will engage the efforts of the instructor. Education in the field and in the laboratory are necessary to fit one for success in life.

THE MANAGEMENT OF GRASS LANDS AND PASTURES.

A Paper read at the County Meeting of the Board of Agriculture at Etna, December 29, 1874;

By Joel E. Shaw, Vice President of the Board.

A paper was read at Orono at the last session of the Board of Agriculture, entitled "No stock, no crops," but my proposition is, "No hay, no stock." Every farmer knows if he has no hay he can have no stock. It is the case with many farmers they do not cultivate their best grass lands, but let them grow up to bushes or run to waste some other way. I think it would prove of advantage to farmers should they put more of their low lands into grass, and turn a large proportion of their high lands that are kept for mowing fields into pastures, and give more attention to their low land that will yield a heavy crop of hay every year—be it a good or poor season for grass. The farmer to get good crops of hay from his farm should prepare the soil thoroughly by cultivation, after he has given it a liberal dressing of manure, before the soil is sown, for the young grass needs a fine seed bed in which to do well.

It is an old established practice to seed our grass lands with a crop of grain, which is one great reason why the farmers lose so large a proportion of the grass seed they sow on their lands. Some farmers practice the system of seeding their grass lands without grain, and get a good yield of hay the first season. I presume in a few years this system will be adopted by many of the progressive farmers that are not satisfied to travel in the ruts of old customs. If farmers would give more attention to top-dressing it would improve their hay crop to a great extent; and a grass field after it is put in proper condition for the mowing machine and to produce a good crop of hay, may be made to yield bountifully for years if liberally top-dressed from time to time, and thereby save the expense of re-seeding every few years.

There are many grass fields where underdraining would prove of great advantage to them and a paying business to the owner; for the soil of grass lands must be in a condition that the water can drain off quickly and give a free circulation of air through the

soil, and also give the grass roots a chance to extend down into the subsoil, from which certain kinds of grasses find a large proportion of their food. Any soil that is full of water cannot be made to produce grass of good quality, and draining often proves a greater benefit to the land than a heavy dressing of manure.

It is the practice of many farmers to pasture their grass fields after the hay crop is taken off, which is a great injury to the grass roots and thereby greatly reduces the next year's hay crop. Most farmers are ready to admit the fact, but as an excuse, say their pastures are short of feed and they have not the hay to feed their stock and to keep them through the winter, if they have not put in any green crop for soiling their stock. My advice to them would be, to sell a portion of their stock and feed hay to what is kept, rather than to pasture their grass lands as many farmers do at quite a loss every year. The seeding of grass lands has much to do with the hay crop of future years. If the farmer does not get a good catch of grass he will realize quite a loss. It is an important question with the farmer, when is the best time to sow grass seed to be the most successful in getting a good catch of grass. In my section it is the practice of some farmers to sow their grass seed the next spring after they take off their grain crop, and by so doing they succeed better than when they sow it with the grain, for they do not lose the young grass by its being dried up when the grain is taken off, and there is no danger of a loss from its being winter-killed. I think this system will work well if the land is in good condition; if not, they will not get a crop of hay the first year, but after that it would give better crops of hay than it would if seeded with grain; and for a series of years the farmer could afford to lose his grain on his grass land and seed only with grass. He will get a fine crop of hay the first year if the land is in the condition it should be. It is the general custom of farmers to seed their grass lands with herds-grass and clover, or clover and timothy, and in most cases they fail to get a good sod which a greater variety of grasses would give them, and at the same time give a heavier yield of hay. Farmers should be very careful not to sow the early and late varieties of grasses together, or they will find they have made a great mistake, for the early varities will be over ripe before the others are in a suitable condition to cut; but they should seed a portion of their grass fields with the early varieties and the other portions or fields to the late varieties, and not have to cut their grass before a part of it is

only partially grown, or have a large portion of it too ripe to make good hay for feeding any kind of stock at a profit.

There are some farmers that think the best and cheapest method of improving run out grass fields is by shoal plowing, and thus thoroughly pulverizing the soil, and re-seeding on the inverted sod without a grain crop; mow two or three years, then plow again and re-seed. By following this course for a series of years their fields will produce fine crops of hay if they do not let their cattle feed on them fall or spring. There are many farms in this State that have many acres of land upon them that could be irrigated at a trifling expense, and they would then give their owners great crops of hay of the best quality every year at a small yearly expense, for tending the water and keeping the sluices in repair. After a field is properly prepared to be successfully irrigated it is a job of work that will not have to be repeated for a lifetime.

I know of a farm in Massachusetts on which the man who owned it (probably a hundred years ago) prepared one field of eight or ten acres for irrigating, and it has been irrigated from that time till the present, I presume. I was on the field some fifteen years since and it was successfully irrigated at that time. I have been told that it has never been plowed since the time it was prepared for irrigation, but has always produced bountiful crops of hay of very fine quality; and I venture the opinion that there are many farms on which irrigation would add largely to the yearly income of the same and increase the present value of the farms hundreds of dollars.

The proper management of our pastures is a question of importance to all farmers, for it is a common thing to find farmers who can feed more stock through winter than they can pasture in the summer. There are many farms that can pasture but little more than half the stock they did years ago. The over-stocking of pastures is one great reason of their being run out to the extent they are at the present time. I know a farmer that has fed his pasture to that extent that the grass roots are nearly all killed out and weeds are taking the place of the grass, and I presume to say that on many farms there may be found ruined pastures from the same cause. Many pastures that were formerly very productive have been allowed to grow up to bushes until they are almost worthless. The grass they produce is sour and unfit for dairy stock and worth but a trifle for any other. If this class of pastures were cleared of the bushes and brakes and made to produce

good qualities of grass, it would be an advantage to the owners; and if farmers would mow the bushes and brakes that grow up in them every year it would improve them very much. There are some pastures that could be improved greatly by plowing and good cultivation. The farmer, when he plows his pastures should improve them, so that when they are re-seeded they will be in a condition to produce good grass for his stock. Probably many pastures could be greatly improved by a thorough harrowing in the fall or early in the spring and being re-seeded at the time. When farmers seed down a pasture they should get all the different kinds of grasses they can think of, and then all the seed dealer knows of. In that way our pastures would produce the early and late grasses, which would give our stock good feed through the season, but above all things the farmer should be careful not to overstock his pasture. I would advise farmers to keep more sheep and put them into their pastures with their other stock; they will eradicate many kinds of weeds and foul grasses, and improve the pasture grasses from year to year.

SOMETHING ABOUT FOODS.

A PAPER READ AT THE COUNTY MEETING OF THE BOARD OF AGRICULTURE AT ETNA, DECEMBER 29, 1874;

BY THE SECRETARY.

There is a story told of a wise and sensible old gentleman—whose name, unfortunately for his own honor, like that of many other philosophers who have enriched the world's literature with sage and valuable instruction, has not been preserved—who, when asked what he wanted for dinner, replied, "A clean plate, a napkin, a friend to chat with, a good appetite and something to eat." Now, while this sentence describes most perfectly the only necessary accompaniaments of a good dinner, it also contains the key to the commerce and business of the world, to the life and activity of every living thing which inhabits the globe—whether animate or inanimate. Clean dishes, napkins, and chosen friends to make social this universally social meal, are, to intellectual beings, pleasant acompaniaments to a good dinner. But, after all, they are of little consequence, except possibly, the required appetite. Many a hungry man has made a good meal where the plates were not very clean; where there were no napkins; and where a sharp appetite made the scanty food diminish but too rapidly. So a crust of bread has tasted sweet to many poor children; and the Divine word completely sums up the domestic economy of eating in that simple sentence—"The full soul loatheth the honey comb, but to the hungry man every bitter thing is sweet." The great and universal cry the world over, is for something to eat. It is a cry that is heard in all countries, at all hours of the day and all seasons of the year. Everything that has life demands something to eat, and if this demand is not satisfied, starvation and finally death is the result. This rule is so universal that it applies to the entire vegetable and animal kingdoms. "I am hungry; give me something to eat," is the language of the most minute as well as of the most gigantic of living beings. From the lichen which clings tenaciously to the side of the barren ledge, to the giant oak of the forest—from the huge elephant roaming through the jungles to

the louse reposing in safety upon the head of the mischievous school-boy—to live is to eat. Where from any cause there is a lack of food, or imperfect, diseased assimilation, there is death. It is true, all the grades of these living things which eat have not mouths, and breath, and digestive organs—but they each and all have a way of appropriating food, which serves their own purpose; and they all understand the selection of food for their use to a degree of certainty that is in many cases truly marvelous. There are certain animals that subsist on roots and twigs, others which grow fat on grass, others which depend largely upon animal food, and others still which subsist almost entirely upon the smaller kinds of their own species. There are plants which flourish in the sunshine and die in the shade; there are those which luxuriate in the dark recesses of the forest and cannot bear the sunlight; there are others which live only when they draw nourishment, not from the earth directly, but from other plants; and others still which subsist wholly upon air. And these animals and plants are never found making mistakes. They know their own positions and the food that best suits them. Cows and oxen subsist upon grass or hay, (they are, it is true, not apt to refuse corn meal or oil-cake) but you never see them eating animal food. The Colorado beetles always know where the potato patch is; and yellow bugs are never found eating up the chickweed and purslane of the garden. And animals as well as plants will go long distances to find the food which especially suits them. Wild beasts, terrific from hunger, prowl for days in search of something to eat. Man, even in our own time, has been known to travel thirty miles for a bag of meal for his family—but this was in the days of spotted trees and hand looms. At present, even, in far too many instances, our farmers have their flour milled in Illinois—and this, when the average yield of wheat per acre in Maine is greater than that of any western wheat growing State. The roots of plants travel long distances for food, and the plants are often so hungry that their roots go for it as Parson Murray's good Deacon went for help for the dying girl—like lightning. Clover roots go down into hard clay six feet, apple tree roots have been found reaching out forty feet, and the tiny rootlets of small plants have been known to work their way through the mortar in a stone wall two feet thick—all, that they may obtain just the food wanted. And so the myriads upon myriads of forms of animal and vegetable life, which occupy every foot of earth's surface,

which fill the unfathomable depths of the great waters, and which abound in the air about us; from the lowest to the highest, the animate and the inanimate, there is this never ceasing strife for food, this yearning hunger which must be satisfied.

The earth which we inhabit is a great storehouse of food:—it furnishes the means of subsistence not only to plants and animals, but to the millions of human beings who live upon its surface. Indeed, so direct is the aid and support which the earth gives us, that it is universally spoken of as our Common Mother, and the expression is one full of force and beauty. Not only did we come from it, and must in the order of Nature return to it—but everything we have in the form of houses, apparel, ornament, food, all directly or indirectly are the product of this common mother. What word, then, in the language we speak, could more fittingly express the relations which the earth sustains to us, than the simple, and beautiful, and comprehensive one which has so long and so lovingly been used to show this relation? As a mother furnishes food and life to her infant, so does our Mother Earth provide first of all, food to the plants which she bears upon her broad bosom. In past ages of her life, hundreds of millions of different species of animals and plants have existed, decayed, and existed again in other forms, continually in a state of transition from the living animal to the earth and from the earth to the living animal—in order that it might become a fit place for the home of human beings, and able to sustain the vegetable life now growing upon it. Almost infinite in number, these plants are also almost infinite in form, and size, and beauty. From the gorgeous and luxuriant vegetation of the tropics to the dwarfed and stunted plants found in latitudes of perpetual snow; from the magnificent cedars of California, where single specimens have been found three hundred feet in height and ninety feet in circumference, to plants so small that over seventeen hundred have been actually counted growing luxuriantly upon a single square foot of ground; and from the delicate snow-drop which opens its petals amid the frost and snow of April, to the almost countless forms of beauty with which our gardens may be adorned and made fragrant—is our earth embellished; and with every step we take, our attention is commanded and our wonder excited, by the lavish prodigality of Nature in clothing the dust at our feet with beautiful forms, and hanging out upon the hills and mountains around us so magnificent a

drapery, such gorgeous embellishments. Indeed, so numerous and varied are the products of the vegetable world, that botanists have not yet been able to even count their numbers. From the giant oak of the forest, with its wide-spreading foliage, to the humble lichen resting upon the ground like a stain of blood—the multitude of vegetable species have only been computed. In the days of Linnæus, who was the father of the science of botany, only six thousand species were known, and even now the number is but twelve thousand. Yet this is hardly a quarter of the whole of earth's flora; the most exact botanists estimating the entire number as between four and five hundred thousand species; and not a year passes but important discoveries are being made in this branch of knowledge by travellers who visit different parts of the world.

Now, while these plants have an outer life which appears to us in their various forms and colors—they have an inner life which goes on actively and silently, and has to do with their very existence; for these plants must all have something to eat and drink. To realize how plants derive their food, it must be understood that they are all made up of an aggregation of minute cells—and the lowest form of vegetable life which consists of a single cell, is as perfect and beautiful of its kind as the magnificent tree or gorgeous plant, which consists of an infinite number of cells piled one upon another; so that they are in reality built up of these individual cells, as a house is built of bricks—and all vegetable growth consists of just these two things: 1st, the expansion of each cell until it gets to its full size; and 2d, the multiplication of these cells, from which the increase in the bulk of the plants takes place. The cells vary in size from about the thirtieth to the thousandth of an inch in diameter, so that generally, there may be from 27 to 125 millions of cells in the compass of a single cubic inch. Now, when it is remembered that the stems of many plants shoot up at the rate of an inch or two in a day, and sometimes three or four inches, we may form some conception of the wonderful rapidity of their formation, and of the constant work going on in Nature's great manufactory.

Roots and stems, and leaves, are each made up of these individual cells, and each have their separate office to perform in the economy of the plant. The roots draw from the soil certain portions of the food necessary to sustain the plant; and this food enters the cells in a state of solution, and is absorbed with the

water which is taken up by the force acting in the small rootlets. Some vegetable physiologists have been almost led to believe that roots are endowed with a kind of intelligent instinct, for they certainly appear to go in search of nutriment, and seem to reject that which is unfitted for their wants. This is proved by the fact that the absorption of the matters dissolved in water, is in some degree independent of the absorption of the water itself. In absorbing this food, the roots and the plant are nourished together, and where food occurs in abundant supply the perfect growth of the whole plant is the result. But while it is true that plants derive the greater part of their food through their natural feeders, the roots—it is also true that some essential elements of plant growth can only be taken through the leaves. This is especially true of carbon, which is absolutely necessary for the life of plants, but which, being insoluble in water, can only be appropriated in the form of carbonic acid gas, by means of the leaves. Water is also often taken up by the leaves as well as the roots; and the sprinkling of wilted leaves has been known to revive a drooping plant, very much sooner than the same effect could be obtained by an application to the roots alone.

Chemists have been able, from a determination of the chemical constituents of plants from analysis, to know of what elements they are composed; and this list comprises twenty-two, among which are some very strange substances. For instance: iron, copper, zinc, calcium, sodium, magnesium, manganese, and three or four other metals, have been found in plants, and hence must be regarded as plant food. Certain varieties of plants seem to have peculiar appetites, and need singular food in order to thrive. In tobacco, sea weeds, lycopodium, and some garden vegetables, iodine, chlorine, sulphur, bromine and phosphorus have been found. But while these substances are present only in small traces, it is well known that the organic constituents of plants are made up of the four elements known as carbon—which in the form of carbonic acid exists in the atmosphere, and has from its universal presence in all organic matter been called the "organic element;" hydrogen, a colorless, tasteless, transparent, inodorous gas, which in combination with water is universally distributed throughout nature; nitrogen, a permanent gas, which united with hydrogen forms ammonia; and oxygen, the most abundant of the elements, which forms eight-ninths of water and one-fourth part of the air we breathe. These four elements make up the largest portion of

the bulk of plants, and are of chief importance as feeding substances. Of carbon, the atmosphere furnishes an abundant supply for all our wants; hydrogen is furnished to plants by rain, mist and dew, and it can only be supplied in this form, although through its agency it furnishes to the plant the various forms of food which are rendered soluble by its action, and the cells of the plants draw and appropriate it to their use; nitrogen is of immense value as plant food, but it must be provided in the form of ammonia or nitric acid, and the latter must be in association with soda or potash in order to be safely used by the farmer; and oxygen, which is contained in the air, is essential for plant growth, as experiments have demonstrated that germination is impossible in an atmosphere where this gas is not present.

It is a wonderful provision of the Allwise Creator of the Universe, that plants also draw support from impure or vitiated air; and while this is injurious to animals, it in fact possesses a high degree of nutrition to plants, so that plants serve a very important purpose in rendering the air pure and healthy for animals and for mankind. But this can only be accomplished under the influence of the sun's rays, and it ceases altogether during the night or when the light of the sun is withdrawn.

The cells of which all vegetable organisms are made up, have been very appropriately designated as the workshop of the plant; and in this workshop the elements that enter into its structure are manipulated and elaborated that they may afford nourishment to sustain and perfect its growth. In this work, the sun's heat is the great motive power, which in some mysterious way enables the plant to perform greater chemical marvels than can be wrought in any laboratory—"marvels which puzzle and confound the philosopher, and leads him to bow in humility before the God of Nature," in comparison with whom the wisdom of man is utter foolishness. "All the forces resulting from heat and muscular exertion have their origin in plants, and however great may be the exhibition of power, the leaves of the trees, and the grasses of the field, have utilized or elaborated it all from the solar rays."

In recent years botanists have given much attention to a genus of plants comprising several species, which actually consume animal food—eating it very much in the same way that a hungry man would eat his dinner. The experiments of those eminent in this science, go to show that certain species of these plants possess a nervous and muscular power as do animals; that they secrete a

digestive fluid similar to the gastric juice of animals; that some of them have the power of discriminating between that which is suitable for them, and that which is not; and that one genus at least has the sense of smell, by which it discerns and reaches after any suitable food that may be within its reach. Dr. Hooker and Mr. Darwin have given recent accounts of experiments with a plant called "Dionial," which absorbs its food by the opening and closing of its leaves. In the experiments of these distinguished gentlemen, a fly was captured and put upon a leaf, which instantly closed, and on re-opening, it was found that the fly had been completely dissolved. A bit of beef was afterward consumed in the same way, but cheese and a piece of wet chalk were almost instantly rejected. These wonderful plants are believed to form a connecting link between the vegetable and the animal kingdom. Thus are being found out year by year, through the labors of earnest investigators, the mysterious secrets of Nature, which are only given up to patient, persistent, observing questioners.

The food which the plant takes up from the soil, passes from cell to cell, and in ascending the stem dissolves in its course some of the organic matter stored up in the vegetable tissue. When this reaches the green shoots and surfaces of the leaves, the sap becomes exposed to the influence of light, heat and air—and here parts with two-thirds of its moisture through evaporation and exhalation. The remainder, which has by this process become much thickened, after undergoing some chemical changes begins to descend by the under surface of the leaf and along the bark. In this descent it deposits certain secretions in the bark, whose office is to nourish and form new tissues. Finally it reaches the extremity of the root where absorption first commenced, and the round of plant food is completed.

Some practical thoughts in connection with what has already been said, may not inappropriately claim the attention for a moment at this point.

The soil, in its unexhausted condition, contains in abundance the elements of plant food, aside from that which the plant obtains from the air, which is either inhaled through its leaves or brought down to the ground by rain, to be taken up by its roots. But wherever the land has been subdued and cropped by man, there we find exhausted, worn out, and in some cases abandoned fields; and the improvidence of man in thus abusing the chief source of his food supply, is in many cases truly painful. In the older por-

tions of our country the land has been cropped for years, the grain, and hay, and potatoes and cattle continually sold off, and no adequate returns made in the form of plant food, for that which the soil has yielded to the farmer. Who wonders that the misused soil refuses to give liberal returns in payment for such treatment? As lands in the Eastern States have, through this neglected system, failed to yield the usual remunerative crops, men have sold or left them and gone West, where in too many instances the same system of depletion has been practised, so that even in some of the rich lands of the West, the average yield of the cereals is not above what it is in Maine with good cultivation. Now it is a well known fact, that some lands from having grown oats or clover for a long time become what is called "oat sick" or "clover sick"—that is, they fail to produce remunerative returns of these crops; and in a certain sense all our old lands may come under some such ban as this. Philanthropic men in view of this state of things, have produced a sort of panacea for lands of this kind, in the form of various patent, concentrated manures, and they are able to show —the art of engraving having reached such wonderful perfection in our day—by very perfect and accurate pictures, that the oats grown from land to which this specific has been applied are several feet taller than those grown on land manured with ordinary manure; in fact, they are not unusually taller than a short man's head! This panacea has been recommended as the very thing for sick and exhausted lands; and hundreds of farmers have paid out large sums of money for patent manure, at sixty dollars a ton, which was little better than the barrels in which it was packed, provided the barrels had been reduced to ashes, and the ashes applied to the land! Now, while it may not be chemically true, it is practically true that farm-yard manure, the solid and liquid voidings of neat cattle, supply to the soil in just about perfect proportions, the elements cultivated plants need for their complete development. And while in the laboratory chemists have found this out by careful and repeated tests, the old farmer found it out by actual practice in the field, when, after having raised a heavy yield of grass from liberal top-dressing, he said, as he laughed out with glee, "I've just found out what land wants, it wants *dung!*" Thus do great minds, pursuing a similar line of reasoning, from a given point, arrive at exactly the same results! And this brings to mind the remark of the old Scotch farmer to his pastor, when in looking over his farm, the latter said—"By the blessing of

Providence, Thomas, you'll raise a good crop on this field"—replied, "Yes, and about the best blessing I know of, is a shovel-full of old manure to the hill." He believed, no doubt, that faith without works was of little value; and he was about right.

It is also an interesting fact, that while those plants which furnish subsistence to animals, or are of use in the arts, will grow in moist, low places, or in damp woods and by the side of streams, the grains and other fast growing plants used as food by man, need a dry, rich, and warm soil in which to attain their perfection. This is true of wheat, corn, potatoes, vegetables and fruits—and even when grown on land of this character we get all the water we want when eating the products—the potato being three-fourths water, wheat nearly one-fourth, corn about the same, and most garden vegetables more than three-fourths. We should learn, therefore, that it is on drained, well cultivated and well manured soil, that not only the most profitable, but the best crops are grown—for even of grasses, it is the better and most nutritious varieties that flourish on high land—and that the production of such crops on such land, is the only paying course. The farmer who manures heavily, cultivates thoroughly and deeply, seeds liberally and minds his own business, is sure to have a good stock of cattle, abundant means for fertilizing his farm, ample crops, a well spread table, and stamps of a good color in his pocket-book. Or in other words, if he feeds his farm, his farm will in return feed his flocks, and herds and family.

In the wonderful economy of the universe, it seems necessary that there should be harmony and connection between the mineral, animal and vegetable kingdoms—and in this connection plants perform a most important part. Indeed, botanists inform us that the chief work of plants is to transform portions of the earth and air, the minerals and gases, into food for animals, and consequently into food for man. Animals live upon vegetables, and these live upon the earth and air. We are incapable of receiving nourishment from any form of mineral substances—but plants feed upon them, and when these minerals have been transformed into vegetable tissues and products, we receive strength and support from them, transforming them into bone and flesh; and at last, when death ensues, they relapse again into their dead, inorganic condition. In this transformation, however, not a particle of matter becomes lost, but it is ever changing, ever active; and the activity produced by these changes is the activity of life, and energy and being.

Ascending in the scale of creation from the plant to the animal, from those organisms which eat only that they may live, to those which eat that they may live and move; we find that the lower forms of life are exceedingly simple and minute. The plant which is made up of a single cell, and which is the lowest form of organism in the vegetable world, is but a representation of the lowest type of animal life, of which there are millions, comprising but a single cell each. It is only with the aid of a powerful microscope that the animalcules, or infusoria, are observed, and with the assistance of a glass of this kind, man has been led on the one hand to admiration, and on the other almost to despair, in attempting their study. These minute animals vary in size from 1-100 of an inch, to a minuteness which tasks the power of the strongest microscrope to detect. They exist in every ditch, pond, lake and river, and wherever decaying vegetable or animal matter is found. In none of them can a nervous system or organs of sense be detected, and in some there is not the trace of a mouth! And yet they put themselves outside of food in a manner that would be a caution to a hungry school boy. They just "go for it," as the boy would say, and simply absorb it! And, although they have neither mouth nor stomach, they have the faculty of taking solid food, and of rejecting that which they cannot digest. Miracle of miracles! Progressing in the scale of this class of animals, there are those found which possess the power of locomotion, having limb-like appendages, which are used for the double purpose of travelling, and for appropriating food; there are others which are provided with mouths at each end of their bodies, and others still which possess several stomachs, although they are not stomachs at all, but a sort of internal cavity which answers that purpose. It is to be hoped that dyspepsia is unknown among our younger brothers who are classed among the infusoria, if it is not there must be a world of suffering in every drop of water; for these minute animals have the power of spontaneous self-division or reproduction, to such an extent that it has been estimated no fewer than seventy billions may be produced in the space of four days, from a single individual! And even this incomprehensible number is but an atom in comparison with the still vaster numbers which fill the waters of the sea—for there they are so numerous, in certain latitudes, (as on the coast of Greenland) that its color for three hundred miles in extent is entirely changed by these floating multitudes. Nor are they all alike, for naturalists have estimated that

there are at least one hundred thousand species of animalcules alone!

Now many of these microscopic animals are merely the ova or germs of higher animal forms; and rising in the scale of organization, they are found to assume new forms and possess new functions. The stomach, heart, and other parts of the internal system of absorption and circulation are added; the head, mouth, muscular fibres and nervous filaments become developed; the vertebrate animals have the skeleton to suit their requirements, feeling and voluntary motion appear—and the higher forms of animals assume their places. The variations in the size and form of these animals is greater, if possible, than among plants. From the whale, which sometimes measures one hundred feet in length and weighs as many tons, to the animalcule, some species of which are so minute that a single drop of water will contain thirty thousand individuals —the range is as wide as it is full of wonderful and singular forms. The earth, the air, the ocean, are alike swarming with animal life: —and while man has become quite familiar with many species living upon the land, there are myriads of all forms and sizes which inhabit the depths of ocean, of which he possesses scarcely any knowledge. Said the great Humboldt: "Upon a surface less varied than we find on continents, the sea contains in its bosom an exuberance of life of which no other portion of the globe could give us any idea. In the seas, above all, creatures corresponding and harmonizing with each other, sport and play. Among these the naturalist finds instruction, and the philosopher subjects for meditation. The changes they undergo only impress upon our minds more and more, a sentiment of thankfulness to the author of the universe."

Call to mind the different animals with which you are acquainted, and it will be quite surprising to see how small the number. The school boy can possibly count up twenty-five or fifty, and most young ladies could not do as well as that, even including toads, mice, spiders, and similar "horrid things" at the sight of which they are accustomed to shudder with fright, and run for dear life! But suppose the list were to reach a hundred, or even five hundred, it would hardly be a unit in the computation of the individuals of the animal kingdom, the number of species of which has been estimated at three hundred thousand, the number of individuals reaching the almost incomprehensible number of twenty-four billions, the parts and adaptations of which exceed sixty

billions. Of birds there are eight thousand varieties known to naturalists; and the insects alone number one hundred and fifty thousand speceis. Below these are myriads of forms of mollusks, worms, infusoria, and animalcules, of which we have but a slight knowledge. Of those which are known, naturalists are enabled to recognize from the lowest to the highest, a law of progression, according to which the species are more and more rare in proportion as they rise in the series of being. In acquiring complication of structure, as among the mammals, they lose in diversity of form; but improve, becoming superior to the lower orders, and at the same time more and more limited in number, as if Nature required more strength to produce them.

This immense number of animals must all have something to eat. Day after day, throughout the revolving years, food must be at hand for the wants of the hosts of the animal kingdom, and that they live and move, is abundant evidence that the food is found. The different means of obtaining it, the variety used, and the manner in which it is assimilated, give abundant evidence of that beautiful adaptation and harmony, which so impresses us with the wonderful completeness and perfection of the plan of creation. Throughout the entire animal kingdom, there is the most perfect correspondence of the structure of an animal to its habits and functions. An animal which lives on flesh, must have great powers of locomotion, enabling it to overtake and destroy its victim. It must, therefore, have muscles largely developed, strong bones, and teeth and jaw-bones especially adapted for tearing animal tissues. Birds of prey have strong talons, and hooked bill. The mouth of the sheep and ox are formed for chewing herbage, while the gastric juices of their stomach dissolve only vegetables and will not act upon animal food. Those animals without teeth in the front upper jaw, are provided with means for re-chewing their food at leisure, of which the ox, sheep and deer are examples. The horse has no such power, but has the necessary teeth to chew his food as he receives it; and none of these animals can digest unchewed or unground food.

Throughout all these variations, we find everywhere present a universal law of harmony and unity, and adaptation—and no fact is more clearly shown than that the division of organized nature into vegetable and animals, into genera and species, is not an arbitrary act of man, but a necessity found in the order which exists in external nature, and by nature itself cast into these grand

divisions and sub-divisions in the most perfect system and order, and that these distinctions are maintained throughout all time. The same birds build their nests in the same way, and the same animals eat the same food as in the morning of creation. Accident may produce an abortive vegetable growth, a malformation in animals—but never the perfect flower, the perfect eye, or the perfect lung. These things are the results of fixed, unchangeable laws.

As farmers, however, we have a more practical interest in the feeding of the domestic animals, those which are of direct use and service to man, and which form so very small a portion of the animal kingdom. And in this, what used to be regarded as of little importance, has in recent years assumed the proportions of a science; and through the aid of chemistry, and scientific investigations, the work of handling the pitchfork and provinder-box, is invested with a deep interest to every farmer—because, properly conducted, it is a source of actual profit.

In all animals there is constantly going on a loss and waste of the system, being greater in some than in others, and also more or less in amount according to numberless circumstances, such as the animal's power of digestion and appropriation, its condition, shelter, exercise, &c. To repair or keep up this waste, food is necessary, and as this food is directly or indirectly supplied by plants, they must contain as they do, the organic elements required for the building up of the animal tissues. These taken into the stomach are assimilated and converted into blood, flesh, and muscular fibre; and it is absolutely necessary that domestic animals should have a mixed food, in order that the farmer may derive from them the greatest profit—the food must furnish the starch and sugar necessary to maintain animal heat, the albuminous compounds to build up the flesh, and the phosphates to strengthen the bones. And these materials exist ready formed in the cereals and leguminous seeds which the animal eats. Therefore, there can be no more perfect feed than good early cut hay, corn meal, and oil cake. The results of numerous trials, show that an ox at work requires two and one-half pounds of good hay or its equivalent, to each one hundred pounds of its live weight, per day, to make good the loss of tissue occasioned by the labor. By the same rule, a horse, cows giving milk, young growing cattle, and sheep, require three pounds each. Or, in other words, the daily loss of the working ox requires that he should consume from twenty to twenty-four

ounces of gluten or albumen (flesh formers), which will be supplied by feeding sixteen pounds of clover hay, twelve pounds of pea straw, one hundred and twenty pounds of turnips, six pounds of beans or peas, or four pounds of oil cake. A plain and easily understood division of food has been made by classing it as the food of support, and the food of production—the former being that used up in maintaining the necessary animal heat, and repairing the daily loss; and the latter that which is consumed over and above the food needed for actual support. It is this food of production which gives the most work, yields the largest amount of butter or cream, makes the most beef, and brings in every time the largest greenback. No farmer can afford to keep his animals just alive, or at a "poor dying rate"—it surely does not pay, either to the animals or to him. Not only do well fed animals yield the most direct profit, but they give the richest manure; so that the fields of the farmer who feeds his animals well are well fed, and they in return well feed the animals. And this co-operation and reciprocity does not end until its results find their way into the safest pocket the farmer has about him.

While plants eat that they may live, and animals that they may live and move; man, proud in his might, standing at the head of the universe, and under whose feet all created beings have been placed—eats not only that he may live and move, but that he may gather strength and fulfil his high destiny on the earth. And he is almost always hungry, especially when little—that is, if the fact that school children, who generally eat their dinners at recess, may be taken as having any bearing upon this point. When he becomes older he not only eats often, and fast, but almost always eats a good deal—taking after "both sides of the house," as the saying is. In man, as in other animals, there is a constant waste of fibre and tissue going on, and food must be taken to make up this loss. The man who performs hard manual labor, of course requires more food than he who does not—and it is some satisfaction to know that if lazy people and idlers, who are the most useless class of animals, waste very little of the tissue of the body, they therefore eat very little. Indeed, they may be counted real benefactors in actually saving food, on the same ground that the boy took when he said pins were the things that had saved the lives of so many people, just because they didn't eat them!

Quite as important as the repairing of the wasted system, is the keeping up of the internal heat of the body, for which about four-

fifths of the food taken is needed. If you would appreciate the heat giving power of a "good square meal," go without your breakfast some morning about this time of year, and when you come home to dinner, don't eat it, but still expose yourself to a cool, northwest breeze. After this you will find that a solid meal, such as laboring men with good appetites need three times a day, will do more to give you warmth of body than fire or clothing. Food is fuel. Both the heat force and the mechanical force generated in the bodies of animals, including man, are derived from food. An animal, however high its organization, can no more *generate* an amount of force capable of moving a grain of sand—than a stove can throw itself upwards, or a locomotive draw a train of cars without fuel. All that such an animal can do is to liberate that store of force which is locked up in its food. It is the chemical change which food undergoes in the body, that liberates the previously pent-up forces of the food which then make their appearance in the form of heat and mechanical motion. But while it repairs the waste, and furnishes the needed temperature, it also gives the body strength to perform its labor, and this strength can come from no other source. When plants grow, as has been shown, they store up the energy of the sunshine, and when we consume the food furnished by these plants that energy is transferred to our bodies. It gives the power of motion, the ability to move from place to place, to work; and in other forms it produces feeling, sensation, hearing, thinking. The body has the peculiar power of abstracting these things from bread and butter, with a piece of meat thrown in occasionally. But it has a power often manifested in another form—it fights. And did you never think how necessary food was to soldiers while enduring privation, and hardship, in upholding the dignity and life of nations? Food has won many a battle, and the want of it has been the cause of many a defeat. The proud army of Burgoyne would never have surrendered at Saratoga, had not his men been hungry; and in the late rebellion, well fed soldiers gained many days, which lank-bellied ones could not help losing. Force expended in this way makes many sad hearts, and many broken homes, it is true; but it is only through it that nations are saved, and the honor of fallen heroes perpetuated.

All food is found to be composed of the same materials or elements as the human body—and these have been classed, 1st, as the non-nitrogenous, force producing substances incapable of form-

ing flesh or muscle, such as sago, arrowroot, sugar, figs, animal and vegetable fats and oils; and 2d, as the nitrogenous substances, capable of producing both flesh and force, as eggs, wheat, flesh, peas, cheese. In addition to the above classification, the mineral substances are obtained from water and the mineral salts, and there is a large class of medicinal or auxiliary substances, such as spices, fruits, beers and wines, tea, coffee, &c. Experiments have demonstrated that no one of these substances is alone capable of sustaining the life of man for any length of time in perfect health. Unfavorable symptoms have always and uniformly followed, where from any cause persons have made use of a single class of articles of food for a constant diet. An analysis of the human body, having a weight of 154 pounds, has been found to contain 111 pounds of oxygen (a gas which would occupy a space equal to 1,300 cubic feet), 15 pounds of hydrogen (occupying about 3,000 cubic feet), 21 pounds of carbon, 13 pounds of nitrogen, and about 8 pounds of mineral matter. Or in other words, it would contain 88 pounds of water and 66 pounds of solid matter. In the course of a year the average adult person consumes more than 3,000 pounds of materials—consisting of 1,500 pounds of water, 800 pounds of solids, and 800 pounds of air. The requirements of the system differ greatly according to age, occupation, climate, season, and other causes. Children take more in proportion to their size than adults, as their food supplies the materials of growth as well as waste—while in the adult, whose weight does not increase, about the same amount is voided as is taken into the system. In the West Indies, the natives can hardly be induced to eat any fat substances whatever; in our temperate and healthy climate a man in active employment may eat three pounds of solid food a day, while in the Arctic regions, a small boy wants a luncheon of five or six pounds of flesh to whet his appetite for dinner. Parry, when on his voyage of discovery to the North Pole, says that he weighed the food of an Esquimaux lad scarcely full grown, and found that in a day he managed to put himself outside of 8½ pounds of sea-horse flesh, 1¾ pounds of bread, 1¼ pint rich gravy soup, 3 glasses raw spirits, 1 tumbler strong grog, 1 gallon water—and then probably looked over his shoulder for more! Experiments have shown that the mean quantity of bread and meat required to sustain the life of man, consists of sixteen ounces of the former and thirteen of the latter, per day; and while our army regulations allow soldiers and sailors fifty ounces of solid food per day; is it

any wonder that thousands of our brave boys perished in Southern prisons, where the rations—when they could get them—were from 4 to 12 ounces of bread, only, per day?

Milk has ever been regarded as the true type of human food, as it is one of the most important articles of diet. The young of all the mammalia are fed entirely upon it during the first period of their lives, and it furnishes in just the right proportions all the elements needed to build up every part of the system. Wheat is the prince of the cereals, and makes nearly a perfect food. Its culture has everywhere marked the spread of civilization; and throughout the vast expanse of the globe there is not a savage, barbarous or semi-civilized nation, where the wheat plant is cultivated. It may in fact be taken as the emblem of our civilization. Of all the countries on the globe, the United States stands first in the production of this golden grain—our annual product being about 275,000,000 bushels—and after supplying our own wants we ship to the mother country each year 42,000,000 bushels, not only to help feed her starving poor, but just to let her know that we are able to take care of ourselves—a lesson she was a long time in learning! It is grown generally between the parallels of 25 and 60 degrees of latitude, and reaches its greatest excellence near the northern limit at which it is grown. The proportion of flesh-forming matters to those which produce force only, are more nearly adjusted to the requirements of the system, in wheat, than in any other article of food—and it is very generally used among the populations of the hardest working nations in the world.

To go through with all of the two hundred and fifty-one substances used as food for man, giving an account of each, would need a whole evening of itself, and the subject cannot be entered upon. Tables have been prepared showing the quantities required for one day's food of various vegetable substances containing the same supply of nitrogen, from which it is calculated that taking two pounds of wheat flour as the standard, the same nourishment would be obtained from one pound of peas or beans, four pounds of buckwheat, ten pounds of cabbage, seventeen pounds of turnips and thirty-one pounds of carrots. According to this table, if a working man should make his breakfast on potatoes he would need to swallow twenty pounds, while he could get the same nourishment from one pound of oat-meal mush—and yet, if obliged to eat oats for his breakfast, he would no doubt think it rather "hard feed."

As has been shown, man requires a mixed diet. Neither the animal or the vegetable, the nitrogenous or the non-nitrogenous, will alone support life indefinitely—and when one or the other decreases below well-defined limits, health declines and life becomes extinct. The use of this variety of food, renders necessary a distribution of labor in the culture of the different plants required to meet its consumption, in the rearing of the different animals, and in the harvesting, transportation and manipulation of the food product of the globe. Think of the millions of acres of land devoted to agriculture, to the production of articles of food; of the commerce of the world, which is founded upon the shipment of the food supplies of the globe from one country to another; of the millions of cars loaded with flour and wheat and meat, which transport these life-giving commodities from and to extreme points, and of the multitudes of human beings engaged, not directly in eating, but in raising, handling, and transporting the food of the world—and you may possibly gain some conception of the importance of bread and butter; not only to our stomachs, but to the business, and commerce, and currency of nations.

Man does not live by bread alone. He may be well fed and well clothed, and if this is all he is still an animal—nothing more. He has an immortal mind, which links him with the Infinite, and it is only as this is cultivated and disciplined that its God-given powers and faculties are brought out, made beautiful, and turned to high and noble purposes—that he rises above the animal in his passions and desires. This it is that gives him the supremacy which he holds over the animate creation of which he forms a part; and it is to the cultivation of his mind, the education of his heart, the enlargement of his soul, that his best and highest endeavors should be given. The reading of useful books, the study of nature, the cultivation of the thinking and reasoning powers—should form leading aims in the life of every rational being. The beauty and excellence of such lives will add a grace and loveliness to character, when material things have lost their charm.

It is a sad thought, that in many parts of our country, in large cities and throughout some of the newer Western States, there is at this time much suffering and misery for want of food. From these places the wail for something to eat comes up to us with a deep sorrow, and appeals to the strongest element of the human heart. Men do not ask for good clothes or dainty fare; they beg only substantial food for their wives and children. Many of these,

possibly, may have gone out from our midst, leaving good homes, and productive fields, to seek what they deemed the larger returns and quicker gains of the so-called "Golden West." In their desolation and want they now look to the East for the means to prevent actual starvation. When will men learn to let well enough alone; when will they find out that Maine, if a cold State, is also a good State to live and make a home in? Let us rejoice that we live in this dear, good State, where there is plenty and general prosperity, where twenty bushels of wheat may be grown to the acre, where three times a day the tables are well spread, where there are few empty mouths, and where few little children go to bed hungry.

FISH SCRAPS AND FISH GUANO.

Since this report has been put in type, my attention has been directed for the first time to a Report on Commercial Fertilizers, prepared by PROF. CHARLES A. GOESSMANN for the Massachusetts Board of Agriculture, and published in the Report of that Board for the year 1873. I extract below that portion relating to Fish Scraps and Fish Guano:—

"The largest amount of fish used for fertilizing purposes is obtained from the fish-rendering establishments along the northern Atlantic coast, from Maine to the mouth of the Hudson river, including Long Island. Forty-two establishments, according to good authority, have been in operation in that locality during the year 1872. Fourteen of these fish factories, producing 8,270 tons of fish scraps and 291,000 gallons of oil, are located along the shores of Long Island; fifteen are situated along the coast of Connecticut; their annual production amounts to 8,240 tons of scraps and 309,900 gallons of oil. The remaining thirteen establishments are north of Cape Cod, along the coast of Maine; they produced 16,000 tons of scraps and a satisfactory quantity of oil. The total yield of scraps as specified thus, amounted, in 1872, to 32,570 tons. The ton of scraps sold at $16, at the works, on board of vessel; the oil sold at 45 cents on the average per gallon. The entire produce of these establishments during the year 1871 had exceeded that of 1872 about 12,000 tons of scraps, on account of a more favorable season during the fall. The price of the scraps in 1871 had been as low as $9 per ton, while in 1872 they brought more, generally from $15 to $16 for the same quantity.

The present prospects of the fish-rendering business are stated to be very satisfactory. The demand for scraps is represented as exceeding three times the present supply. A large proportion of it serves as the nitrogenous constituent in the manufacture of phosphatic commercial fertlizers, particularly for the Southern trade. One of the main difficulties with which our dealers in the fish refuse matter apparently have still to contend, consists in the

want of satisfactory drying and grinding apparatus. This fact alone can explain the inferior mechanical condition of the fish refuse, and the great difference in the percentage of its moisture, which we quite frequently notice in that article when offered for sale. The line of distinction between fish scraps and fish guano is sometimes too loosely drawn to operate satisfactorily in both directions. A few analytical results obtained by testing some of the fish refuse sold within the State, may prove the propriety of the previous reflection.

FISH GUANO.

	I.	II.	III.
Moisture lost at 100° C	18.34	9.96	8.30
Animal matter	55.72	66.11	65.03
Ash constituents	25.94	23.93	26.66
Nitrogen	6.17	7.31	–
Total phosphoric acid	7.2	7.1	–

No. II. was sold at $40; the usual retail price of a good fish guano is $50 per ton of 2,000 pounds. In counting the value of the nitrogen and of the phosphoric acid contained in these samples according to the standard price in retail transactions, we find it to be $45.60 in No. I., and $52.40 in No. II., a difference of $6.74 per ton. A good, well ground and dried fish guano belongs to the best class of substitutes for Peruvian guano; it acts, however, slower, for obvious reasons.

FISH SCRAPS.

	I.	II.
Moisture lost at 100° C	80.2	36.53
Animal matter		45.52
Ash constituents	18.78	17.95
Total phosphoric acid	4.68	–
Nitrogen (in animal matter)	5.06	–

These samples consisted of the coarsely broken up, pressed fish; they sold at $20 per ton to farmers. Their nitrogen and phosphoric acid per ton, in case of a finer mechanical condition of the fish refuse, would be sold by the manufacturer of the fertilizers to the farmer at about $34. For farther illustration, I add here an

abstract from a printed communication of a manufacturer and wholesale dealer in fish guano of this State. The following analytical results of fish guano were given :—

	I.	II.	III.	IV.
Water expelled at 100° C.....	29.06	19.85	22.17	46.03
Organic and volatile matter.....	26.79	46.39	60.49	41.70
Bone phosphate.....	29.67	30.31	17.13	9.99
Nitrogen in animal matter.....	3.63	6.43	8 38	5.72
Phosphoric acid in bone phosphate	13.67	13.89	7.85	4.58

Below these printed analyses was stated in writing, 'I am selling this fish guano now at $15 per ton, cash, by the car-load, March, 1873.' No distinction was made as to which of the sample was meant, although there was an unusual difference in their commercial value. This will become particularly plain, by calculating each of these samples according to the usual standard price of nitrogen and insoluble phosphoric acid in the retail transactions.

Incorporated into our ordinary commercial fertilizers,—

No. 1 would be valued per ton				$38 00
No. 2	"	"	"	55 20
No. 3	"	"	"	59 70
No. 4	"	"	"	41 08

There is an actual difference of $21.70 per ton, in the value of sample No. 1, as compared with No. 3. A mixture of equal quantities of these four kinds of fish guano would have produced an article, which, according to the adopted scale of valuation, has to be considered worth $48 per ton of 2,000 pounds. As the composition of such an article would entitle its manufacturer to charge that amount, we find that the farmer is expected to pay somewhat over 200 per cent. on the first cost, merely for getting fish scraps retailed in an improved mechanical condition."

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ERRATA.

The reader is requested to make the following corrections:

In the list of members, the term of D. M. Dunham should read, February 11, 1876. Mr. Dunham was appointed to fill a vacancy, and the list as printed contains an error.

Page 177, 3d line, for H. T. Porter read H. F. Porter.

Page 190, 37th line, for consolidated read constituted.

Page 221, 26th line, for abstracting, read assimilating.