REPORT

OF THE

CANADIAN

Dairymen's Association,

WITH

TRANSACTIONS & ADDRESSES OF THE ANNUAL CONVENTION,
LIST OF MEMBERS, REPORTS OF FACTORIES,
AND OTHER
INTERESTING INFORMATION,

FOR THE YEAR 1873,

To which is Added, by Permission, the Address of L. B. Arnold, Esq., as Delivered before the American Dairymen's Association, at Utica, N. Y.

Published by the Association.

INGERSOLL:
PRINTED BY HARRY ROWLAND, MASONIC HALL BUILDING, THAMES STREET.
1873.

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INTRODUCTORY REMARKS.

It is with no ordinary degree of satisfaction that we are permitted to present to the members of the Canadian Dairymen's Association, and to dairymen generally, the Report of our Sixth Annual Convention. We say that it is with no ordinary degree of satisfaction, from the fact that in it we think may be seen proofs of the steadily-increasing interest that is taken throughout our whole Province in the projects our Association is intended to advocate and advance. It might be interesting to notice the advancement our Association has made from the time of its organization, but space will not permit; suffice it to say, that the first Report, published four years ago, contained only the names of one hundred and sixty members, while we have now on our books nearly four hundred, which fact alone shows the interest manifested by the general public towards it, as well as the zeal displayed by its officers and members.

The Convention, of which a full and complete report is herein contained, was much more largely attended than any former one—the dairying interest from almost every section in the country being well represented; and we trust that under the Act passed the last session of our Legislature (a copy of which is herein contained), the two Associations, formerly called the "Canadian Dairymen's Association" and the "Ontario Dairymen's Association," may successfully exercise their united influences for the advancement of the dairying interest throughout the whole of Ontario.

There should be no "East," no "West," no "North," no "South," among dairymen; our interests are common, and should not be retarded by sectional feeling. When we assert that this is an age of wonderful progression in almost every branch of agriculture, we state facts that are patent to all; and that it is the right of Canadian dairymen to take advantage of the knowledge and appliances with which they are surrounded, is also equally clear; and we know of no more feasible way to become acquainted with the different improvements pertaining to the dairy than by becoming members of our Association, and attending our Annual Conventions; and that these advantages are appreciated and made use of is easily seen by the large numbers who from year to year spare neither time nor expense in order to be present, not only to hear, but to take part in the questions that are there discussed. And it must be pleasing to the officers more intimately connected with the Association to see their labors appreciated, and to find they are producing such satisfactory results.

Neither trouble nor expense has been spared by the committee in charge to make the Convention the most interesting, as well as the most useful, of any before held, and we think their efforts have not been without success.

The services of men such as the Hon. X. A. Willard, M. A., Prof. Caldwell, L. B. Arnold and Prof. Bell, with whose names you are doubtless familiar, and whose lectures we would most respectfully recommend for your perusal, were secured at considerable expense, in order to render the Convention the more interesting and profitable.

The discussions contained in this report will, we think, be found very interesting, not only to dairymen, but to agriculturists generally, embracing, as they do, many important subjects pertaining to draining, manuring, &c.

We have, also, at considerable trouble and expense, endeavored to obtain, as far as possible, the statistics of the various cheese factories throughout Ontario, in which will be found the additional information, over last year, of the number of cows connected with each factory. But here a lamentable feature presents itself, viz., that out of the vast number of factories throughout the country (to nearly all of which we have forwarded circulars, requesting statistics), a great majority have failed to reply. The reasons for this we cannot explain, but trust that it may be different in the future, as we earnestly solicit the co-operation of all concerned.

We anticipated to have been able to present this Report to the public before this date; but owing to the delay occasioned by not receiving factory statistics, we have been unable to place it earlier before the printer. Hoping, however, it may prove satisfactory in its subject matter and arrangement, it is respectfully submitted.

J. CARRUTHERS HEGLER,
SECRETARY.

INGERSOLL, APRIL, 1873.

AN ACT

TO

Protect Butter and Cheese Manufacturers.

ASSENTED TO MARCH 4th, 1868.

WHEREAS, it is expedient and necessary to Encourage and Protect Butter and Cheese Manufacturers in this Province: Therefore, Her Majesty, by and with the advice and consent of the Legislative Assembly of Ontario, enacts as follows:—

1. Whosoever shall knowingly and fraudulently sell, supply, bring or send to be manufactured to any cheese or butter manufactory in this Province, any milk diluted with water, or in any way adulterated, or milk from which any cream has been taken, or milk commonly known as "skimmed milk;" or whoever shall keep back any part of the milk known as "strippings;" or whoever shall knowingly and fraudulently sell, send, bring or supply milk to any cheese or butter manufactory that is tainted, or partly sour from want of proper care in keeping pails, strainers, or any vessel in which said milk is kept, clean and sweet, after being notified of such taint or carelessness, either verbally or in writing; or any butter or cheese manufacturer who shall knowingly and fraudulently use, or direct any of his or her employees to use for his, her, or their individual benefit, any cream from the milk brought to any cheese or butter manufactory without the consent of all the owners thereof, shall, for each and every offence, forfeit and pay a sum not less than one dollar, nor more than fifty dollars, in the discretion of the presiding Justices before whom the case shall be heard.

2. Any two or more Justices of the Peace, having jurisdiction within the locality where the offence has been committed, may hear and determine such complaint upon the oath of one or more credible witnesses, and shall have power, in case the penalty awarded by them be not forthwith paid, upon conviction, to levy the same by distress and sale of the goods and chattels of the offender by warrant under their hands and seals, or the hands and seals of any two of them; and the penalty, when recovered, shall be paid over by such Justices, one-half to the person complaining and one-half to the treasurer of the municipality, district, or place where the offence shall have been committed; and, in default of payment or sufficient distress, the offender may, by warrant signed and sealed as aforesaid, be imprisoned in the common gaol for a period not less than one day, nor more than twenty days, at the discretion of such Justices, or any two of them, unless such penalty, costs, and the charges of commitment, be sooner paid.

3. Any party aggrieved by such fraudulent conduct as aforesaid, may, at his or their election, sue the offender in any civil court of competent jurisdistion, and recover from him the amount of damages sustained, and levy the same, with the costs, according to the ordinary practice of the court in which such suit shall be brought.

4. Provided always, that no Justice or Justices having any pecuniary interest in any such butter or cheese manufactory, as aforesaid, shall hear or determine any such complaint.

5. In case of summary proceedings under this Act, any person, complainant or defendant, shall have the right of appeal as provided in Chapter one hundred and fourteen of the Consolidated Statutes of Upper Canada.

AN ACT

TO

Amend the Agricultural and Arts Act.

THE DAIRYMEN'S ASSOCIATION.

33a. The societies now existing and known respectively as "The Canadian Dairymen's Association" and the "Ontario Dairymen's Association," may organize and form themselves into a society, comprising not less than eighty members, each paying an annual subscription of not less than one dollar, to be known as "The Dairymen's Association of Ontario," by signing the declaration and taking the proceedings (so far as applicable) prescribed in sections twenty-six, twenty-seven and twenty-eight of this Act, in relation to horticultural societies; and upon notice thereof being inserted in the *Ontario Gazette*, such society shall become a body corporate, and may make by-laws, rules and regulations not being contrary to this Act or the general law of the Province, for its guidance and management.

1. Such association shall be entitled to receive from unappropriated moneys in the hands of the treasurer of this Province, a sum not to exceed seven hundred dollars in any one year, on the like conditions (so far as applicable) provided in section forty-six, in the case of county or electoral division societies.

2. Such association shall hold a meeting on the second Wednesday in February in each year, either at Ingersoll or Belleville; the first of such annual meetings to be held at Belleville on the second Wednesday in February, in the year of our Lord one thousand eight hundred and seventy-four, and the two meetings following at Ingersoll, and shall continue to hold such annual meetings in

like manner, once at Belleville and twice at Ingersoll; and shall, at each such meeting, present a full report of its proceedings, and a detailed statement of its receipts and expenditure for the previous year; and elect a President, Vice-President, Secretary, and Treasurer (or a Secretary-Treasurer), and not fewer than five, nor more than nine, Directors, and shall elect two Auditors; the officers of the said association, until the elections at the annual meeting to be held in February, in the year one thousand eight hundred and seventy-four, to be as follows:—Thomas Ballantyne, President; Ketchum Graham, Vice-President; J. Carruthers Hegler, Secretary; Charles E. Chadwick, Treasurer; Edwin Casswell, James Noxon, Peter J. Brown, James M. Wilson, Peter Daly, William Yates, Henry Ostrom, Benjamin Hopkins, and George Morton, Directors; and Charles H. Sorley and Thomas Wells, Auditors.

3. The said association shall also hold annually a cheese fair or exhibition, in connection with the annual agricultural shows held at Ingersoll and Belleville, respectively; such cheese fair or exhibition to be held in the same way as the annual meetings of the said association are held—that is to say, once at Belleville and twice at Ingersoll; and at each such fair or exhibition a sum amounting to not less than one-half of the annual grant mentioned in sub-section one of this section, shall be given as prizes for cheese.

4. A copy of said report and statement of receipts and expenditure, and a list of the office-bearers elected, and also such information on the subject of dairies and dairy products in this Province and elsewhere, as the association may have been able to obtain, shall be sent to the Commissioner of Agriculture within thirty days after the holding of such annual meeting.

8. Section fifty-one of the said Act is hereby amended by inserting in line four after the word "sell," the word "mortgage;" and sub-section one of the said section, as amended by the nineteenth section of the Act passed in the thirty-fourth year of the reign of Her Majesty, chaptered nineteen, is amended by inserting in the fifth line of said sub-section, after the word "sell," the word "mortgage;" the power to mortgage by the foregoing part of this section enacted shall extend to electoral division agricultural societies as to all property held by such societies respectively.

9. In Schedule B, lines two and three, strike out the words "the Act respecting the Bureau of Agriculture and Agricultural Societies, and insert "The Agricultural and Arts Act" in lieu thereof.

10. In Schedule D, line four, strike out the word "special;" in line five, after the word "of," insert "a reading-room;" and in line six strike out the word "both" and insert "all" in lieu thereof.

11. This Act shall be read as a part of the Act hereby amended.

ARTICLES OF ASSOCIATION.

WHEREAS, it is deemed expedient to form a Canadian Dairymen's Association, through which, as a medium, results of the practical experience of dairymen may be gathered and disseminated among the dairying community ; therefore be it

Resolved, That we, the undersigned, do hereby associate ourselves together for mutual improvement in the science of cheese-making, and more efficient action in promoting the general interests of the dairy community.

ARTICLE I.—The name of the organization shall be "The Canadian Dairymen's Association.

ARTICLE II.—The officers of the Association shall consist of President, Vice-Presidents, Secretary, and Treasurer.

ARTICLE III.—The President, Vice-Presidents, Secretary, and seven other members appointed at each annual meeting, shall constitute the Executive Board of the Association.

ARTICLE IV.—The officers of the Association shall be elected at each regular annual meeting, and shall retain their offices until their successors are chosen.

ARTICLE V.—The regular annual meeting shall be held on the first Wednesday in February in each year, at the Town of Ingersoll, Ontario.

Officers of the Association for 1873.

PRESIDENT.

THOMAS BALLANTYNE, Esq., Sebringville P. O.

VICE-PRESIDENT.

K. GRAHAM, Esq., M. P. P., Belleville.

TREASURER.

C. E. CHADWICK, Esq., Ingersoll.

SECRETARY.

J. C. HEGLER, Ingersoll.

DIRECTORS.

EDWIN CASSWELL, Ingersoll.
PETER J. BROWN, Ingersoll.
PETER DALY, Belleville.
HENRY OSTROM, Moira.
JAMES NOXON, Ingersoll.
JAMES M. WILSON, Ingersoll.
WILLIAM S. YATES, Belleville.
BENJAMIN HOPKINS, Brownsville.
GEORGE MORTON, Morton.

AUDITORS.

CHARLES H. SORLEY, Ingersoll.
THOMAS WELLS, Ingersoll.

LIST OF MEMBERS

OF THE

Canadian Dairymen's Association,

FOR THE YEAR 1873.

Name.	*Address.*
Adkins, Joseph	Putnam.
Abraham, Thos	Newark.
Atkinson, Francis	Nissouri.
Anderson, John E	Wyoming.
Adkins, John	Putnam.
Adams, John	Ingersoll.
Anderson, Wm	Woodstock.
Ackert, John	Ingersoll.
Almas, E. R.	Norwich.
Allison, John	Brownsville.
Bodwell, A. M.	Mount Elgin.
Bryant, Geo. W.	Embro.
Betchel, Moses	New Hamburg.
Butler, John	Mount Elgin.
Brown, John A.	Nithburg.
Burrell, D. H.	Little Falls, N.Y.
Bloor, George	Ingersoll.
Bell, Joseph	Brownsville.
Bobier, Wm	Wallacetown.
Baird, Thomas	Bright.
Birdsall, W. H. M.	Canboro.
Belton, Wm	London.
Bobier, Joshua	Ingersoll.
Butterfield, D. S.	Norwich.
Ballantyne, Robert	Sebringville.
Banbury, Charles	Mount Elgin.
Brand, David	Forest Station.
Brown, Joseph S.	Embro.
Ballantyne, Thomas	Sebringville.
Beer, Henry	Putnam.
Bailey, George	Ingersoll.
Butler, Edwin	Norwich.
Bell, John	Fairview.
Buchanan, John	Ingersoll.
Byron, John	Ingersoll.
Brady, James	Ingersoll.
Bungay, L. F.	Norwich.
Bailey, James	Holbrook.
Brown, Thomas	Ingersoll.
Brown, P. J.	Ingersoll.
Clark, Lewis J.	Aylmer.
Cook, G. H.	Beachville.
Craik, James	Putnam.
Collett, Martin	Toronto.
Cody, M. B.	Mount Elgin.
Cadman, Richard	Watford.

Name.	*Address.*
Cleverdon, S.	Strathroy.
Cook, A. L.	Tilsonburg.
Chisholm, Walter	Springford.
Corless, Moses	New Durham.
Chalmers, David	Mussleburgh.
Congo, Charles	Sheffield.
Cook, Wm	Mount Elgin.
Cohoe, D. B.	Warwick.
Cohoe, John G.	Fredonia, N. Y.
Chisholm, John	Seaforth.
Cumming, Robert	Bentley.
Cain, James	Newark.
Currie, George	Woodstock.
Capslick, Wm.	Putnam.
Chapin, J. M.	Embro.
Crawford, Wm.	Culloden.
Caldwell, Samuel	Auburn.
Cline, Dr.	Belmont.
Carroll, R. H.	Ingersoll.
Clark, J. E.	Otterville.
Collins, A. J.	Newry.
Cook, Simeon	Ingersoll.
Crawford, Albert	Ingersoll.
Christner, Meuno	New Hamburg.
Callander, Scott & Co.	Clinton.
Casswell, Edwin	Ingersoll.
Chadwick, C. E.	Ingersoll.
Dodge, Heman	Woodstock.
Dodge, Jesse	Ingersoll.
Dunn, John	Harriettsville.
Dunn, John	Ingersoll.
Dennis, T. S.	Leamington.
Dewart, John B.	Kertch.
Dempsey, D. A.	Stratford.
Dempsey, John	Fairview.
Dibb, John	Derwent.
Dow, John M.	Stratford.
Dobell, John	Ingersoll.
Dodge, John	Beachville.
Davis, Wm. & Co.	Toronto.
Davis, Thomas	Peterborough.
Dundas, John	Putnam.
Dutton, Benjamin	Glanworth.
Daly, Peter R.	Belleville.
Elliott, Samuel	Ingersoll.
Ellis, Wm. E.	Hespeler.
Essletine, Joseph	Culloden.
Elliott, James	Tilsonburg.
Ellis, Wm. A.	Culloden.
Evans, John	Harriettsville.
Francis, David	Fullarton.
Fraser, A. C.	Beachville.
Facey, Robert	Harriettsville.
Fisher, A. S.	Clinton.
Freeland, James	Mount Elgin.
Farrington, H.	Norwich.
Farrington, E. H.	Cadiz, N. Y.
Fluelling, John	Mount Elgin.
Fraser, A. C.	Ingersoll.
Fulton, John	Brownsville.
Gustin, Ralph E.	Forest.
Griffin, George	Burgessville.
Grandy, J. W.	Culloden.
Graham, D. W.	Kamoka.
Green, Robert	Attercliff.
Green, R. C.	Attercliff.
Green, P. H.	Sheffield.
Greive, Thomas	Sebringville.
Galloway, George	Ingersoll.
Galliver, Henry	Ingersoll.
Griffin, Byron	Burgessville.
Griffin, S.	Ingersoll.
Gillard, W.	Newark.
Gracey, Robert	Woodstock.
Griffin, Saunders	Vienna.
Gram, Henry	Derwent.
Golding, E.	Thamesford.
Grant, J. L.	Ingersoll.
Graham, K.	Belleville.
Gilmour, James	Nilestown.
Hamilton, George	Cromarty.
Harrington, Jacob	Woodstock.
Henderson, John S.	Ingersoll.
House, Henry	Bookton.
Huffman, Paul	Kelvin.
Hopkins, E. N.	Brownsville.
Hagle, Amasa	Arkona.
Hopkins, Benjamin	Brownsville.
Harris, J. B.	Antwerp, N. Y.
Harris, E. G.	Seaforth.
Hickson, John	Seaforth.
Hagle, Luke	Arkona.
Harris, Wm.	Culloden.
Herriott, Wm.	Mount Elgin.

Name.	*Address.*
Harris, George M.	Mount Elgin.
Harris, George B.	Mount Elgin.
Hildebrand, George	Stratford.
Harris, Wm.	Mount Elgin.
Hopkins, H. P.	Ingersoll.
Healy, E.	Tilsonburg.
Harland, E.	Guelph.
Healy, D.	Corinth.
Hartly, C.	New Durham.
Henderson, D. H.	Ingersoll.
Hill, G. C.	Ingersoll.
Hunter, E.	Londesborough
Heath & Finnemore	London.
Hulett, D.	Norwich.
Huxley, Wm.	Ingersoll.
Hegler, J. C.	Ingersoll.
Ingram, Wm.	Ingersoll.
Inglesby, C. D.	Springford.
Ironsides, John	Troy.
Jolliffe, Daniel	Avon.
Jenks, George	St. George.
Jarvis, Jonathan	Ingersoll.
Jarvis, James	Embro.
James, J. A.	Belmont.
Jenvy, Charles	Springford.
Jarvis, Edmond	Ingersoll.
Jameson, George	Seaforth.
Kirkley, P.	Norwich.
Kidd, Edward	Birrell's Rapids
Kipp, H. W.	Springfield.
Keachie, James	Sheffield.
Kirkley, Wm	Lyons.
Kennard, Franklin	Warwick.
Kerr, John	Ingersoll.
Lossee, H. S.	Norwich.
Louthian, Wm.	Byron.
Lockhart, James	Wolmer.
Lawr, John	Avon.
Levett, S. C.	Galt.
Lawson, J. W.	Salford.
Lane, J. B.	Dorchest'r St'n.
Lawson, Thomas	Nilestown.
Lowes, J. H.	Ingersoll.
Martin, Wm.	Bookton.
Moulton, Wm.	Brownsville.
Mabee, O. P.	Tilsonburg.
Meadows, Charles	Brooksdale.

Name.	*Address.*
Moore, Jacob	Otterville.
Moore, A. B.	Otterville.
Malcolm, David	Woodstock.
Moorehouse, A. S.	Shetland.
Monroe, Neil	Ingersoll.
Mundy, George	Orwell.
Mott, Elgin, E.	Norwich.
Murray, John	Arkona.
Moulton, John	Ingersoll.
Morrison, John	Winthrop.
Malcolm, Andrew	Rogerville.
Morris, Wm.	Avon.
Millar, John	Tavistock.
Merrill, W.	Norwich.
Manson, John	Norwich.
Murray, John R.	Embro.
Matthew, J. M.	Ingersoll.
Marshall, Robert	Lakeside.
Morlock, Wm.	Tavistock.
Muir, George	Grimsby.
Millar, Samuel	Wartburg.
Millar, Thomas J.	Norwich.
Mabee, W. B.	Beachville.
Mott, Elias	Norwich.
Monk, D.	Mount Elgin.
Morton, George	Morton.
McCabe, George	Suth'land's Cor.
McKee, Robert	Belmore.
McFirley, John E.	Corinth.
McKenzie, John A.	Crumlin.
McCulloch, John	Newark.
McLaughlin, D.	Ingersoll.
McMichael, C. P.	Woodstock.
McDiarmid, Hugh	Sparta.
McDiarmid, John	Sparta.
McCarty, Robert	Brucefield.
McCracken, Henry	Norwich.
McBeth, John S.	Ingersoll.
McNeil, John	Bothwell.
McLean, Allan	Ingersoll.
Nixon, Charles	St. George.
Norton, F. D.	Nilestown.
Noxon, James	Ingersoll.
Nichol, Andrew	Innerkip.
Nelles, W. B.	Salford.
Orth, Samuel	Holbrook.
Ostrom, Henry	Moira.

Name.	*Address.*
Owen, Leonard	Ingersoll.
Pendleton, W. R.	Orwell.
Peer, Wm.	Richwood.
Phillips, O. S.	Newmarket.
Peers, Adam S.	Caisterville.
Pearce, J. S.	Tyrconnell.
Pullin, Hezekiah	Avon.
Pierce, Joseph	Tyrconnell.
Park, P. C.	Centreville.
Park, A.	Ingersoll.
Prouse, Thomas	Ingersoll.
Phillips, James	Woodstock.
Phelan, Daniel	Ingersoll.
Peers, Richard	Ingersoll.
Peers, Alex.	Sumas, B. Col.
Robinson, Wm. J.	West McGilv'y
Robinson, Robert	West McGilv'y
Ricker, Christopher	Sheffield.
Ryan, C. B.	Culloden.
Ross, Charles	Grovesend.
Richardson, Lewis	Kerwood.
Rymph, Jerome	Tilsonburg.
Ruckle, David	Culloden.
Ruckle, John	Culloden.
Robins, Alfred	Copenhagen.
Reid, J. H.	Culloden.
Ronson, J. B.	Ronson.
Ronson, J. A.	Courtland.
Richardson, John	St. George.
Ruckle, Daniel	Culloden.
Shearer, W. R.	Vittoria.
Smith, Job	Norwich.
Sweet, John	Orwell.
Semmerville, Thos.	Harriettsville.
Smith, Anson	Hannons.
Small, Wm.	Mount Elgin.
Stewart, John	Clearville.
Scott, John B.	Tilsonburg.
Stinson, Augustus	St. George.
Schragg, Christian	New Hamburg.
Stephen, Samuel	Keyser.
Sclater, C.	West Flamboro
Stephens, Stephen	Ingersoll.
Seager, James	Troy.
Stonehouse, Wm. C.	Thamesville.
Stephen, Henry	Pumholm.
Sanderson, Thomas	Harwich.

Name.	*Address.*
Stewart, Johnson	Harriston.
Smith, John Town	Simcoe.
Schram, Charles	Florence.
Schooley, E. M.	Otterville.
Small, Frank	Newark.
Stafford, Wm.	Ingersoll.
Stafford, James	Villanovia.
Scatcherd, George	London.
Springfield Factory	Springfield.
Straith, Peter	Clinton.
Springer, Wm.	Ingersoll.
Stanton, D.	Woodstock.
Shrapnell, G. J.	Ingersoll.
Stevenson, Wm. H.	West Magdala.
Turnbull, George	Tilsonburg.
Tupper, Elias	Waterford.
Tye, Edward	Peterboro.
Thompson, Wm.	Arkona.
Thompson, Robert	Innerkip.
Terry, James	Ingersoll.
Titus, H. S.	Otterville.
Thornicroft, M.	Lambeth.
Tenant, E. J.	Ingersoll.
Varnum, Uri S.	Forest.
Vickers, Thomas	Owen Sound.
VanHorn, John H.	Tilsonburg.
Wade, Joseph	Watford.
Williams, Frank J.	Culloden.
Williams, James	Culloden.
Wilson, B.	Ridgetown.
Walker, George	Brucefield.
Webb, Wm.	Ridgetown.
Webber, Robert	Strathallan.
Wood, Alex.	Branchton.
Ward, W. B.	Dungaird.
Willis, George	Ingersoll.
Wilson & Haskett	Ingersoll.
Weeks, Thomas	Tempo.
Wallace, W. M.	Harriettsville.
Weeker, Nicholas	Botany,
Wilkinson, John	Salford.
Warner, Warren	West Magdala.
Wood, James	Branchton.
Wilkinson, Wm.	Ingersoll.
Wilkinson, John	Ingersoll.
Wilson, Charles	Ingersoll.
Waddle, Wm.	Culloden.

Name.	*Address.*
Woodley, Abram	Boston.
Woodward, John C.	New Durham.
Whitelaw, R.	Beachville.
Webb, Edwin	Ingersoll.
Wooley, Henry	Springfield.
Woodcock, R. A.	Ingersoll.
Wase, J. K. W.	Otterville.
Whyte, John	Cromarty.
Weir & Hope	Crumlin.
York, W. H.	Brockway Centre, Mich
Yeo, Wm.	Sparta.
Yates, Wm. S.	Belleville.

ANNUAL ADDRESS,

DELIVERED BEFORE THE

Canadian Dairymen's Association,

AT

INGERSOLL, CANADA,

FEBRUARY 5th, 1873,

BY

X. A. WILLARD, M. A.,

OF HERKIMER CO., NEW YORK,

PRESIDENT OF THE NEW YORK STATE DAIRYMEN'S ASSOCIATION AND BOARD OF TRADE—AUTHOR OF PRACTICAL DAIRY HUSBANDRY, ETC.

MR. PRESIDENT, LADIES AND GENTLEMEN:—It gives me great pleasure to meet you again in convention. I esteem it a high honor to have so retained your confidence and good opinion that you still have patience to hear me. I can only say that I have tried to be faithful to your interests, and have labored earnestly to elevate that branch of industry which we have come here to-day to represent.

An address upon the dairy before an audience like this—educated by the discussions and papers of six annual conventions—is far more difficult than it was years ago, when the whole subject of the dairy was new to the great mass of hearers.

NOTE.—The Address was illustrated by large charts and diagrams, the figures of which could not be given in the printed copy without considerable expense, and are therefore omitted.

If we are to make progress—advanced ideas—progressive thought must be wrought out and truths eliminated, by the means of which we may step higher and higher in our scale of practice.

If we can advance but one single step upward, from year to year, it is a matter of vast import to you and to me, and to the dairy interest of the world; but to remain stationary—to get no further onward in knowledge or practice, from one year to another—is most unsatisfactory to, and must be damaging in, its influence on the future of these conventions. It is not the will of Providence that man should reach perfection at one bound, but by little steps onward and onward. If I can impress upon you but one progressive idea—but one suggestion—which is a step higher up for progress and improvement than was realized at your last convention, I shall feel that something has been done to forward the great work which God designs *shall be accomplished*, and that my mission here has been for some good.

FACTS AND IMPROVEMENTS IN DAIRY PRACTICE.

Some important changes are gradually taking place in the great central dairy region of New York which are likely to have an important bearing upon the dairy interest of the State, and must affect, in some degree, other dairy districts of the continent.

The power which New York wields in the commerce of the dairy is very great, and will be better appreciated, perhaps, when her dairy products that annually go into market are considered, to say nothing of the numerous private or farm dairies scattered over the State. New York had, in 1870, about a thousand factories in operation. If we take 400 cows as the average to a factory, and 400 pounds of cheese to a cow, the result will be 160,000,000 pounds as her annual product. In 1864 the census gave upwards of 72,000,000 pounds of cheese and 84,000,000 pounds of butter as the amount sold. I estimate the present annual product of New York at over 100,000,000 pounds of cheese and 100,000,000 pounds of butter. Nearly all the cheese that goes abroad comes from New York and Canada. New York alone ships annually not far from 60,000,000 pounds. As the price of cheese exported governs to a great extent that of the whole product made, we can see how any considerable decline of production in New York must affect this interest.

Now, some years ago the river counties of the State furnished New York City, and other markets south, largely with hay; but of late years they have been unable to supply the demand. It is said that the hay lands of the river counties are less productive than formerly, and that in many instances a change to milk, to truck, and other kinds of farming, have become in some instances more profitable—in others imperative. Be this as it may, it is evident they are unable to supply the vast demand for hay which the increased population of the Atlantic cities and the shipping interests demand. The enormous quantities of hay required to supply the street railways, and the every-day expansion of these roads as a necessity for city travel, will in some measure account for the growing demand—a demand that may in part be realized, from the fact that one single line alone, in New York City, makes an annual consumption of more than 3,000 tons. The rapid growth of the country; the changes going on from day to day, and the increased demand for various kinds of food, are so marked that the farmer who does not keep close watch of the times soon finds he has lost his reckoning, and is among a people "that for ways that are dark, and for tricks that are vain, like the Heathen Chinee, are peculiar."

The hay lands for several years have been pushing westward along the railways until they have now reached the central part of the State. The facilities offered by the railroads for carriage, and a reduction in tariff consequent upon the building of new roads terminating at the sea-board, together with the high price of hay, are gradually absorbing good dairy lands along the line of the direct roads, and breaking up the dairies.

The number of those who have recently abandoned the dairy, and have gone, and are about going, into the hay farming, is very considerable; and they contend that the profits from the business are much better than can be realized from cows.

Hay nets the grower as far west as Madison and Onondaga Counties—150 miles from the Hudson and 300 from the sea-board—from $14 to $16 per ton. In Herkimer County, from $16 to $18 per ton, in the barn, has been realized the present season. Farmers argue the question in this way: It takes three acres of our best land to keep a cow through the season, and she will yield, say, from 400 to 500 pounds of cheese, which, at 12 cents net, is, say, $48 to $54. Now, three acres of hay, at 1½ tons to the acre, is 4½ tons, which, at $16 per ton, is $72,

or, at the less price of $12 per ton, is $54—an amount equal to that turned from the cow, while the cost of cows and their risk is avoided, together with a vast saving in labor.

The question of keeping up the fertility of the land, though of serious import, is believed by many to be feasible. They argue that by allowing the aftermath to rot upon the ground, by harrowing the meadow in spring, and top-dressing with ashes, bones, muck, road-scrapings, plaster, and such available fertilizers, together with the sowing of grass-seeds, every three or four years, upon a harrowed surface, fair crops and the fertility of the soil may be maintained.

But that question need not be discussed here, since it is only the fact of a change in farming to which I wish to call your attention.

Again, the supply of milk for city consumption becomes every day more urgent, and new fields are constantly demanded. The total amount of milk, exclusive of condensed milk, supplied to the cities of New York and Brooklyn, is 120,000,000 quarts per annum, which, at 10 cents per quart, amounts $12,000,000. But as this is not enough to supply the demand, or else because plain, country milk is too strong for city stomachs, about 40,000,000 quarts of water, it is estimated, are added to it at a cost of $4,000,000 more. If we reckon the produce of a cow at 1,200 quarts per annum, it will be seen that 100,000 cows are required to supply the milk in the first instance; and if the other 40,000,000 quarts were obtained in a legitimate way, instead of coming from the capacious udder of the pump and pen-stock, more than 30,000 more cows would be needed in this business. The pasturage and winter-keep of 130,000 cows, it will be seen, eats up a good many cheese and butter farms. Judge French states that the milk car from Concord, Mass., carries to Boston daily 1,000 cans of milk, of 8½ quarts each, for which the producers receive $133,000 a year at their own doors. This is over 3,000,000 quarts from a single locality. He estimates that $100,000 go to the farmers of Concord alone, which he figures as averaging $40 to every man, woman and child in the town. He thinks no other branch of farming so harmonious with the culture of small fruits and vegetables as milk producing.

The milk district is, however, constantly receding farther and farther from the great cities, on account of the enhanced value of farm lands. The population of our cities is increasing rapidly, and new

demands for the more perishable kinds of food are constantly being made upon the surrounding country; and so the cheese and butter lands are constantly being pushed farther back. This begins to cut sharply into the butter and cheese interest of the State.

Then there are other causes which are operating more or less all over the State—a change from the dairy to sheep or stock-growing, or some other kinds of farming that are less exacting in time and attention; and this applies in a measure to other States, and among farmers who thoughtlessly rushed into the dairy when prices were high, and were disappointed in not realizing a fortune every year from the business. It will be observed that for six or eight years past the surplus of dairy products in the United States has only been about 60,000,000 pounds of cheese, and no butter of any importance to spare from home consumption. The increased product of both butter and cheese, from year to year, has gone into consumption among our own people; and hence, the fears that dairying would be overdone has not been realized.

THE SITUATION.

What, then, is the situation to-day? The emigration to the United States is largely of a cheese-eating people; cheese is becoming more and more a necessity among our native population; the large capital required for the dairy business prevents many from entering upon it; the comparatively limited extent of land adapted to the dairy in soil, water and climate—all seem to argue a sound, healthy condition of dairying as a business at last year's rates of compensation, with the prospect of an advance rather than a decline in prices. As to exports, the gradual advance of the laborer's wages in England must result in a larger consumption of cheese, and in a larger demand from America, coupled with better prices, if we can furnish a sound, good-flavored article to suit the palate of consumers. The low prices in 1871 were due in a great measure to imperfect cheese—cheese injured in the curing and in the shipping, and thrown into the market in large quantities during hot weather, requiring forced sales to save from heavy losses.

I hope to point out presently some of the faults of American dairy practice, and the method by which the business may be made more remunerative than it is; and first as to the

It is an old trite saying that "all the milk a cow yields goes in at her mouth." And I wish every dairyman would treasure up this motto as one of the golden rules of the dairy. It is just pure gold, every word of it. You may talk about breeds and the best cow for the dairy; but if you expect any breed to make milk without first putting it into her mouth, you will be most egregiously disappointed. I do not say but there is something in breeds; blood tells, whether the animal has four legs or two; but of whatever blood you select for the dairy, mark well that the animal is of good constitution, has a capacious stomach, and is a good eater. I am not talking to you from theory, but from practice. In my experience I have been able to take the common cows of the country and get a product of from 500 to 600 pounds of cheese per cow as an average for a series of years. Fish, of Herkimer, affirms that by breeding and by feeding he was able to make an average of 900 pounds to the cow. I never went much above 600 pounds, because I doubt the expediency of feeding meal and bran, at high prices, through the summer, when cows are getting plenty of grass and other succulent food. Do not stint in water or salt; and then, for winter-keep, an abundance of good hay, with roots, is all that is required.

In spring—after calving and until grass—I like strippings or oat-meal as an additional food.

I early learned this—that if you wish a cow to do her best, you must cultivate her acquaintance intimately, and be unsparing in little acts of kindness. You may whip and torture a cow into submission, but she will strike the balance against you in the milk pail. It is like biting off your own nose to spite somebody else, and never pays. I think one of the greatest faults among dairy farmers to-day is lack of kindness and consideration to domestic animals. Cows should be petted daily, and be made to feel that man is a friend and protector. All pain, fright and uneasiness checks the secretion of milk, and the man who is passionate and abusive in his herd never did, and never can, realize a full yield of milk from it. I think that anyone who has the charge of animals should study their character and disposition. It is an interesting study, and, under the law of kindness, you will not unfrequently bring out wonderful traits and exhibition of affection, which will show a fore-

thought and design, which may well be ranked with the higher intelligence of reasonable beings. I think man is made wiser and better by his study of, and kindness to, domestic animals.

FOOD FOR MILK.

The question of the best food for producing milk is one which has elicited great attention. The recent experiments of Keohn, and others, seem to show that no change in the quality of food is capable of materially affecting the quality of the milk, so long as the ration is of such a quality as to be healthy, and is given in sufficient quantity.

What is meant by quality of milk here is its relative constituents, chemically considered, and does not embrace its taste, liability to decomposition, &c. In other words, according to the experiments, if a cow, on hay, yields milk that has four per cent of butter and four per cent of caseine, a ration of grain or meal, in addition to the hay, does not make the milk richer in butter or cheese, or materially change any of the other constituents. The different kinds of food may and do increase the quantity; but the relative proportion of constituents remain about the same. Thus, for instance, if a farmer desires to make his milk rich in butter, he cannot reach the result by a change of food, but must look for it in the breed of cows. These experiments seem to have been made with a great deal of care, and with a great variety of food—from that rich in starch, sugar and oil, to that containing much nitrogen, as bean meal. The later investigations of Bossingault seem also to corroborate this theory. If this be true, the practical farmer has merely to turn his attention to those kinds of food that are best adapted to keep his cows in a good, thrifty, healthy condition, and that will make them yield the greatest quantity of milk of good flavor. Of course, it is understood that these experiments have no reference to the milk of cows which are diseased, or which have been starved by being kept on an insufficient quantity of food, or that which is not supplied with the requisite elements of nutrition. In such cases, as is well known, the milk is thin and poor in quality.

COMPOSITION OF THE MILK.

Experiments.	Food Consumed Each Day. FIRST SERIES.	Kilogrammes.	Butter.	Lactine.	Caseine Albumen.	Mineral Matters.	Dry Constituents.	Water.	Milk in 24 Hours.	Age of Subject, or Time from Calving.	DAYS.
I.	HAY.	13.07	3.60	5.10	3.54	0.65	12.89	87.11	8.22	135	DAYS.
II.	HAY. OIL CAKE.	13.37 1.56	3.34	4.92	3.51	0.62	12.39	87.61	9.35	142	DAYS,
III.	HAY. BEAN MEAL.	14.07 1.56	3.39	5.10	2.99	0.62	12.10	87.90	9.97	151	DAYS.
IV.	HAY.	14.09	3.66	5.11	3.40	0.65	12.82	87.18	8.74	160	DAYS.
V.	CLOVER.	46.00	"	"	"				8.98	170	DAYS.
VI.	HAY.	15.00	3.72	5.12	3.26	0.65	12.75	87.25	7.63	180	DAYS.
VII.	HAY. MEAL.	12.46 2.86	3.30	5.11	3.94	0.56	12.93	87.07	8.38	189	DAYS.
VIII.	HAY.	13.42	3.96	5.46	3.13	0.60	13.15	86.85	7.73	195	DAYS.
IX.	HAY. LINSEED.	11.00 18.03	4.01	5.25	3.45	0.62	13.33	80.67	6.84	201	DAYS.
X.	HAY.	12.50	3.80	4.74	3.89	0.65	13.08	86.92	6.26	206	DAYS.

COMPOSITION OF THE MILK.

VIII.	HAY.										
IX.	HAY. LINSEED.	11.00 18.03	4.01	5.25	3.45	0.62	13.33	80.67	6.84	201	DAYS.
X.	HAY.	12.50	3.80	4.74	3.89	0.65	13.08	86.92	6.26	206	DAYS.

COMPOSITION OF THE MILK

Experiments.	Food Consumed Each Day. SECOND SERIES.	Kilogrammes.	Butter.	Lactine.	Caseine Albumen.	Mineral Matters.	Dry Constituents.	Water.	Milk in 24 Hours.	Age of Subject, or Time from Calving.	DAYS.
XI.	HAY.	15.00	3.42	4.85	3.02	0.69	11.98	88.02	14.12	43	DAYS.
XII.	HAY. BARLEY.	14.25 1.83	4.91	4.89	2.80	0.80	13.40	86.60	13.88	47	DAYS,
XIII.	CLOVER.	53.67	5.06	5.22	2.71	0.70	13.69	86.31	13.83	55	DAYS.
XIV.	HAY.	15.00	3.74	5.12	2.48	0.70	12.04	87.96	12.38	63	DAYS.
XV.	HAY. MOLASSES.	13.65 2.13	2.55	5.08	3.01	0.63	11.27	88.73	11.67	72	DAYS.
XVI.	HAY.	14.00	3.08	4.45	2.91	0.64	12.08	87.92	11.40	78	DAYS.
XVII.	HAY. LINSEED.	11.48 1.83	3.84	4.86	2.98	0.69	13.37	87.63	9.97	85	DAYS.
XVIII.	HAY.	12.50	3.74	4.97	2.80	0.69	12.20	87.80	9.13	95	DAYS.

We have chemical analysis of nearly every kind of food which is used for domestic animals. Chemistry tells you how much starch, sugar, oil, gluten, albumen, and other constituents, are in hay, grain and roots; but it does not tell the nutritive value of any kind of food.

Nutritive value is found by putting the substance into the stomach of a living animal, and noting the results. It is true, we have some knowledge of the nutritive value of sugar, starch, oil, albumen, gluten, and other constituents of food; and from the relative proportion of these, in a given substance, we can guess as to its general nutritive effect. Still, there are some kinds of food that produce better results than the percentage of their nutritive constituents would seem to show. Roots, for instance, which are largely composed of water, when fed in connection with other food, will not unfrequently do more good than a larger per cent of nutrive elements locked up in other forms. Farmers, therefore, should not be too credulous in adopting the practices of others, but experiment carefully, and test their value. Some men will tell you that fodder-corn is nearly worthless as a summer soiling crop, and that better results will be obtained from clover, lucern, or something else. They may find it so in their practice, or may imagine it to be so; but I cannot agree with them, since my experience tells me that we have no plant, in our hot, dry summers, that will give such good results as corn-fodder. It makes good milk, and it makes an abundant flow. I cannot grow clover for summer soiling so cheaply as I can grow corn-fodder; clover fails in hot, dry summers, while corn-fodder does not; and I should esteem it a calamity to the dairy interest of America were this plant blotted out of our summer soiling crop. White clover I regard as one of our most valuable pasture plants; it gives a nice flavor to milk; it is rich in sugar—an essential in milk—and therefore helps to maintain the health of animals in their abundant secretion of this fluid.

Pastures should always, if possible, be located on high ground and stocked with a variety of grasses—June or Kentucky blue grass, orchard grass, blue or wire grass (*poa comprena*), and those indigenous to the soil—the grasses that propagate themselves by layers. The different species of agrestic supply pastures throughout the year. Among the grasses that afford most nutritive matter in early spring are meadow fox-tail, tall fescue, and, indeed, all the fescues are valuable

pasture grasses. In laying down permanent pastures, attention should be given to several points, viz., that the species be suitable to the soil and climate; and this information is best obtained by studying the soil and situation where the different species occur naturally; that species that flower and come to maturity at different periods be sown together, that the pasture may be green throughout the season, and at all times afford a bite; that the species be the sort that are relished by the stock that are to be kept on the pastures, as it is well known that sheep, horses, cows, &c., show different preferences as to some species of grass. I have referred to those which are particularly adapted to cows. Rye grass and red clover do not last in permanent pastures; nevertheless, clover should be sown, as it gives abundant feed for the first two years.

Clean, sweet water should be abundant, and of easy access; for the more water you can induce a cow to take, under ordinary circumstances, the more milk will she yield. This has been very clearly demonstrated by scientific investigation. The experiments made by the editor of the Boston *Journal of Chemistry*, showing the influence of cold in diminishing the flow of milk, are of interest. He found that cows that were allowed to stand in streams or ponds of water during hot weather (a habit they are apt to fall into, if permitted,) always fell off in their milk in considerable quantity. So it will be seen what a variety of circumstances (though apparently insignificant in themselves) have a controlling influence in the production of milk.

COST OF MILK.

I have said there was a reasonable prospect that good dairy products would not go below the rates of 1872, the chances being that prices would advance during a series of years rather than decline. As an additional reason to those already given, the cost of producing milk in different sections may be varied. From statistics carefully prepared from actual experience, it appears that the cost of milk has advanced in England, during the past two years, from 25 to 30 per cent. At a meeting recently held in Manchester, in which the cost of producing milk was compared with that of two years ago, it was stated, on the highest authority, that cows were now £7 dearer than then—an advance of 33 per cent. The wages of cow-men, two years ago, were 14 shillings

sterling per week; now they are 18 shillings, with a prospect of going higher—an advance of 21 per cent. There was a corresponding increase in other departments; so that the average increase in the production of milk is fully 28 per cent, and it was thought milk could not be afforded by the producer on the borders of Cheshire for less than 4d. per quart, equal to 8c. our money.

Upon the cheap lands of Illinois, it has been shown by abundant statistics that milk costs the producer 12½ cents per gallon in summer, and 18 cents per gallon in winter. In New York and the New England States the cost is above 12½ cents per gallon; so if we count a gallon of milk to make a pound of cheese, the cheese must sell at an average of 14 cents per pound to pay expenses; and if a gallon of milk makes half a pound of butter, the butter cannot be afforded below 26 cents per pound. I think, therefore, that the increase in dairying will hardly keep pace with the increased demand for consumption, unless prices advance beyond the rates of 1872.

USES OF MILK, AND SOME OF ITS CHARACTERISTICS.

Milk has been put to some curious uses; but, in fact, everything connected with milk is curious. Milk has been used as a cosmetic, in all ages and climes. The Roman ladies took their milk baths, and the imperial wives of the voluptuous Cæsar revelled in it. A milk bath is said to be not only invigorating, but to give a wonderful delicacy and beauty to the skin—a fact which perhaps ought not to be mentioned here, since I should be sorry to hear of some enterprising factoryman opening his factory as a bathing house, and then turning the bath into curds.

We know that cream is good for chapped lips and for scalds, while country lasses affirm that buttermilk will remove tan and freckles. The ammoniacally prepared curds of milk, under the name of lacterine, are used for fixing the pigments of calico printers. Lactic acid has been used in the finer kinds of tanning, and the red lead manufacturers find that the workmen—who take a dose of a pint and a half of milk per day—are proof against any symptom of lead disease. Then, the butyric acid of rancid butter is used in extracts and cosmetics for imparting the delightful flavor and odor of pine-apple. The physician now uses milk

as a remedy for various kinds of chronic disease. Spirits are made of distilled milk, which are said to be not only an exhilarating beverage, but a sovereign remedy for disease. We have milk prepared with rum and gin, and put up in bottles by manufacturers, who highly recommend it to travellers and tourists where temperance laws are stringent. Meerschaum pipes are said to be now manufactured from caseine, and sugar of milk is largely used by homœopathists for coating nauseous drugs to make them more palatable.

Then, you see, whether it be rum or calomel, milk serves an important purpose in concealing the fangs of those deadly poisons which the temperance lecturer or root doctor will tell you all about. Then we might go on enumerating the uses to which this fluid is put, besides its more vulgar employment for the delicacies of the table, and the tickling of the human palate in a reasonable and legitimate way.

Milk is described by the chemist as a glanular secretion which is peculiar to the mammalia. It is generally of a white, but frequently of a bluish white, color, more rarely of a somewhat yellowish tinge, opaque, without odor (some cheese factory milk excepted), of a slightly sweet taste, and an alkaline reaction. Milk of average quality contains from 13 to 14 per cent of solid matters, and very rich milk from 16 to 17 per cent of such matters. In average milk the percentage of—

Water is	87.40	per cent.
Butter	3.43	" "
Caseine	3.12	" "
Milk Sugar	5.12	" "
Mineral Matter	.93	" "

Fresh milk, on microscopic examination, appears as a clear fluid, in which fat globules—the so-called milk globules—are suspended as in an emulsion. When examined under the microscope, without the addition of any chemical reagent, these globules exhibit no trace of any investing membrane, although its existence has been demonstrated beyond a doubt in various ways. Henles' method consisted in observing, under the microscope, the action of diluted acetic acid on the milk. The milk globules exhibit changes of form, under these circumstances, which they could not possibly experience if they were mere fat globules; for they become distorted—some appearing caudate, others biscuit-formed. From the greater number there escapes a small drop, which appears almost

like the nucleus of a large globule, and is soon displaced by another small, fat globule, which emerges from the milk globule, and either combines with the larger globules, or is only made to project in such a manner that the milk globule exhibits a faint resemblance to a fermentation fungus, in the process of development. When treated with less diluted acetic acid, the milk globules become confluent. The best proof of the existence of an investing membrane is afforded by an experiment instituted by Metscherlich. On shaking perfectly fresh milk with ether, it is scarcely at all changed—the ether merely taking up a little fat. Now, if the milk were a simple emulsion, it would yield all its fat to the ether, and would be converted into a transparent, tolerably clear fluid. As this is not the case, the separate fat vesicles must be surrounded by an insoluble substance. If now we add a substance capable of dissolving these membranes, ether, when shaken with the milk, will act on it precisely as on an emulsion—that is to say, it will take up the fatty matters—and, indeed, this is the case if a little caustic or carbonate alkali be added to the milk before it is shaken with ether. Sulphate of soda has the property of causing the capsules of the milk globules to burst, after which the fat can be extracted from the milk by ether; the watery fluid, however, remains very turbid, but no longer exhibits under the microscope either milk globules or shreds of destroyed capsules, but only extremely minute, scarcely insoluble, molecular granules, which are unquestionably the fragments of the destroyed capsules, and do not consist of finely comminuted fat; for on addition of a little potash they not only do not disappear under the microscope, but the fluid, which had previously retained its milky color, becomes perfectly clear and limpid. What, then, is the composition of this membrane surrounding the milk globules? The chemists have supposed it to be caseine; but, if it is caseine, is it not curious that this caseine is in a coagulated condition, while the bulk of that substance in the milk is in a soluble form? It has been supposed by some chemists that caseine is a compound substance, and that we are yet to separate and define its constituents. In our entire ignorance, says Lehmann, of the true chemical constituents of caseine, we cannot resort to any experiments to elucidate its mode of formation. Although we are unable distinctly to recognize the presence of caseine in the blood, there is little doubt that it is found there, and that it is merely separated

by the mammary glands. We must clearly understand the difference in the constitution of albumen and caseine before we can venture to offer a conjecture regarding the conversion of one into the other. The occurrence of caseine in milk—the best of all kinds of food—leaves no doubt regarding the use of this substance. Caseine not only yields to the infant body the material by which soft parts are nourished and caused to grow, but likewise conveys into the system a sufficient quantity of bone, earth and lime to cause the skeleton of the infant body gradually to attain its necessary solidity.

CASEINE AND MILK-ASH.

In chemical text-books the caseine is generally said to be held in solution in milk by means of an alkali, with which it is supposed to form a kind of salt; and the precipitation of caseine by means of an acid is explained as a consequence of the decomposition of the compound formed by the caseine and alkali—milk-ash being described as containing abundance of alkaline carbonates.

In examining samples of milk-ash, obtained in the course of investigations instituted by the chemists employed in the interest of the London *Milk Journal*, on London milk, it was found that there was no effervescence when an acid was poured on a milk-ash. This led to careful experiments on the action of a very diluted standard acid on the ash, and it was found that there is no appreciable quantity of alkali or alkaline carbonates. According to observations made in a great variety of milks, the milk-ash does not contain so much alkaline carbonates as would amount to the one thousandth of its weight; therefore, the current theory that caseine is rendered soluble in milk by means of an alkali cannot be true.

I mention these facts to show that all the mysteries connected with milk have not yet been solved. and that it yet offers an abundant field for experiment and observation.

FORMATION OF FAT IN MILK AND CHEESE.

Commissioner Hirschberg, in a communication to the *Milch Zeitung*, makes the following interesting remarks concerning the formation of fat in milk and cheese. He says:—"Subsequently to Herr Voits' demon-

stration that fat arises from the decomposition of albumen in living organisms, Herr Kemerich satisfied himself that the same process goes on in albumen after it has been removed from the body. He found that the fatty matter contained in milk increases in quantity for a few days after it is drawn, while the amount of albumen becomes less. But the formation of fat, in milk freely exposed to the air, is conditional in the development of fungi. If their germs are deranged by the milk being raised to a temperature of 180° Fah., or if means are purposely taken to prevent the admission of fungus germs to it, while the access of air is still permitted, the fatty contents of the milk diminish, the existing fat is oxydized by the air, and no new compensatory supply is formed; exactly analagous processes attend the formation of fat in cheese. Here also the existing proportion of butter is diminished by the atmospheric air on the one hand, while on the other a fresh supply is formed by the influence of the fungi, which are becoming developed. According to the preponderance of the one or the other processes, the fat contents of old cheese will rise or fall in amount.

"Practically," says Herr Kemmerich—in concluding his paper on the subject in *Pfluger's Archives of Physiology*—"the method by which we can regulate the formation of fat in ripening cheeses to any desired degree, has long been known to us. If we wish to produce extremely rich, hard cheeses, above everything, very cool, and not too dry, cellars are required, and care must be taken to pack small cheeses very close together, so as to prevent in some measure the access of air." The philosophy of curing cheese is very imperfectly understood—at least in America. Many dairymen, as well as cheese dealers, do not believe that fat in cheese can be produced in any other way than by the cream which is in the milk; and yet it has been proved, over and over again, that cheese properly cured, though made from milk partly skimmed, is often more mellow and rich tasting than cheese made from whole milk, but not so well cured.

PARASITES IN MILK.

The recent theory of fungus spores, from which all kinds of fermentation, through their developing fungus germs may be produced, was first brought forward by Swan, in explanation of vinous fermentation.

Hallier, who, after Pastern, farther pursued and perfected it, observed that milk which had been boiled in an isolated apparatus would become sour and coagulated in 24 hours after introducing pencillium spores, while the same milk, without this fungus, remained fresh for many months, and showed no trace of acid to the taste, nor of acid reaction. Hopper observed in 1859 that fresh cow's milk, coming in contact with atmospheric air, takes up oxygen and gives off carbon, and that the volume of the separated carbon is greater than that of the oxygen taken up; that this operation was apparently very active during the first 24 hours, and that milk, by standing longer in contact with a given volume of air greater than the milk, may, within from three to four days, take the whole of the oxygen out of this air. After farther researches, Hopper believes he is warranted in the conclusion that milk, under the process of taking up oxygen and giving off carbon, gradually forms additional fat, and that this formation of fat comes under the analysis of caseine; again, that a material must also be produced with the fat from the caseine, which considerably excels the caseine in its capacity for containing nitrogen. Although Hopper did not succeed in isolating this material, yet it may nevertheless be held in the highest degree probable, says Prof. Marteny, that the only extractive matter found in alcohol extract, and which exhibits nitrogen in a high degree, springs from this source. Deschamps found in 1840, in calves' rennet prepared with alcohol, and of such strength that eight drops was sufficient to coagulate one litu of milk, the following ingredients:—Muriatic acid in great quantity, butryc acid, capron capsin and lactic acid, salamoniac, chlorine, magnesia, traces of sulphate salts, phosphoric lime, and a peculiar material which he calls *chymos*, and which he regards as the peculiar active principle in the rennet. In order to separate the *chymos*, Deschamps pours a small residue of ammonia in the rennet, which precipitates the *chymos*, and then washes and dries the precipitate. The *chymosin* resembles gum outwardly. It is so insoluble in pure water that it may be reduced to a powder under it, but is soluble in acidulated water; and this makes such a solution as will coagulate milk with the same efficiency as the rennet itself.

Hallier, on the contrary, thinks that the rapid decomposition of fresh milk is owing to its being filled in a peculiar way with fungus cells; and he proves from his experiments that by a small addition of

pencillium spores, the coagulation and separation of the caseine may be produced quite as quickly as with rennet.

CONCERNING RENNET.

We have a number of theories concerning the nature of rennet, and the peculiar principle on which its virtue in cheese-making depends; but it is a question whether any of the theories of its action are strictly correct; indeed, there is so much difficulty involved in the investigation of this subject that we are not likely to have all our queries satisfactorily solved for some time to come. The cheese-maker has learned a few things of much practical utility respecting the effect of rennet in cheese-making; but it is evident his knowledge is far too limited, and that were he better acquainted with its true nature and operation it would subserve an important purpose in promoting improvement in his art. We know that, to make good cheese, the quantity of rennet of a given strength must vary according to the quality of the milk. Thus, for instance, when milk is thin and impoverished, more rennet should be used than when the milk is rich, because in rich milk the buttery particles induces a more rapid action of the rennet. When too small a quantity of rennet is used, the curing process goes on slowly, and the cheese is liable to be hard, dry, crumbly and sour, and perhaps will begin to leak whey when two or three weeks old. On the other hand, when too much rennet is used, the cheese cures too rapidly, and the texture will be tender, soft and salvy. Such cheese is ripe early, and must be consumed soon, or it will depreciate in flavor, and is liable to be lost, from too rapid decomposition.

It will be seen from this that discretion and judgment must be used by the cheese-maker in the employment of rennet, according to the quality of the milk he has to manufacture. To what extent cheese may be improved by the use of the exact proportion of rennet required, is not generally understood; but our best cheese-makers have learned the fact that an improper use of rennet causes the cheese to turn out a very inferior product.

Everyone knows, says Herr Martiny, in a recent number of the *Milch Zeitung*, that rennet is an essential in the preparation of cheese from sweet milk. But its mode of action is one of the observant points

in dairy work. We use it empirically with a sort of blind reliance on its unknown agency, and always with a degree of uncertainty as to the precise results obtainable in each individual operation. A nearer acquaintance with it might put us in a position to employ it rationally instead of thus empirically. Almost all we know concerning rennet, as yet, is that its efficacy depends upon a peculiar active power, which is destroyed at a temperature of about 122° Fah., is most energetic at blood heat, and gradually lessens as the temperature declines from that point. We have yet to enquire—

First.—Does this active power belong to a certain peculiar principle, or does it proceed from organisms living in the rennet?

Second.—What would be the chemical and physical properties of such a principle?

Third.—Of what kind are the organisms referred to?—are they animal or vegetable structures?—whence are they derived?—of what are they composed?—and what becomes of them?

Fourth.—In either case, how is the action of rennet to be explained?

Fifth.—How should the preparation of rennet be conducted?

Sixth.—How can the goodness—that is, the activity and freshness—of rennet be estimated comparatively in the same way as the degree of sweetness or of acidity in a given solution?

Seventh.—What influence does the addition of a greater or less amount of rennet to milk at different temperatures, and of various degrees of fatness, exercise on the quality of the cheese?

Eighth.—What chemical, physical or organic changes does damaged rennet undergo, and what effect has such rennet on the cheese made with it, according as it is more or less spoiled?

Till these points are satisfactorily investigated, all cheese-making must be more or less hap-hazard business, and any good result that may accrue is due rather to a happy accident than to the success which legitimately attends a careful compliance with well-organized, firmly-based principles.

Now, although calves' rennet has been found the best agent, so far, for coagulating the milk for the purpose of cheese-making, it is by no means improbable that a substitute may yet be obtained fully equal, if not superior, to rennet; and this substitute may possibly come from the vegetable kingdom, or from some other source—perhaps electricity.

That some plants have the principle which will coagulate milk has long been known, but we have no record of extended experiments as to their application for the purpose of cheese-making.

SUBSTITUTES FOR RENNET.

Linnæus says the solid milk of the Laplanders is prepared by pouring it, warm and fresh from the cow, over a strainer on which fresh leaves of the PINGUSCULA VULGARIS, or Turk's hose, have been laid. The milk, after passing among them, is left for a day or two to stand until it begins to turn sour. It throws up no cream, but becomes compact and tenacious, and most delicious in taste. It is not necessary that fresh leaves should be used, and even a small portion of the solid milk will act upon that which is fresh after the manner of yeast. The PINGUSCULA belongs to the family of Butterworts.

It will be seen from what I have said that the subject of rennet, in its relation to the coagulation of milk and cheese-making, offers a wide field for experiment and observation; and I hope the attention of cheese manufacturers will be directed to the matter, and that something useful may grow out of their investigations.

The souring of milk, when left at rest at ordinary temperature, is due, according to Hallier, to living vegetable organisms of the same character as mould fungus. The commonest forms of this organism are the thread fungus, designated by the mycologist as *odium lactis* and *mucor-racemosus*, while the latest observations have added still a third—*drityortilium macorides*.

Besides these decided vegetable forms, there are in milk also those lower forms that, by the scientists, are assigned to the animal kingdom, under the name of *monads* and *vibriones*. The chemical nature of milk, especially its higher nitrogenous element, when left to itself, makes a particularly favorable ground for a multitude of those vegetable organisms, which, under the name of mould fungus, originate through the decomposing influence of all organized nature. They are the parasites of organized forms, and, in order to perform a part so significant, their spores are carried everywhere in the atmosphere; and through numerous and different fungus, individuals can by this means deposit themselves on the surface of the milk. Their primary or original form

appears as yet to be somewhat limited. If in summer you expose warm milk in vessels for several days you will observe with the naked eye, upon the wrinkled, drying surface of the cream—and, indeed, chiefly in its small hollows—a delicate downy mould. This belongs to the form (Fig. 1.) It was designated by Dr. Bail, in 1857, as jointed fungus. Hoffman, in 1865, and Hallier, in 1867, found it in various stages of development upon sweet-wort, and it has been described and represented, especially upon milk, as *odium lactis* (Fig. 2 and 3.) Following closely upon this form, and also more fruitful is *mucor-racemorus* (Fig. 4), whose connection with the jointed fungus of Bail and Hallier has been affirmed. Both forms, especially the latter, appear not only upon milk, but upon other substances rich in nitrogen. Bail showed that *mucor-racemorus* is always upon the boiled steepings of malt; and it is well known that the *mucor-varietus* are chiefly inhabitants of the animal intestinal secretions. Both these forms of mold—*odium lactis* and *mucor-racemorus*—always form themselves spontaneously upon milk which is exposed to atmospheric air under proper temperature. Hallier, who regarded the *odium* only as a form of transition, mentions as proper milk molds, *pencillium crustateum*, *aspergillus microsporus*, and *torula infesceus*. Yet the account Hallier gives of their development awaits the confirmation of other mycologists. Bail's observation showed that for the normal development of the *pencillium crustateum* and *pencillium glancum* (Fig. 5), the milk may by no means be a favorable ground. Letzterer, in 1870, found upon milk, long standing in regular layers, two to four inches deep, those interesting organisms which have only recently been physiologically studied by Dr. Bufield, and assigned the name of *dietyostelium mucoroides*. The spores of these fungi are communicated to the milk, partly from the air, and partly, as stated by Hopper, from the udder, the milk duct of which appears to be inhabited by fungi of this nature. Hopper found that goat's milk, which he excluded from the atmospheric air in glass vessels, curdled after three days, at ordinary temperature. On the other hand, the same glass vessels, filled to one-third their contents with milk at 59° to 77°, and subjected to a continual stream of carbonic acid gas, or of hydrogen, for the space of half an hour to an hour, and then hermetically sealing the ends of the apparatus, the milk, after the gas was run through it, showed no perceptible alteration; but after two or three days it was coagulated. Another portion of the

milk boiled in a glass retort, with nearly a similar volume of atmospheric air at 266°, quickly heated and then sealed up, did not coagulate in the space of half a year.

Hallier infers from this that the milk probably contains the milk acid ferment, ready formed, and that by heating it to a temperature of over 212° it is destroyed; and further, that the milk acid fermentation, once commenced, requires no admission of oxygen for its continuance. Of animal organisms in normal milk, Fox observed, in 1841, two *infusoria*, a smaller *monad* that always appeared to originate the earliest and most frequently in milk, and a larger *polygastine* (an animalcula of many stomachs) that was regarded by Fox as a bristly or hairy *monad*. According to Hallier, *vibrio lineola* often appeared on very sour milk.

I have now given you the recent views of scientists in regard to the souring and coagulation of milk. You have seen that the milk contains within itself the seeds of decomposition. Others of a similar nature come from the atmosphere, and thus in a short time the milk, so to speak, begins to vegetate, or is filled with innumerable microscopical vegetable organisms, plants or parasites, which, feeding upon its constituents, bring about decomposition and the separation of certain solids from the water which holds them in solution. There is yet much mystery concerning the nature of these organisms, and the manner of their springing into life. Dr. Bastian, in his recent work on the "Beginning of Life," advances the theory of evolution or spontaneous generation. That question need not be discussed in this place, since it is only the existence of these organisms in milk that now claims attention. At all events, the practical dairyman will have a reasonable explanation, from the data given, as to the reason why milk, heated to the boiling point, will keep longer than fresh milk—because many of the organisms or their spores are killed by the heat. And experiments show that fresh milk placed in bottles, and plunged in boiling brine, thereby acquiring a temperature above that received by boiling water, will destroy a still greater number of organisms, thus fitting the milk to keep sound for months, if the air be excluded by corking the bottles.

That great experimenter on milk—Gail Borden—though unacquainted with the germ theory, struck at the very root of this question in his practical method for milk preservation. He held from the first that milk should be drawn only from healthy, well-fed cows, and in the

most cleanly manner; that it should not come in contact with any harmful odors, and that all possible haste should be made to get it into the heating wells, and from thence to the vacuum pan, where it would be out of the influence of incipient decomposition.

IMPROVEMENT IN DAIRY PRACTICE.

Mr. Borden believed that the very first object to be attained was the proper education of farmers in the production of milk; and it is just here that the cheese and butter factories of America should make a combined effort for improvement. Heretofore it has been very difficult to reach farmers and draw them out to our dairy conventions; and while immense progress has been made in the education of cheese and butter manufacturers, the farmer remains comparatively ignorant of many of the leading principles in the production of good milk. If we could have had the farmers at our conventions from year to year, and had they, from the knowledge gained, made an equal exertion with the manufacturers for progress and improvement, the dairy products of America would be beyond question to-day of an excellence far surpassing anything that has yet been manufactured.

What, then, are we to do in the premises? How are we to inaugurate an improved system of milk production upon the farms? Men still persist in dogging and racing cows from the pasture to the stable. They still beat, kick and maul the dumb beasts at every fancied offense. They allow the cows to slake their thirst from filthy pools, and to wade through mud and mire foul with odors of decomposing vegetable and animal matters. They think it a wanton waste to exclude the milk of diseased cows from the factory cans, and still save that from feverish and caked udders, gargety and sore-teated cows, whose milk is alive with organisms that spread poison and disease to all they touch. These things must be overcome, or we can never hope to rise above the standard now obtained. I think the friends of the dairy can do no better service to that interest than by keeping this matter constantly before patrons until a reformation is effected. Borden's plan was to send an agent out among patrons, visiting the farms from week to week until these improvements were fairly inaugurated. If every factory would take this matter in hand, and insist upon it with a steady, determined will, we should soon

have a reformation that would tell on the products of the country, and save millions of dollars that are now thrown away by a useless waste. Some of the New York factories are turning their attention to this question, and have already inaugurated reform among their patrons. During the past summer I visited some of these factories, and after examining carefully the cheese upon the range, in one instance, in particular, where the number was over a thousand, I said to the manufacturer that I had never seen such a uniform and perfect lot at any factory, in all my travels and observations, and inquired especially in regard to its manufacture. "Ah," said he, "we just adopted your suggestion made here three years ago in regard to the production of milk among patrons, and we went at once, from the second class to the first, among the *fancies* of the State." I followed my inquiries concerning this cheese to the shipper and to dealers in England, and found there was no factory in the State that was more sought after, or brought a better price. Now, I ask you if this is not better than to expend your energies in learning how to manage imperfect milk, and in making from it a second class cheese which goes begging at a second class price.

A good deal has been said about cooling milk at the farm. When the milk is intended for cheese factories, that process should be adopted, not only for the purpose of protecting the milk from decomposition while on its way to the factory, but because the cooling of the milk, and its agitation while being conveyed to the factory, operates in a wonderful manner in preventing the cream from rising. This has been demonstrated by repeated scientific experiments. For butter-making it is more advantageous to retain the animal heat as far as possible until it arrives at the factory, and then cool as soon as may be to a temperature of 58° to 60°, and not be allowed to go higher than that while the cream is rising.

Prof. Dannfelt, of the Royal Agricultural College, of Stockholm, states that a larger quantity of cream can be obtained from a given quantity of milk, by cooling quickly with ice water, reducing the milk to about 36° Fah., and keeping it at that point during the creaming process. Under this management nearly all the cream rises in 12 hours, and beyond 24 hours no advantage is gained in the quantity of cream obtained. The question is one of great importance, and our dairymen will do well to turn their attention to this subject, and make the proper

experiments with ice water to verify this matter of temperature. I recently saw at the New York State Fair a new apparatus for setting milk, where this principle could be carried out, and with great economy as to the supply of water. It consists of four tin cans, each 20 inches deep and 20 inches in diameter. Each can is placed in a wooden tub, with space between the can and tub, on the sides and bottom, for the reception of water. In the centre of each can there is arranged a double scroll of tin, movable, and hung upon wires. This scroll is made by bending the tin over wire, so as to make space for water, one-quarter of an inch thick and three and a half inches wide—the two scrolls, when joined together, making a flat, circular piece of hollow tin, seven inches wide. From the upper end of the scroll a pipe is erected, surmounted by a funnel, for the reception of water. At the lower end of the scroll there is another pipe, coming up and going over the tin can, for the discharge of the water into the space between the can and tub. Now, in the operation of this apparatus after the milk is strained into the can the scroll is introduced, and sinks in the milk to a point below that which will be occupied by the cream. Water is now turned into the pipe leading to the scroll, and the milk receives a thin sheet of water in the centre of the can, and from thence, falling on the outside, fills the space between the tub and can, and then flows off into a reservoir. When the cream is up, it is dipped off, and does not come in contact with the scroll which is below. Connected with this apparatus is a refrigerator, which receives the waste water; and when it is cooled it can be used over again. After being cooled, the water is pumped into an upper reservoir of the refrigerator, and then conducted to the pipes and made to do its service over again. With a barrel and a half of water, the milk from 20 cows may be cooled daily, and kept at a temperature of 60° Fah., or lower, for a week during the hottest weather of summer, while the consumption of ice to supply the refrigerator will be no more than 20 pounds per day. A syphon is used for drawing off the milk from the cans. Milk should always be carted from the farm to the factory in spring wagons, and under an awning or cover. There can be no doubt but that much milk, under our present system, is injured by being exposed to the sun, while in rainy weather water is introduced in the milk, which not only gives a false weight, but does real injury, especially to milk that is to be kept over during the night.

CHEESE HOUSES.

The question of curing cheese upon the shelf I regard as one of the most important subjects that can engage the attention of dairymen. The loss on account of bad flavor, and otherwise imperfectly cured cheese, that can be traced directly to faulty, dry houses, may be safely estimated at no less than from $5,000,000 to $8,000,000 annually. It is one of the most singular things connected with the dairy business of America, that scarcely any attention is given to the proper construction of curing houses, so that there shall be no loss in curing the cheese, either in flavor or weight.

I have here the analysis of several kinds of cheese, the best of their kind; and I wish to call your attention to the proportion of water in each. You will see that American cheese is much drier than that of other varieties, and it is a very serious complaint against our factory-make, both at home and abroad:

	Cheshire.	Best Cheddar.	Double Gloucester.	Single Gloucester.	American.
Water	32.59	33.92	32.44	28.10	27.29
Butter	32.51	33.15	30-17	33.68	35.41
Caseine	26.06	28.12	31.75	30.31	25.87
Sugar of Milk, Lactic Acid	4.53	.96	1.22	3.72	6.21
	4.31	3.85	4.42	4.19	5.22
Mineral Matters					
	100 00	100 00	100 00	100 000	100 00
Nitrogen	4.17	4.51	5.12	4.85	4.14
Common Salt	1.59	1.55	1.42	1.12	1.97

	Cream.	Buttermilk.	Butter.	
Water	61.67 to 64.80	89.65		
Butter	33.43 to 25.40	0.79		
Caseine	2.62	3.01		
Sugar of Milk	1.56 } 7.61	5.72		
Mineral Matters	0.72 to 2.19	0.83		
Fatty Mat'r			Margain. Oleine. Capsoine Capsine. Butyric.	77.05
Caseine				1.06
Whey				20.09

You will see from the table that American cheese is about $3\frac{1}{3}$ per cent drier than best Cheddar, and nearly five per cent drier than Cheshire and Double Gloucester. This difference in weight between best American and best English cheese does not result from peculiarity of American manufacture, or from pressing, but comes simply from the manner in which the cheese is cured. The hot, dry weather of American summers, and the universal practice of allowing the cheese to take its chances with the weather, causes the evaporation or drying out of too much moisture, thereby affecting not only the richness and flavor of the cheese, but lessening its weight. The loss of weight, you will see, is from three to five pounds per 100, or from 6,000 to 10,000 pounds on a factory of 500 cows averaging 400 pounds per cow. And if this cheese could be saved, and converted into cash at 10 cents per pound, the money gain on such a factory is from $600 to $1,000 per year more than now obtained, simply in the matter of weight, to say nothing of the other and greater losses in flavor and defective quality on account of badly constructed curing houses. It has been observed and proved by chemical analysis that this rapid evaporation and loss of moisture has the effect of rendering cheese less rich in butter than it is; hence the fact that a skimmed cheese, properly made and cured, will appear richer in butter than a whole milk cheese which has been deprived of too much of its water while curing. I have seen small cheeses almost totally ruined in this way—dried up to that extent that they were tough and leathery to the taste, or of a crumbly, mealy nature, in which no richness could be observed. During the past season I made an extended tour of observation among the Limberger cheese factories of Northern New York. Now, the Limberger cheese, when fully ripe for the German taste, smells badly; but *there is a time* in the process of curing when the flavor is perfect, and the cheese is most delicious, resembling, in its extreme fatness and plastic, mellow texture, a first-rate Stilton. The curing process has been carried on in cellars, where evaporation is slow, and the cheese being placed close together, the moisture, during the process of fermentation, becomes intimately mingled with the cheese constituents, and is assimilated, so to speak, giving the appearance and taste of fatness, or a very large quantity of butter in its composition.

In our process of curing in hot weather, the moisture passes off too rapidly, or before it can be assimilated. In fall, when the weather is

cooler and damper, our cheese is richer and better, not wholly on account of extra richness in the milk, but because more moisture is retained in the cheese, and which has been perfectly assimilated during the curing process.

IMPROVING CHEESE HOUSES.

How to regulate temperature in curing rooms for the hot weather cheese has been a question of great interest to cheese manufacturers and dairymen for a long time. What is needed is something simple, cheap, and which requires but little attention. There are very few curing rooms in the country that are constructed with any regard to preserving an equable temperature. In hot weather they vary in temperature with the surrounding atmosphere, and the cheese is often overheated, thus causing rapid fermentation and deterioration in flavor. The principle has been abundantly established by experiment that cheese will not retain a sweet, clean and nutty new-milk flavor, if exposed to high degrees of heat in curing. It has also been demonstrated by experiment that a temperature of about 70° Fah. is the best range of heat in the curing process for desirable results.

Notwithstanding these facts are generally known, little or no effort is made to improve curing rooms, and in consequence serious losses obtain year after year on account of cheese getting off flavor before it can be sold. A large number of factories, on account of imperfect curing rooms, put their cheese forward in market during hot weather at low prices, and often below its true value, because it is feared bad flavor will result from holding. The main question which is considered, it would seem, is whether to accept a known loss in making immediate sales, or to run the risk of holding and marketing an inferior product. In either case a loss must result, whereas if proper curing rooms were constructed, so that cheese would not deteriorate, the matter of holding it must not unfrequently appear to be the better course.

A very few factories have adopted the plan of double walls in the construction of curing houses, and they are of considerable service in regulating temperature. But for upper rooms something more is needed, and perhaps the plan proposed by a correspondent of *The Nation* may offer suggestions to inventors for arranging a cheese-

curing house, where temperature may be controlled in hot weather. It is as follows :—

"It is proposed to lead a considerable number of small air pipes several times through a very large box or bin, which is to be packed full of some light substance—moss, for instance—through which air could easily find its way. Water from above will be suffered to drip all over the top of this moss, and will trickle through it to the bottom of the bin. Through the moss, from the bottom upward, a current of air will be forced, and thus produce rapid evaporation. This will cool the air pipes, and they will cool the air which passes through them. To force a current through the pipes, and and to force another through the moss, a very large but light pair of bellows will be used, worked by a sort of clock arrangement, in which the immediate motive power will be a heavy weight. A horse will, with ten or fifteen minutes' heavy pull—once a day or once a week, according to the heat of the weather—wind this clock affair. It has a pendulum, and can be started or stopped at pleasure, and, by altering the length of the pendulum, will run fast or slow, according to the heat. The cold air which the air pipes furnish will be let through cheap wooden pipes to the various rooms of the house, always near the ceiling, and be turned on or off like the hot air of ordinary furnaces. The doors and windows will be kept closed in the hottest weather as carefully as in the coldest. There will be no flies, mosquitoes, or dust. The blinds will be open and the rooms light. The air will be as dry as that outside, and the temperature will be between 60° and 70°, as may be desired. Such a machine will not cost much, and the projector thinks that the extra work it will enable him to do in the hottest weather will soon repay him for the outlay."

Mechanical powers like the one for working the bellows have been exhibited at some of our recent New York State Fairs, applied to the common dash churn. This mechanical movement consists in a system of gearing driven by a heavy weight attached to a stout rope, which is wound about the cylinder of the machine.

The *Scientific American*, speaking of the merits of this machine, says :—

"Mechanical powers of this character have not heretofore been very acceptable for domestic purposes—some requiring too heavy weights,

and thus using too much rope. The inventor of this movement has produced a power that seems very free from the objections named. It is very compact, occupying a space only 18 by 20 inches, applicable for pumping water, and many other kinds of light work."

There may be other and better ways of regulating temperature in curing rooms during hot weather, and the plan suggested may be too complicated or faulty when put to a practical test. Still we are in hopes that some plan will be inaugurated for overcoming the bad influences of heat in curing rooms. What is especially needed in this direction at the present time is a plan that may be easily applied to old factories, so that the buildings now in use may be utilized. Considering the immense losses that are sustained every year in overheated cheese, and the great desire of cheese manufacturers for suitable curing rooms, the subject is well worth the attention of inventors. A cheap, simple and efficient plan—one that could be easily adopted at the factories—could be made to pay largely, not only to the dairy interest of the country, but to the inventor.

FORWARDING CHEESE AND BUTTER IN HOT WEATHER.

Refrigerator cars are now coming into use, and all perishable products that are liable to be affected injuriously by heat, while being conveyed to market, should be forwarded in such cars. The cheese and butter trade has assumed large proportions, and their freightage is an important source of income to the railway ; and I see no reason why all proper appliances for the delivery of these goods in sound condition should not be incumbent upon the roads.

Dairymen certainly are entitled to these improved methods for the transmission of their property ; for whatever losses are incurred on account of shipping goods in hot weather, react upon the producer, since *the greater the risk, the lower the price* to meet the contingency of such loss. The introduction of refrigerator cars, we suppose, may be credited for the most part to competing roads which vie with each other in securing the freight of the Great West. This competition often gives the West undue advantages over the East, not only in the carrying appliances, but in the relative cost of freights.

The perishable products of the far-off Western prairies, says the

New York *Tribune*, are now coming to the East in refrigerator cars—a device which must have an effect on the value of Western lands something akin to that of steam itself. To send fresh meat, fruit, butter, &c., 1,500 miles in the hottest season of the year, and have them arrive in market in prime condition, is a feat of which our respected ancestors of half a century ago little dreamed; yet that is now done every day between Chicago, Boston and New York. The best cars of this description, as is claimed, are classed among freighters as the "Blue Line," constituting part of every freight train running from Chicago to Boston and New York.

They are owned by the various roads over which they run, and, of course, move rapidly and make close connections; and their success is such that the company guarantee the delivery of the articles in as good condition as when received. They are built double all around, with inside double doors, filled in with charcoal, and have a capacity for holding two tons of ice. They are also arranged so as to be furnished constantly with a current of cool, dry air. At the principal stations they are carefully examined, and ice added whenever it is deemed necessary, by means of which the guarantee of a safe arrival is made good. Very naturally, too, the business is growing rapidly, as 20 cars a week are now in demand, where four sufficed a short time ago. Each car will carry 20,000 pounds. Cars are also furnished at points east of Chicago whenever there is freight enough to make up a load. Thus, one by one, are the difficulties mastered that retard intercourse between the producer and consumer.

Dairymen should see to it that their goods, in hot weather, are freighted in such cars as will deliver them in good, sound condition. A good deal of cheese from Central New York, bought for export, goes upon shipboard almost immediately upon its arrival in New York City. It not unfrequently, however, becomes overheated in the intermediate time of leaving the factory and being put upon the ship, and, as a consequence, becomes more or less touched with bad flavor.

The use of refrigerator cars would, I think, obviate this difficulty in hot weather, since the cheese, on its arrival in New York, would be so cooled off as to take its place on the vessel and not be affected with heat, and hence would arrive in the foreign market in prime condition.

During the past summer I called the attention of some of the New

York shippers to this question, and some tests were made, to show its advantages, with cheese shipped from Central New York. A lot of cheese from a factory was divided, and one part forwarded in a refrigerator car to New York, and the other part in the ordinary way. Both lots arrived in the city at the same time, but that in the refrigerator car, on account of its perfect condition, bringing nearly two cents per pound above the other lot, which was overheated and in a less desirable form to go upon the market.

BUTTER PACKAGES.

I have another suggestion to make in regard to butter. What is greatly needed is a better system of packing than now obtains, and especially with butter designed for the European markets. Butter, to keep well for any considerable time, must be excluded as far as possible from the air. The usual way of packing in tubs and casks will not do this in as perfect a manner as is required to ensure nice, fresh flavor. A better way is to surround the butter with brine, on the plan of the White packages. In this plan the tub is made very much in the form of the old Welsh tub, except that it is more tapering. The staves are heavy, and heads are provided at both ends, so as to make a package that will not leak. In packing, the tub is turned on the small end, and a sack of cotton cloth is made to fit the tub, and into this the butter is packed until it reaches to about an inch of the groove for holding the upper head. A cloth is now laid upon the top of the butter, and the edges of the sack brought over this and neatly pressed down; then the head is put in its place, and the hoops driven home. The package is now turned upon the large end, and the sack of butter drops down, leaving a space on the sides and top. Strong brine is now poured through a hole in the small end until it fills all the intervening spaces. It will float the butter. The hole is tightly corked, and the butter is pretty effectually excluded from the air.

Butter put up in this way—I know from actual experiment—will keep a year in sound condition, and, I believe, would cross the Atlantic and open as fresh in the London market as when it left the dairy on this side.

Experiments have been made in sending butter from California to

our Eastern markets, packed in brine, and it came in prime, fresh condition, and altogether superior to the same kind of butter put up in dry packages.

A favorite style of putting up butter in California is to make in two-pound rolls, and wrap in thin muslin. Now, in shipping East, a new, stout oak barrel, iron-bound, is taken, and a large canvass-bag made to fit the inside; then the rolls, covered with thin muslin wrappers, are packed in upright layers, the head put in place, and the barrel filled with brine until the rolls are entirely surrounded with the pickle. Butter thus treated will make the journey to New York without any deterioration in flavor, and I have no doubt it would cross the Atlantic in good condition.

I see no reason why Canadian butter cannot be made to take a high stand in the English markets, and command a much better price than now obtains. I know from observation of Canadian dairy lands that they have the requisites for producing good butter. What is needed most, in my opinion, is the introduction of creameries or butter factories, where there shall be high skill in manufacturing, so that a uniform, fine-flavored and good-textured butter will obtain. Then, by adopting the brine package as I have suggested, or something similar, and shipping the lots as soon as made, or when fresh, Canadian dairymen will find no difficulty in realizing good prices.

I have tested hundreds of samples of Normandy, Irish, and other kinds of high-priced butter, in the London market, and have found nothing better in flavor and texture than that manufactured in our best American creameries.

The best grades of French butter are lighter salted than American. High salting is considered a defect in the London market, and hence, in shipping butter abroad, this fact should be fully borne in mind.

High-salted butter, even though it be unobjectionable otherwise—in flavor, texture and color—will not command so good a price as if it were light salted. I have no doubt that the best grades of Canadian butter lose in price on this account when reaching London; but a much greater loss is sustained from inferior manufacture and inferior packages.

Louis S. Robbins, of New York, has recently invented a new process for expelling the buttermilk from butter, and especially for restoring rancid butter to a palatable flavor. The process consists briefly

in throwing the butter into a tub and allowing a shower of water, at a temperature of 100°, to fall upon it until it assumes a melted form. After being stirred about, to separate the buttermilk, a stream of cold water is showered over it, when it assumes a firm consistency—the impurities in the meanwhile having been washed out. The butter is then laid upon the butter table, and fine salt worked into it by means of a corrugated roller. He claims that rancid butter, under this process, can be restored into a palatable and wholesome article of food.

HOME MARKETS.

In conclusion, I cannot help urging upon your attention the importance of developing home markets, and promoting in every laudable way the consumption of dairy produce among your own people.

I may be wrong, but it seems to me the true progress of a country depends upon its building up manufactures, and thus creating a demand for your agricultural products at your own doors.

AN ADDRESS,

DELIVERED BEFORE THE CANADIAN DAIRYMEN'S ASSOCIATION, AT INGERSOLL, ONTARIO,

FEBRUARY 6th, 1873,

BY

PROFESSOR BELL, M. A.,

Of Albert University, Belleville, Ontario.

The application of the co-operative system to the making of cheese on a large scale, and the consequent introduction of dairy husbandry into the practice of our farmers to a much greater extent than until lately has prevailed among them, promises to effect a beneficial change in the character of their agricultural operations, and to constitute an important epoch in the agricultural history of these Provinces.

Canadian cheese, I am glad to observe, has already attained a high reputation, and commands a ready sale and a good price, in the markets of Europe. In order to sustain, and, if possible, to extend and augment this reputation, it is necessary that the principles upon which the operations of our factories are based, and by which they are regulated, should be clearly understood and appreciated by all who are concerned in or connected with the manufacture, as it is only by a strict adherence and constant recurrence to correct, fixed principles that permanent success can be attained, or valuable improvements effected, in any branch of manufacturing industry which is conducted through the agency of the chemical forces. The very fact of your meeting in convention to discuss the subject, and to give and receive information

respecting the making of cheese and butter, and their concomitants, proves that you are aware of the benefits to be derived from the diffusion of such knowledge, and augurs well for the continued success of the movement.

When I was first invited to deliver an address before a dairymen's convention, I consented to do so, not because I expected to be able to add much to the practical knowledge of the subject possessed by my audience, or suggest any improvement in the apparatus employed or the processes adopted in the factories; for although during the first twenty years of my life I was conversant with the management of the dairy, and took an active share in its work, yet my experience was gained on a small scale, and belongs to a remote period; and I have not had much opportunity of becoming acquainted with the manipulation of the improved apparatus now in use. But as my later studies have led me to investigate more closely than is usual among practical farmers the chemical actions and effects that are involved in the manufacture of cheese and butter, and the correlative relations of certain facts in animal and vegetable physiology connected with the same, it occurred to me that I might be able to give an explanation of the more prominent of those actions, effects and relations which should be generally intelligible, and thus shew the *rationale* of the manufacture, and the reason why some things ought to be done, and others avoided, both by those who conduct the operations within the factories, and those who supply the material on which those operations are performed.

Milk being the chief ingredient employed in the making of cheese and butter, in order to understand clearly how milk ought to be treated, so as to produce the greatest quantity and the best quality of those substances, it is necessary that the composition of milk, and the changes to which it is liable from natural causes, and also those which may be induced upon it by artificial means, should be clearly understood.

Milk is a very composite fluid, intended and provided by nature for the sustenance of the young of a certain class of animals—hence called "mammalia," or teat-bearing animals—for a longer or shorter period after birth. It varies in the proportion of its constituents according to the nature of the animal which yields it. Thus the milk of the goat and of the sheep contains much more solid matter than that of the cow, and very rich and highly-flavored cheese is made from each in some countries;

but as the milk of the cow alone is used in the cheese factories of this country, I shall confine my remarks to the product of that animal.

The constitution of freshly-drawn cow's milk, though it varies slightly in different individual animals, from the influences of breed, food, mode of treatment, and other circumstances, may be generally stated as follows:—In 1,000 parts—or, say, pounds—there will be water, 873 parts; fatty matter, or butter, 30 parts; caseine—the basis of cheese—48 parts; sugar of milk, 44 parts; phosphate of lime, $2\frac{1}{3}$ parts; chlorides of potassium and sodium, $1\frac{1}{2}$ parts, together with a little magnesia and iron in combination with phosphoric acid, and a little more soda combined with the caseine.

From this it is easy to see how nicely this liquid is adapted for the sustenance of the young animal and the promotion of its growth. There is water to convey the nourishing substances to the various parts of its bodily frame, and to supply the waste occasioned by secretion, perspiration and evacuation; fatty matter and sugar to sustain respiration and maintain the requisite degree of heat by their oxidation; caseine to form the muscles by its conversion into fibrin, or flesh, and to supply sulphur for the formation of hair, hoofs, horns, &c.; phosphate of lime—the solid matter of the bony framework on which the body is built—and finally, iron to redden the blood and carry the vitalizing oxygen through the arterial system. But the cow gives a great deal more milk than is necessary for the support of her calf, and the milk is too valuable a product to be disposed of in that manner. As, however, it is peculiarly liable to suffer decomposition, and to become in a short time unfit for consumption, the ingenuity of man has contrived means to separate the more valuable ingredients—the cheese and butter—from the other constituents of milk, and to give them a solid and permanent form as wholesome and agreeable articles of food, which are capable of being conveniently kept in store, or transported to distant markets as important objects of commerce.

The making of butter is a purely mechanical operation, and consists in agitating the milk or cream in such a manner as to rupture the little vesicles in which the fatty part of the milk is enclosed, so that the particles of butter may be set at liberty, when they agglomerate into a mass, after which all that remains to be done is to wash it clean from the residuary liquid, or buttermilk, and incorporate with it enough of

salt to preserve it for a longer or shorter period, as may be deemed necessary.

The manufacture of cheese, however, is a very different and much more complicated process, and affords an interesting example of the application of chemical principles and chemical manipulation to the production of a valuable article of consumption and of commerce. Milk, as we all know, and as I have already stated, is of a very changeable nature, and can only be kept in a fresh state for a very short time, especially in warm weather. It soon becomes thick and sour, and then passes rapidly into the putrefactive stage of fermentation, when it becomes offensive and quite unfit for use as food. As, however, it contains a considerable quantity of wholesome nutritive matter, which is also very agreeable to most palates, the separation of this part from the rest, and its reduction into a solid and permanent form, in which it can be preserved for a lengthened period, has long occupied an important place among agricultural occupations.

The true basis of cheese is the caseine contained in the milk—a substance which bears a striking analogy to muscular fibre that is to the lean part of flesh, and, like it, is composed of carbon, hydrogen and nitrogen, in union with oxygen and a little sulphur and phosphorus. It is insoluble in pure water, but dissolves readily in water in which a portion of an alkali—such as potassa or soda—is dissolved. Milk, when recently drawn from the cow, contains enough of these alkalies to hold the caseine in solution; but if from any cause the alkali is taken away from the caseine, and made to enter into combination with another substance, the caseine assumes the solid form, or, in other words, a curd is formed. This is accomplished by direct action when an acid—such as nitric, muriatic or acetic acid—is added to the milk, as immediately upon its introduction it combines with the alkaline matter, taking it away from the caseine, and leaving the latter to become solid. Cheese may be made by the admixture with the milk of any of these acids, or of many similar substances; but the process adopted in our dairies involves a much more complex series of reactions, which I shall now proceed to detail.

Besides the substances which I have enumerated, milk contains nearly five per cent of a peculiar substance called "sugar of milk." It is composed of carbon, hydrogen and oxygen, and is nearly allied to the

sugar we use in our tea, the only difference being that it contains a little more hydrogen and oxygen than the "cane," or common sugar, the latter being composed of 24 parts of carbon, 22 of hydrogen, and 22 of oxygen, while in milk sugar the proportions are equal, viz., 24 of each. Fermentation is easily induced in this substance, and then it is rapidly converted into lactic acid, which much resembles acetic acid—the active principle of vinegar—in its nature and composition. As soon as this acid is formed it combines with the soda and potassa to form neutral salts, or lactates, and sets the caseine free to coagulate and form a curd, which it does in a very short time. This effect is produced with equal certainty, whether the acid is generated by the action of the atmospheric air, or more rapidly by the introduction into the milk of another substance.

There are several substances which have the property of causing the sugar of milk to ferment, and enter into the acid state. The addition of a small quantity of any other acid, or the liquor made by infusing a portion of old cheese in warm water, is sufficient to start the conversion, which then goes on until the whole of the caseine is turned into curd. The substance, however, which, above all others, claims our attention in this connection—both on account of its interesting, though obscure reaction, upon the milk-sugar, and because of its importance in our system of cheese manufacture—is the animal tissue of the stomach and other intestines of the calf, kid, lamb, pig, and, no doubt, in the similar parts of the young of most milk-giving animals.

This tissue, or its infusion, when brought into contact with the milk, disturbs the equilibrium of the components of the milk-sugar, and causes it to form lactic acid. I cannot state the cause or the mode of this action; for the best chemists have hitherto failed, so far as my knowledge extends, to give even a plausible explanation of it; but it is certain that this power is increased by the tissue being salted and dried, and it seems to be equally well established that the power resides in the tissue itself, and not in any extraneous extractive matter it may contain; for after having been digested in warm water or whey, and salted and dried again, the stomach is found to be as capable as before of exciting fermentation in the milk-sugar.

Temperature is an important element in chemical operations, and must be carefully attended to in cheese-making. A heat of from 90° to

100° of Fahrenheit's thermometer seems to be most advantageous. If the milk is much colder than this when the rennet is introduced, the curd will be slowly and imperfectly formed, and the cheese will be soft and sticky; if the heat should be raised above the higher figure, the action will be too intense, and the cheese will very likely be hard, dry and crumbling. After the curd is once fairly set, the rest of the process is purely mechanical, and does not come within the scope of my present inquiry, except to say that the more care that is exercised in separating the solid matter from the whey, the finer will be the quality of the cheese. If too hastily done, a considerable portion of the butter will be carried off, and the cheese will be poor. If the whey is not entirely removed, a portion of the milk-sugar and of the rennet will be left behind to induce fermentation and partial decomposition, communicating to the cheese an unpleasant smell and taste, and materially affecting its keeping qualities, even to the extent of rendering it unfit for market in a very short time.

The kind and degree of pressure to which it is subjected has also a considerable effect upon the quality and texture of cheese. There are several various forms of cheese-presses in use, but they may be divided into two classes—those in which the pressure is applied by means of a screw and nut, and those in which it is applied by a weight suspended from a lever or combination of levers. The action of the former is intermittent, being strongest at first, and diminishing as the curd consolidates; so that this press requires constant attention to keep the nuts tightened up. Cheese pressed in this way is apt to be permeated throughout its whole substance by numerous vesicles, or cavities, containing carbonic acid gas, or, in some cases, sulphide of hydrogen or ammonium, or even that still more offensive compound—proto-sulphide of carbon. The lever press, on the contrary, is apt to press the curd too much at first, and make it leaden and heavy. The best sort of press is that in which these two principles are combined—the pressure being applied by lever action and regulated by a screw working through a dial plate, and furnished with an index.

I have hitherto spoken of caseine as if it were the sole constituent of cheese; but there are other substances which are taken up—in part, at least—mechanically by the caseine in the act of coagulating, and which exercise an important influence upon the flavor, the market

value, and the economical properties of cheese as an article of diet, viz., the oleaginous matter, or butter, and the phosphates of lime, magnesia and iron; but as there are other matters to which I wish more immediately to direct your attention, I shall delay the consideration of these substances until I come to treat of the value of cheese as an article of food.

What I have stated respecting the instability of milk, and its extreme susceptibility towards atmospheric and other influences, ought to convince everyone engaged in the work of the dairy of the necessity of preserving the utmost possible degree of cleanliness in all the vessels into which milk is put previous to being sent to the factory. A very small—almost undistinguishable—quantity of partially decomposed milk or cream, adhering to the inside of a pail or can, will be like the "little leaven which leaveneth the whole lump," and perhaps be the cause of spoiling a whole making of many pounds of cheese. It is not sufficient that vessels which have been used to hold milk should be washed ever so carefully with cold, or even with warm water, before being used again for the same purpose. They cannot be considered fit to be used a second time until they shall have been scalded out by rinsing with water at full boiling heat; and if after such scalding any particles of greasy or cheesy matter should be observed sticking to the sides, or in the angles of the vessels, they should be washed with a solution of washing soda or diluted potash lye, which will remove either substance effectually. Chemical cleanliness—*i. e.*, perfect cleanliness—is one of the most difficult things in life to attain; but the nearer we can approach it, the more nearly will our processes approach perfection, and the more satisfactory will be their results.

In occasional excursions which I have made in the country around Belleville, I have observed that the cans in which the milk is conveyed to the factories are placed upon open stages and platforms, to stand till the wagon comes to take them away. Now, considering the very marked effect that a slight increase of temperature has in altering the constitution and promoting the decomposition of milk, I think it would be well to erect a slight roof over each of these platforms to protect the cans from the direct rays of the sun, and also to put a light tilt, with a cotton or canvass cover, over the milk wagon. It would also be advantageous to have a jacket or outside covering of factory cotton, or other

cheap, light material, fitted over the cans and well wetted with water, which, by its evaporation, will keep the milk perfectly cool while waiting for the wagon and on its progress to the factory ; with this additional advantage, that the warmer the weather the cooler the milk will become, in consequence of the increased rapidity of the evaporation. In this manner, persons who reside in the East Indies are wont to cool their wine and other liquors for the table, and on the same principle even ice is formed there, notwithstanding the heat of the climate. I am informed that some farmers in the County of Hastings have adopted this plan, as recommended by myself at the convention held in Belleville last year, and find it work satisfactorily.

It should also he considered a duty, imperative upon all those who supply milk to the factories, to keep back the milk of animals which exhibit any symptoms of sickness, however slight they may be ; when they may have been overheated by fast driving, or being chased by dogs; when, from having been absent from milking time, the milk has been retained much longer than usual in the bag, as also at the time when the animal, under the procreative instinct, seeks the male, and for at least a week after calving. These are not mere speculative ideas of my own, but are derived from the practice of an estimable old lady, who conducted a rather extensive dairy in the neighborhood of Newcastle-on-Tyne, England, some 50 years ago, who was renowned for the excellence of her cheese and butter, and who never allowed a drop of milk, which she knew to have been drawn from an animal under any of the above mentioned conditions, to enter her cheese vat or butter churn.

I have been thus particular in addressing the foregoing remarks to the patrons on the outside of the factories, rather than entering upon the consideration of the processes that are carried on inside their walls, first, because the operators know their business better than I do ; second, because if a company happens to engage a person who cannot make good cheese when furnished with proper apparatus and good raw material, they can, and probably will, discharge that individual and engage another more competent person in his stead ; and third, because I am certain that however extended may be the experience, or however great the skill of an operator, it is impossible that he can make fine, or even good cheese, unless he has good material to work upon ; and it is quite possible that the floating curds, and other detrimental and unaccountable

circumstances which cause so much annoyance to the manipulators and so much loss to the shareholders, may arise from the neglect or non-fulfilment of some of the conditions I have mentioned. As for those persons who are so meanly mistaken as to keep back the strippings, or send skimmed or watered milk to the factories, I hope that there are none of the kind in this part of the country; but wherever they are found they ought to be prosecuted to the full extent of the law, and the penalties inflicted, and the forfeiture of their stock and share of the profits which may have previously accrued, should, in all cases of conviction, be rigorously exacted; for such knavery is calculated to destroy the reputation and reduce the profits, not only of the factory with which they are connected, but of the whole produce of the country.

Milk is the raw material of cheese, but the cow is the source of milk, and no treatise or discourse on cheese-making would be complete without a notice of the animal and its relations to the subject. As a general rule, the smaller breeds are considered to be the most profitable to the dairyman, as they give a much better return in proportion to the quantity of food they consume than the larger breeds do. In England the Alderneys are very highly esteemed, and by many eminent agriculturists are placed first on the list of dairy breeds, though the Ayrshires have about an equal number of advocates, and, as far as I can judge, are perhaps, upon the whole, the more profitable breed to keep, as their constitution is stronger and more hardy, and they will thrive on coarse fare, and require less attention than the Alderneys; and though the quantity of milk they yield is not so great in proportion to the weight of the animal, yet the absolute quantity is as great, or greater, and the richness is about equal. Add to this that the Ayrshires will generally last through a greater number of seasons, and when no longer wanted for the dairy they fatten much more rapidly, and attain a much greater weight than the others. One variety of the Ayrshires—the polled, or Galloway breed, as it is sometimes called—I can testify from my own experience cannot be surpassed in the richness of its milk, both in cheese and butter, though the quantity given is seldom so large as in some of the other breeds.

Many capital dairy cows are to be met with among the common and grade cattle of this country, and some prominent dairymen advocate the crossing of the common cow with the short-horn, and the resulting

breed again with the full-blooded Ayrshire, as affording the preferable breed for dairy purposes; but until the raising of cattle for the dairy becomes an established branch of our farming economy, and some experience is gained in the matter, it is perhaps premature to attempt to lay down rules or settle principles in the matter of the special production of dairy stock.

No breed of cattle with which I am acquainted excels in richness or sweetness of milk the black cattle, or Kyloes, of the Highlands of Scotland, though the quantity those little animals yield is small. Their flesh is also so delicate and well-flavored that their meat always brings the highest price in the London market. I am of opinion that by the introduction of this variety, and perhaps also of some of the hardier races of sheep—such as the Cheviots, or the black-faced Highland breed—a large extent of the wilder and more remote districts of Ontario might be made profitable as grazing grounds after the forests are cleared off, either for the meat market or the dairy. In the fall of 1859, about the beginning of October, I made an excursion into the east part of the Township of Hungerford, and in going from lot 30 to lot 32, in the 3rd concession, I crossed a wide space of uninclosed land, which had apparently been cleared some eight or ten years previously. It was covered with a close sward of grass nearly a foot high, green, fresh and succulent, among which a fine herd of cattle were luxuriating in splendid condition. I had a few days before gone over the 2nd and 3rd concessions of Sidney and Thurlow, where everything was dry, parched and adust. The contrast certainly was very striking. On several subsequent occasions I have observed that there was good grazing upon the granitic series when the limestone districts were dried up and bare, and that the mutton raised upon the Laurentians is superior, both in richness of flavor and shortness of grain, to that which is fed upon the limestones of the Silurian system. I believe, therefore, that the real value of our back country will ultimately be found to consist in its pastures rather than in its mines.

The feeding of the animal is the next point of importance. When we consider that the cow contributes nothing of her own to the contents of the milk pail—that her organism only selects, extracts and combines the substances that exist in the food which she consumes—we shall easily understand that it is the interest of the farmer to see that his cows are

supplied with such fodder as contains a sufficient proportion of the substances which form the basis of cheese and butter. In the spring and early summer, when the grass is rank and succulent, and the cattle can obtain all the nutriment they want by grazing, they require but little attention; but when the herbage becomes dry and scanty every judicious farmer will have in reserve a sufficient extent of green crop to carry his cows over the season of scarcity, and maintain them in good condition until the approach of winter compels him to house them in the barn. For this purpose a mixed growth of rye grass, red clover and oats, with vetches, is especially valuable, as this combination of plants contains in great abundance the elements of caseine, gluten, albumen and oil, which are the chief substances the dairyman desires. Indian corn, too, planted rather thickly in rows, with vetches drilled in the intervals, and cut green, will also make capital fodder.

To keep up anything like an equable supply of milk from a number of cows, their pasture ground should be so subdivided by fences that they may be confined to one section until they shall have eaten the grass well down while the other section is growing. It must be remembered that the cow, which has teeth only in the lower jaw, and thick, cartilaginous, almost immovable lips, requires to have the grass long enough for her to twist her tongue round it, and so bring it within range of her teeth, which, by a peculiar side-long motion, rather shear than bite the stems and leaves. The horse, with his well-furnished jaws, and the sheep, with its small, fine muzzle, and both provided with muscular and movable lips, can graze much closer to the ground than the cow can; and the horse would maintain himself in good condition, and the sheep thrive and grow fat, upon a pasture on which a cow would literally starve. All pastures ought to be provided with shade to protect the animals from the midday heat, and shelter to shield them from storms and cold. In many parts of England and Scotland every field is provided with an erection called a "hemmel," some seven or eight feet high, and large enough to contain the number of animals to which the field is usually "stinted." It is composed of stakes driven firmly into the ground, interwoven at the sides with branches, and roofed with straw or litter. In the "hemmels" the cattle or other stock find shade or shelter as they may require. In this country, where wood of any required dimensions is so easily obtainable, and where the branches of

the pine and cedar afford such suitable material for sides and roof, these "hemmels" could be erected at a very trifling expense; and if placed upon the line of the dividing fences, and so constructed as to be easily made accessible from either side, as might be required, they would be found very advantageous in our changeable climate.

Above all, cattle should have access to pure, good water, and should never be allowed to drink from stagnant pools or ponds into which the drainage of houses, barns, stables or manure heaps finds it way. If there is one physiological fact connected with the propagation of disease better established than another, it is that impure water is the most active of all agents in disseminating infection, more particularly that of typhoid fever and that fearful scourge—Asiatic cholera—among the human race. Every case in which typhoid fever has appeared in England as an epidemic has been traced most unmistakably to the use of water contaminated with sewage matter. For a long time the reason of this alarming fact was shrouded in gloom and mystery—chemical analysis giving no indications by which wholesome water can be distinguished from that which contains a deadly poison; but after some delay, and much uncertainty and alarm, the improvements effected by modern science and skill in the construction of the microscope were brought to bear upon this inquiry, and it was soon conclusively proved that the deleterious quality was owing to the presence of certain living organisms of a low type which are developed in the sewage, and which, when taken into the stomach along with the water, increase and multiply at an astonishingly rapid rate, entering into the circulation and penetrating the tissues like the trichina of pork, and initiate, by the irritation they produce, the dreadful diseases I have mentioned.

Now, the same causes which operate so disastrously upon man, act in a similar manner upon his domesticated animals; for their bodies are constructed upon the same fundamental plan, and their functions are determined by the same general laws which regulate our own. At the late meeting of the Ontario Dairymen's Convention at Belleville, in March, 1872, I had the pleasure of hearing that eminent agricultural physiologist, Professor L. B. Arnold, of Ithaca, deliver a discourse on "The Handling of Milk," profusely illustrated by admirably executed diagrams, in which he cited an experiment by Professor Law, in which a fungoid form was traced from the water of a stagnant pool through the

cow into the milk, from which it passed into the cheese, and impregnated it with poisonous matter. It is also a known fact that both the milk and flesh of cows that are fed upon grass cut from meadows which are irrigated with liquid sewage become infested with an animal organism, either identical with, or closely resembling, the deadly trichina spiralis; and the milk-sellers of Edinburgh have in consequence discontinued the use of such fodder.

Time forbids me to give more instances in proof of this position, and I can only refer my hearers to the reports of the English Registrar-General and of the Royal Commission on the water supply of London; the evidence taken before the Sanitary Committee of Her Majesty's Privy Council on the occurrence of typhoid fever in the village of Terling and the town of Guildford; the valuable little work of Messrs. Wanklyn and Chapman, on "Water Analysis;" and the admirable tract by Professor Tyndall, on "Dust and Disease," in which works, especially in the last mentioned, they will find much useful information on this and many kindred subjects.

And here I would observe that every factory should be provided with a microscope of considerable power—one which would cost from $20 to $30—and a book of directions; and every operator ought to be instructed in its management, so that he may be able to recognize the presence of those deleterious organisms, whether vegetable or animal, which exercise an injurious influence upon the flavor, the texture and the wholesomeness of cheese. It has also occurred to me that an instrument may be constructed, at a very small cost, for the detection of any trick that may be played in skimming or watering milk before it is sent to the factories. It would be formed of two slips of common window-glass about ten or twelve inches long and three inches broad, set close together at one end, and kept apart at the other end by a third piece of glass or wood, an inch or one inch and a quarter wide. These pieces should be cemented together, and also to a bottom of wood or other convenient substance—the whole being made water-tight at the joints. One of the side slips should be graduated two and a half inches. The mode of using the instrument would be to fill it with the milk to be examined, and move it longitudinally before a lighted lamp or candle until the shape of the flame could be distinguished through the substance of the milk. With very little practice the operator would learn

which division of the scale would indicate average, honest milk, while the flame appearing more distinct towards the broader end would show that the milk had been tampered with.

With respect to winter feeding, as the operations of the factories are suspended during that season, I have only to remark, independent of the profit to be derived from the home manufacture of their milk, that cows which are well fed and comfortably housed during the cold weather of winter are much better prepared to yield a good profit during the ensuing season than those which are scantily fed and insufficiently protected from the vicissitudes of the season. In my mother's little establishment, her cows were always fed in winter upon the best quality of old meadow hay, along with which turnips were given; and many an hour I have spent, while yet a boy, with cold fingers and feet, sitting on the end of a board laid across a washtub, armed with a huge carving knife, cutting the turnips into thin slices to avoid the danger of choking, for agricultural machines were neither so common nor so cheap 50 years ago as they are at the present day. In addition to this fare, each cow had a mash of brewer's grains, mixed with a portion of wheat bran or shorts, and about a pint of crushed linseed cake or pea meal—the whole scalded with boiling water twice a day at milking time. And yet these cows craved for greater variety in their diet. I have known them to refuse their hay, and eat up every particle of their bed straw their chains would allow them to reach. Cows that are treated in this way are not only prepared to stand the transition from the dry food of winter to the succulent grass of spring without derangement, but if in calf are much less liable to abortion, which the change of food is apt to produce in cows that have been less kindly and less carefully treated. Very few cases of the kind ever occurred among my mother's cows. As brewers' grains can only be had in very few places, I may mention that chaff or fodder, cut fine, and mixed and scalded in the same manner, makes a very good substitute.

Before leaving this part of my subject I must put in a plea for gentleness in the treatment of cattle generally, and of milch cows in particular. As there is no animal which will make a better return for good treatment in respect of food and lodging, so there is none more sensitive to kindness, or the contrary, in the manner of those under whose care she is placed; and while she will resist and resent ill-usage

very strongly, I can testify from my own experience that she will be gentle, obedient, and even affectionate towards those who treat her with consistent and uniform kindness.

The flavor of cheese is a very important item in the determination of its market value, and may be affected by many other circumstances besides the management of the milk in the dairy or the factory. Of these I shall only notice the food of the cow. Cows that are soiled with cut grass, and those which are fed in well-fenced pastures, from which all noxious and ill-flavored weeds have been extirpated, are more likely to yield a uniformly good and sweet quality of milk than those which are suffered to roam the woods and commons. Many plants affect the taste of milk very powerfully when eaten by the cow. I have known instances where the whole milk of a dairy became totally unfit for several days for the manufacture of cheese or butter, because some of the cows had got access to beds of the wild garlic, or wild onion; and everyone knows the peculiar unpleasant taste which turnips impart to the milk and butter of the cows to which they are fed, unless the precaution is observed of putting a small piece of saltpetre into the pail into which they are milked. On the other hand, the delicate flavor of the celebrated Parmesan cheese is said to be owing to an admixture of the milk of goats which feed upon the wild thyme that grows profusely on the rocky ridges and slopes of the Apennines, on which they browse. In the north of England, and in Scotland, a very rich but strong-tasted cheese is made by mixing the milk of the ewe with that of the cow.

There is another substance contained in milk which I have not noticed yet, as it does not appear to enter into the composition of cheese or butter in any appreciable quantity. This is albumen, the most familiar example of which is the white of an egg. It is nearly similar to caseine in its chemical composition, but does not become solid under the same influences; it therefore passes off in the whey, from which it can be separated by raising the liquid to a scalding heat, when it coagulates and forms the famous curd, which, when strained out and eaten with cream and sugar, is accounted a great delicacy. The whey also carries off part of the butter and nearly all the milk-sugar. The butter can be recovered by agitation, and, though not so good as that which is obtained by churning the whole milk or cream, is useful for shortening and other domestic uses. The milk-sugar can also be

separated by evaporating the liquid that remains after the albumen and butter have been extracted, when it crystallizes out. If the whey is fed to hogs, they must be kept at some distance from the factory, so that the unsavoury smell of their ordure may not affect the milk, which is peculiarly susceptible of such influences.

It now remains for me to consider cheese in its economic relations. It is undoubtedly the cheapest article of diet we possess, affording a greater quantity of actual nutriment, for a given expenditure, than any other single food material. It contains, indeed, nearly all the substances that are required to support our bodies—nitrogen, to maintain the volume of the muscles and repair the constant waste of the tissues; carbon and hydrogen, to sustain the animal heat; lime and phosphoric acid—the constituents of bone; sulphur, to meet the demands of the scarf-skin, the hair and the nails; oxide of iron, to vivify the blood; phosphorus—the most active material stimulant of the brain and of the nervous system generally—that sensitive and delicate telegraph by which the impulses of volition are communicated to the organs of thought, of action, and of expression, through which the intellectual and spiritual part of our double nature sends forth its mysterious manifestations. It has, however, one defect and one deficiency—it is deficient in starch, which is much required in the process of respiration; and it presents its nutritive matter in such a highly concentrated form that only a small quantity of it can be digested or assimilated at one time. It therefore requires to be supplemented, and, as it were, diluted with some farinaceous food, which shall at once supply the substance in which it is deficient, and so increase its bulk as to distend the stomach sufficiently to enable it to act effectually upon the mass. It is therefore generally eaten along with bread, and "bread and cheese" are as inseparably united in our speech and in our stomachs as roast beef and plum-pudding, or pork and beans.

From its composition it will be aptly inferred that cheese is eminently fitted to sustain the muscular strength; and in this connection I may relate an anecdote communicated to me by a gentleman, long since deceased, who vouched for the circumstances having happened within his own knowledge:—

In the vicinity of the town of Bradford, in Yorkshire, there lived, some 70 years ago, a rather eccentric old gentleman, who farmed a small

estate of 150 or 200 acres, which had belonged to his family from time immemorial, and which he cultivated chiefly as a dairy farm. He kept lying in his barnyard a large kidney-shaped boulder stone, and it was his custom, whenever he hired a new farm-hand, to make the man try to lift this stone—a feat which very few were able to perform. At the end of his year's service he would make him try again, when, without exception, everyone lifted it with ease. The old man would then explain to them that this increase of power arose from the fact that cheese had formed a large portion of their diet, and would conclude with this advice:—"If you want to be able for your work, eat plenty of cheese."

I have not touched upon the application of the co-operative principle to the manufacture of butter, but I have no doubt that in this way may be made a very superior article to that generally produced on private farms; and if ever from over-competition, or any other cause, the cheese market should decline so as to make the manufacture unremunerative, it will be well to know that we have the manufacture of butter to fall back upon, and that we need not kill off our cows, or suffer our factories to go down, for want of occupation. The English market can absorb a vast quantity of first-class butter, but it would be of no use to send an inferior article thither.

I have now, Mr. President, to express my earnest wish and sincere hope that the movement in behalf of dairy husbandry which has been so auspiciously begun, and so successfully carried out so far, may go on and prosper, and that the manufacture of cheese on a large scale, for the English market, may form a permanent branch of our agricultural industry, and an enduring item in our country's prosperity. And I hold it to be by no means the least conclusive evidence of the great and growing importance of this branch of business to Canada, that our friends on the south of the great lakes acknowledge us as rivals, and begin to dread our competition in the markets of the world. Following the Utica *Herald's* report of the American Dairymen's Convention, held last month, I find that Mr. L. B. Arnold, in delivering the annual address, made the following pregnant statements and admissions. After stating that he did not apprehend much danger from the opposition of English or German cheese-makers, he went on to say:—"I anticipate that the shipping interest of the United States will meet with more formidable competition nearer home. I allude to our Canadian neighbors." He

then informs us that in the year preceding the abrogation of the reciprocity treaty in March, 1866, Canada imported from the States about 1,500,000 pounds of cheese, at a cost, in round numbers, of $200,000, adding that "the almost prohibitory tariff which was then laid upon that luxury compelled the Canadians to rely upon supplying themselves with their own make." He then traces the rapid progress of the cheese manufacture among us from 1866 to the present time, and estimates that during the year ending in June, 1873, our shipments will have taken the place of their exports to the extent of 20,000,000 pounds! and concludes this portion of his address in the following words:—"Whether this estimate is too large or too small, the fact must be apparent that Canadian cheese must, before very long, seriously affect our trade in the English market."

From these admissions I think we may fairly argue that if the dairymen of the United States, with all the advantages they enjoy; the prior possession of the market; their longer acquaintance with the apparatus and processes, and their more extensive experience in the manipulation of the manufacture; the energy they uniformly display in their business transactions, and the unlimited supply of capital they have at command to support their operations—if these men, I say, acknowledge their dread of our competition, it must indeed promise to be formidable. And with this assurance to encourage you, I am sure that your best endeavors will be exerted to convince them that their fears were not entertained in vain.

TRANSACTIONS

AT THE

SIXTH ANNUAL MEETING

OF THE

Canadian Dairymen's Association,

HELD AT THE

TOWN HALL, INGERSOLL, ONTARIO,

ON

WEDNESDAY AND THURSDAY, FEBRUARY 5th and 6th, 1873.

At half-past eleven o'clock on Wednesday morning the Convention was called to order by the President of the Association—Thomas Ballantyne, Esq.

On motion of B. Hopkins, the Chair was empowered to appoint the Standing Committees.

The following Committees were appointed by the Chair :—

Committee on Order of Business—C. E. Chadwick, G. Hamilton and W. Wilkinson.

Committee on Nominations—B. Hopkins, J. Noxon, W. S. Yates, H. Farrington and H. S. Losee.

Committee on Finance—E. J. Hickson, D. Phelan and W. Allison.

On motion, the Convention adjourned to meet at 1:30 p. m.

AFTERNOON SESSION.

The Convention was called to order at half-past one o'clock—the President, Thomas Ballantyne, Esq., in the Chair.

The Committee on Order of Business made the following as their first report :—

1st—President's Address.

2nd—Prof. Bell's Address.

3rd—Discussion on Marketing Cheese.

4th—Discussion on Floating Curds.

After adjournment, the Annual Address by X. A. Willard, Esq.

On motion, the report was adopted.

ADDRESS OF THE PRESIDENT.

He had prepared no formal address. This was the less necessary, when we consider the large and efficient staff of lecturers whose services had been secured to address the Convention. He congratulated them on the success that had attended the dairy interests throughout the Province of Ontario, which was so manifest in the increased quantity and improved quality of dairy products. That the dairy and farming interests have thus been placed on such a firm basis must be highly satisfactory to all engaged in them. There can be no doubt but this Association, by the important and varied information which it has disseminated through the country, has largely contributed towards the accomplishment of these desirable results. Since the organization of the Association it had passed through many trials and difficulties, which, he was happy to say, had in the most part been surmounted. He would briefly refer to the steps taken to obtain an act of incorporation.

Messrs. Noxon and Janes, who had been appointed by the Executive to act in the matter, found that the Association at Belleville, representing the eastern section of the Province, which in the meantime had been organized, was recognized by the Government, who were unwilling to recognize two Associations, and recommended that some arrangements should be effected between the eastern and western Associations towards an amalgamation.

A basis of agreement was drawn up and signed, subject to the approval or disapproval of the Executive—the main features of which

were that every third meeting of the Association be held at Belleville, and a cheese fair alternately at each place.

From representations made to the Government by the eastern Association—as though the union was complete—the basis of which, however, our Executive refused to confirm, they received a grant of $500, which had been devoted to the giving of prizes at a cheese fair.

The Government is fully alive to the importance of the Association, and he trusted that some arrangements would be effected which would reconcile satisfactorily all sectional interests, and that the appropriations which the Government is willing to make to us, in common with other agricultural institutions, may be applied for the advancement of the interests of the Association.

A question drawer will be furnished, which will afford anyone an opportunity of asking such questions as may be thought desirable. The questions are to be made in writing; will be collected from the audience; read in your hearing, and answered by those qualified to do so.

We have had more than the usual quantity of sultry weather the past season, in which milk is liable to taint, and as a consequence we have been troubled with more than the usual quantity of floating curds. On this important subject of tainted milk, Prof. Caldwell, of Cornell University, will address you.

The President then introduced Prof. Bell, of Albert College, who addressed the Convention on the chemical composition of milk and cheese, causes of floating curds, pasture suited for dairy stock, &c. (The address will be found in full, beginning on page 51.)

MARKETING CHEESE.

The President said this was an important matter, and not well understood. Our neighbors on the other side understand this question much better than we do. During the hot season cheese does not retain its keeping qualities. Frequent shipments were therefore necessary. Sales should be made weekly or fortnightly. It would be a great advantage to have some one appointed by the factory committee to make sales, as it was almost impossible for buyers to get large committees together. The time thus required was a serious loss. He would call upon Mr. Casswell to open the discussion.

Mr. Casswell said there was no greater mistake made in Canada than that of marketing cheese. All over the country there were instances of losses sustained by refusing good offers. There were a few instances, no doubt, in which the proper course was taken, and sales made once a month; and by comparing their reports with those who have kept their cheese they would be found most successful and most satisfactory to their patrons. It is a certain fact, admitted by all who have opportunities of judging, that American cheese is better flavored than ours, because ours is over-kept. They send theirs to market early. It has been argued at this Convention that we could raise the price of cheese by keeping it. Many factories paid bitterly for it this season. By keeping, it was exposed to accidents, fire, &c., and many had been frozen. He was very glad prices had gone up; but they might depend upon it that Canadian cheese would not be on a par with American cheese unless they got it in the market early. It used to be said the English taste required a strong cheese. It was not the case now. They like a mild, clear-flavored, flaky cheese, He advocated monthly sales, and, in large factories, fortnightly. He knew some factories where an average of 11⅞c. had been realized when sales were made monthly and fortnightly. This must be very satisfactory to their patrons, who receive their money every month. There was another reason for making early sales that must not be lost sight of—not only is the quality of the cheese better, but, by getting in the market early, you encourage consumption, because it is in a state fit to be eaten. He hoped the patrons would urge the factorymen to make early sales. Some may think we urge this that buyers may make a very large profit. This was not the case. We do not want to make a large profit. He agreed with Mr. Ballantyne with regard to one man being appointed to make sales. It was a great annoyance and loss of time to buyers to have to hunt up the committee before a sale could be made. He again reminded them of the large amount that was injured by over-keeping. This over-kept stuff was called Canadian cheese. He knew of lots made at the same time of the year that had deteriorated in value to a large amount. He was satisfied that if the course recommended was pursued, from its improved quality, our Canadian cheese would have a different name.

Mr. Burrell, of Little Falls, N. Y., as one having large experience

in the matter, was called upon. He said his being called upon to speak upon this subject was quite unexpected. He was sure that they (the Canadians) understood it quite thoroughly. He would only tell them what was their (the Americans) experience in marketing cheese. On the 1st of June the patrons of factories held a meeting and appointed a committee of three, who should be salesmen. This committee appointed one of their number as salesman. The committee meet the buyers on a regular sales' day, which, with them, was Monday, at a certain established cheese market. The sales' committee of some large factories met every week to consider prices, &c. They (the Americans) claimed that by marketing early the cheese arrived in England with better flavor and richer in quality. Frequent sales, therefore, was their practice—generally when the cheese was from 30, 35 and 40 days old. If kept longer it would deteriorate in quality before it reached England. Their experience was that, taking into consideration shrinkage, interest on the money, labor and insurance, a saving of ten per cent was effected by making frequent sales. This was the opinion of some of the best factorymen.

Mr. Casswell asked whether spring cheese was not frequently forwarded when 20 days old, and high prices obtained in the London market.

Mr. Burrell said that was the case; if kept longer it was liable to go off flavor.

On being asked what was their custom at cheese fairs, Mr. Burrell said they had weekly market days at Little Falls. The buyers visit the factories during the week, examine the cheese on the shelves, make memoranda, and are prepared to make an offer for such and such lots on market day. Occasionally a factory will bring a load of cheese, selecting two or three from each lot as samples. Salesmen sometimes come from long distances—as far as Alleghany County—bringing samples in glass bottles—being careful not to allow them to become heated in their pockets. These samples are guaranteed, sales are made, and when the cheese arrives in New York they are examined, re-boxed, and fitted up for shipment. Should bad ones be found, or inferior qualities as compared with the samples or lots examined, a reduction is made, the amount of which is determined by a board of arbitration. If you should go to the factories and try to buy, they would very likely ask

one or two cents more than the market price. You cannot buy a pound on the shelves. Large quantities, however, change hands on the market days. He had known as many as 18,000 boxes to be sold in one day.

The President said it would be a great improvement if that mode of marketing cheese was introduced into Canada.

Mr. Farrington thought this subject was very far from being exhausted. He did not differ very much from the views expressed by his friends, Messrs. Burrell and Casswell, although he took exception to some. He was reminded of a certain time when he brought early apples to Ingersoll, expecting to obtain a high price. He was greatly disappointed and brought them home again. From observations extending over a good many years he was was satisfied that all the cheese could not be consumed thus early, and, therefore, anything like remunerative prices could not be obtained. When there was enough in New York to supply the demand, where could we dispose of it? There were times when, for two or three weeks, he could not get an offer for his cheese. It was well known that June produced more cheese than any other month in the year, and that the consumption is the smallest just when this comes into market. At the same time, hundreds of thousands of boxes of New York cheese were being shipped or awaiting shipment, seeking a market in England. Our cheese all this season had been sent into the market to compete with cheese a month younger. We wanted a market independent of New York, by which we could send our cheese straight along to England. New York knows enough to take care of herself, and Canada must know enough to take care of herself. What must we do, then, in view of all the circumstances? We must take measures to work off our cheese. Prices were often fictitious, and buyers were ever bunting their heads together. He did not blame factorymen for asking a good price—it was their duty to ask enough. We, as factorymen, do not know what the private advices of buyers are. Private advices are supposed to be reliable. Let us make a cheese fit for the market when 30 days old, if the market is ready for it, or a cheese that would keep three or six months, if necessary. Cheese could be made in May that would carry through the season without any bad flavor, providing the elements were right. Of course, we all understand that the English market likes a young cheese. Let us give them all the

young cheese they want; but it is our duty to make a cheese that will keep. If made right, it will keep six or eight months.

Mr. Casswell was afraid Mr. Farrington's remarks would leave a wrong impression on the minds of those present. Because he kept his cheese, others, to their injury and to the injury of the dairy interests of the country, would keep theirs. He denied the correctness of Mr. Farrington's statements with reference to fictitious prices and the lack of buyers to take the cheese at any price. At the time referred to he (Mr. Casswell) had offered and paid 13c. a pound, and could afford to do it. It was folly to think of dictating terms to New York. She would continue to dictate terms to Canada in this respect. Factorymen knew through the public prints what prices were as well as the buyers. He again referred to the immense quantities that were injured by over-keeping, and urged upon dairymen the importance of getting their cheese in the market before it acquired an off-flavor, or was injured by the frost. An undue preference was sometimes shown for New York buyers. The dollar of an Ingersoll man was as good as the dollar of a New York man.

Mr. Farrington asked Mr. Burrell whether, in his opinion, if the cheese was generally shipped when from 30 to 40 days old, it could be consumed.

Mr. Burrell said it was a well-known fact that American cheese cured more rapidly than the English, could be forwarded sufficiently early to be ahead of it, and supplied as cheaply, if not more so, and thus to some extent take the place of it. They found it to their advantage to make early and frequent sales.

Prof. Bell, on being asked at what stage of development he thought cheese capable of imparting the greatest amount of nourishment, said that no doubt would depend considerably on the character of the cheese, season, &c. If kept much longer than when it was ripe, he thought it would, without doubt, deteriorate.

Mr. Burrell said he had simply stated what he had found to be the best practice for them at Little Falls; he could not say it was best for Canadians.

Mr. Farrington remarked that he did not get a direct answer from Mr. Burrell to his question. Mr. Burrell said they sent their cheese forward when it was fit for the table; it encouraged consump-

tion. He was confident its consumption had increased more than double, not only in cheese-producing localities—as Herkimer, for instance—but also where no cheese is produced. He believed it would be consumed. They would eat the cheese if they could get it.

Mr. Chadwick thought the question had been pretty well discussed, and had brought out a great deal of useful information, which would, he was satisfied, lead to important results. He then moved, seconded by Mr. Farrington, that a committee be appointed to take into consideration and report upon the best method of marketing cheese, the propriety of establishing weekly or periodical cheese markets in certain localities, &c.

The following gentlemen were then appointed such committee :—Messrs. Allison, Hamilton, Phelan, Farrington and Hopkins.

At the urgent request of several delegates, Mr. Hopkins came forward and gave their experience, in connection with the Brownsville factory, on marketing cheese. He said he had been connected with that factory since 1867, and had more or less to do with the sales that had been made. Their experience was that monthly, or, if possible, fortnightly, sales were most advantageous. They had made 263⅞ tons, and their prices ranged from 9c. to 11⅞c. Their average of milk per pound of cheese was nine and ninetty-three one hundredths.

On motion, the question was then laid on the table.

FLOATING CURDS.

Mr. James, of Belmont, was called upon to open the discussion. He thought floating curds might be avoided, even in bad seasons, if patrons would take extra care. When they occurred, he increased the temperature, added more acid, and an extra amount of salt. He preferred also to grind the curds. By these means he was enabled to obtain marketable cheese. On being questioned as to what he thought was the cause of floating curds, Mr. James said there were many things that would cause it—such as extremely hot weather, cows being allowed to drink stagnant water, and uncleanliness with regard to cans and pails. He made twice a day from the middle of May to the middle of September. He did not think a fine cheese could be made from floating curds, although a fair one could.

On motion of Mr. Hamilton, the President addressed the meeting

on floating curds. He did not know whether he had any more experience than others. He had visited a great many factories during the past season, and had opportunities of examining large quantities of cheese. There had been an unusual quantity of cheese manufactured from tainted milk this season, which to some extent was the result of the unusual amount of sultry weather. The more unfavorable the weather, the more care was required of those having the care of cows and the handling of the milk. He believed if factorymen were more particular with their patrons—if they would frequently examine the milk supplied by them, and refuse any that exhibited the least signs of neglect—the instances of floating curds would be few and far between. He had no cure for it but that of saving some of the milk from each can, and subjecting it to a close criticism. They had far less trouble with floating curds since they adopted that course.

Prof. Bell agreed that want of perfect cleanliness was the principal cause. If factorymen were more anxious to receive the milk in proper condition than to increase the quantity, less difficulty would be experienced in this respect. The opposite course, too often pursued, was contrary to all principles of science.

Mr. Webb said a circumstance occurred in connection with their factory which proved conclusively the deleterious influence of stagnant water coming in contact with cows, although not taken in their stomachs. In passing to and from the pasture, some cows, whose milk they received, were accustomed to walk in a ditch, which, on the recurrence of rain, would partly fill with water, by which their legs and udders would become soiled. It was found that the vat supplied with milk from those cows would have floating curds whenever stagnant water was in the ditch through which they walked, but would cease when the water dried up.

Mr. Rymph declared he had never seen a floating curd, although he made cheese from 150 cows that had access to as bad water as he ever saw.

A delegate asked how far this milk was drawn.

Mr. Rymph—The farthest, half a mile.

Mr. Farrington—That explains the mystery.

Mr. Clarke said that during the season his cheese-maker called his attention to the floating curds. He took the report of last year's

convention, from which he ascertained the several causes there mentioned. The one he thought the most likely to have caused their trouble was fast driving of the cows. When that fault was corrected the floating curds stopped.

Mr. Farrington wished to remove a wrong idea which they might entertain in regard to his doctrine of keeping cheese. He did not advocate keeping it if it could be marketed and consumed. There was a great deal delayed on the way, and injured, for want of better facilities for transportation.

The President said that Mr. Farrington was so generally correct in his views that he did not wish to contradict him, but he could not agree with all he had said on this subject. We could not expect to get New York prices. The distance for transportation from Canada was against us. It was not necessary to send by way of New York. Our proper route was by way of the St. Lawrence. More attention was being paid by the Grand Trunk officials in the matter of transportation, and there would also be steamship accommodation. He agreed with the statement made with reference to increased consumption, which in England was much larger in summer than in winter. His experience and observation on this subject left no room to doubt but that early and frequent sales would be more successful and satisfactory.

Mr. Webb, of Ridgetown, said the character of Canadian cheese in England was very satisfactory. With reference to lots that he had shipped, he had received word back that they were pronounced first-class.

Mr. Chadwick presented the second report of the Committee on Order of Business, as follows :—

To the President of the Canadian Dairymen's Association:

Your Committee on Order of Business beg to present this their second report :—

That this Convention, on adjourning, do stand adjourned till to-morrow morning at nine o'clock, and upon assembling the first order of the day be the reception of reports of committees, after which the Hon. George Brown will deliver an address upon "Soiling." Prof. Caldwell, of Cornell University, will then deliver an address upon "Tainted Milk."

Your committee would recommend that the Chair do appoint a committee to confer with the Executive of the Association upon the subject of an Act of Incorporation of the Association.

Your committee also recommend that questions for the question

drawer be received up to adjournment for dinner, and that after the recess for dinner the answering of such questions be taken up; and also that the ordinary routine business of the Association be gone into, after the disposition of which the questions of the day be taken up and discussed till the final adjournment.

All of which is respectfully submitted.

C. E. CHADWICK, Chairman.

Ingersoll, Feb. 5, 1873.

The report having been adopted, the Convention adjourned.

The Annual Address by Mr. Willard (which will be found in full, commencing on page 17) was delivered in the evening at the Town Hall, which was literally packed with attentive listeners.

At the conclusion of this excellent address a hearty vote of thanks was given to Messrs. Willard and Prof. Bell.

SECOND DAY—MORNING SESSION.

The Convention met on Thursday morning at nine o'clock—the President in the Chair.

The Committee on Marketing Cheese presented the following report:—

To the President of the Canadian Dairymen's Association:

Your committee appointed to consider the subject of Marketing Cheese beg to report that after much consideration we would recommend—

1st. That factorymen appoint a committee of not more than three to market the cheese of the factory, and that they authorize some one of their number to make sales at prices they may from time to time agree upon.

2nd. That a regular cheese market be established at important dairy centres, to be held on a certain day of the week, semi-monthly, or oftener, as may be necessary.

3rd. That dairy markets for the present be established at Belleville, Stratford and Ingersoll, on such days of the week as the Executive may decide.

4th. That the Executive be instructed to give all necessary assistance in establishing such market.

All of which is respectfully submitted.

GEORGE HAMILTON, Chairman.

Ingersoll, Feb. 6, 1873.

Moved by Mr. Hamilton, seconded by Mr. Caswell, that the report be adopted.

A delegate from north of Woodstock thought that place ought to be a cheese market.

Mr. Casswell said it would not do to establish too many at first, or the object would be defeated. If Woodstock was selected, for a stronger reason London, St. Thomas, and other places, would have to be selected. He hoped they would not select any more than three at first. Business men would go much greater distances.

Mr. Burrell's opinion was requested. He stated that in Central New York cheese markets were not nearer than from 25 to 30 miles of each other. The greater the distance apart, the larger the number of buyers who would attend them. If buyers could meet factorymen all in one place it would be all the better. He said in their locality attempts to fix cheese markets 10 miles apart had signally failed.

The report was adopted.

The Committee on Nominations submitted the following report :—

To the President of the Canadian Dairymen's Association :

Your Committee on Nomination of Officers beg to report, recommending the election of the following members as officers for the present year :—

President—Thomas Ballantyne.
Vice-President—Benjamin Hopkins.
Secretary—J. C. Hegler.
Treasurer—C. E. Chadwick.

And would further recommend that the following members, with the officers, form the Executive of the Association :—

James Noxon, C. E. Chadwick, E. Casswell, A. Oliver, M. P. P., George Hamilton, W. S. Yates, H. Ostrom, H. Farrington and Daniel Vandewatter.

All of which is respectfully submitted.

BENJ. HOPKINS, Chairman.

Ingersoll, Feb. 6, 1873.

The report was adopted, and the gentlemen named therein were declared the officers of the Association for the ensuing year.

The committee appointed to confer with the Executive on the subject of Incorporation submitted the following report as the basis of an Act of Incorporation :—

To the President of the Canadian Dairymen's Association :

Your committee appointed to confer with the Executive on the subject of Incorporation beg respectfully to report, recommending the following as the basis of an Act Incorporating the Association :—

That the name of the Association shall be the Canadian Dairymen's Association. The management to be under a Board of nine Directors. The officers to be a President, Vice-President, Treasurer and Secretary, elected annually by the Directors; and the President, Vice-President and Treasurer to be from their own number. The Directors to hold office for three years—three retiring annually, and their places to be filled by open vote at the regular annual meetings of the Association. The Provisional Directors to be K. Graham, M. P. P., W. S. Yates, Dr. Coleman, Adam Oliver, M. P. P., Benjamin Hopkins, Jas. Noxon, Thos. Ballantyne, C. E. Chadwick and E. Casswell, and to hold office until their successors are appointed. The Directors to retire in the order in which they are named. The Association to hold a general annual meeting in each year, said meetings to be held two years in succession at Ingersoll, and every third year at Belleville. The annual meeting of 1874 to be held at Belleville, and the two following annual meetings at Ingersoll. The time of holding the annual meeting to be fixed by the by-laws of the Association; and that it shall have the power at its annual meeting to pass such by-laws and rules and regulations as may be expedient for the management of its affairs, they not being inconsistent with the Act of Incorporation. Money granted by the Government to be applied to the collection and dissemination of practical and scientific knowledge relating to the products of the dairy. The President of the Association, for the time being, to be a member of the Board of Agriculture.

All of which is respectfully submitted.

JAMES NOXON, Chairman.

Ingersoll, Feb. 6, 1873.

On the report being read, Mr. Hamilton moved that it be adopted.

Mr. Yates wished to say that with reference to the proposed basis of amalgamation to obtain an Act of Incorporation he dissented, on the part of Belleville, with regard to the number of directors appointed, and the manner in which they retire.

Mr. Oliver, M. P. P., said he thought it would be exceedingly unwise to hurry this report through. It was a very important one, and he trusted that they would be able to make it agreeable and acceptable to our Belleville friends without sacrificing large interests of this part of the country. The Minister of Agriculture, he knew, was very desirous that a fair understanding between the east and the west should be effected, and that they work harmoniously together. We ought to study the interest of the east as well as the west, he thought, and this, he believed, had been done; and he also believed that they will, after due reflection, accede to the proposed basis. It is generally admitted

that where there is one cheese made in the eastern section there are five made in the west; and he thought by giving Belleville one-third of the management of the Association it was all they could reasonably expect. If at a subsequent period they should exceed us in the manufacture, grant them a corresponding proportion of the management. If there could be no satisfactory union concluded, from what he knew he believed the Minister of Agriculture could be prevailed upon to recognize two Associations, with Toronto as the dividing line, subsidizing each in proportion to the number of pounds of cheese manufactured in each section; but he thought no means should be left untried to accomplish a satisfactory amalgamation. Our Belleville friends, he thought, would see the advantage of possessing one-third of the finance and management rather than one-fifth, which would probably be the case if two Associations were formed. He again expressed a hope that such measures would be adopted as would result in making but one entire national institution.

Mr. Yates called upon Prof. Bell, who, as the exponent of the views of Belleville, stated the reasons for dissenting from the report of the basis of amalgamation. He said that while they were anxious to amalgamate, and acknowledged the superiority of the west over the east, they could not accept a basis so one-sided. They thought the proportion of directors should be four to five instead of three to six, though he did not apprehend that the interests of the two sections would be likely to clash. Then, with respect to the retiring of the members, you will observe that the three first-named are all from the eastern section, and would all retire next year.

Mr. Chadwick—They would be eligible for re-election.

Prof. Bell said they thought one should retire from each section annually. These were the principal points of difference. While they would disclaim all sectional feeling, they could not altogether avoid taking a certain sectional view.

Mr. Farrington was pleased with the remarks of Prof. Bell on this subject. He (Mr. Farrington) thought the proportion of directors proposed by Prof. Bell might be accepted by us, as the east would always be in a small minority. That principle was recognized by the United States in choosing their Senators. The small States were not willing to allow the larger ones the number of Senators proportional

with their population, &c., fearing that they would be completely swallowed up by them.

Mr. Noxon said, as chairman of that committee, he would explain on what grounds the committee fixed upon the basis embodied in the report. After due consideration it was agreed that one-third of the financial aid from the Government would be a fair proportion. This, then, being agreed to and decided upon, he thought there could be no reasonable ground of complaint in maintaining the same proportion in reference to the number of directors. Then, in regard to the retiring directors, it was so arranged that they of the east might have the privilege of electing those of their choice at the next annual meeting of the Association at Belleville, as those from the western section would at the two following meetings at Ingersoll. He did not see as anything could be more reasonable and just. There was no argument to show that the proportion should be different. He hoped we would enter into this important undertaking in the proper spirit. If we become incorporated the Government will give a reasonable amount of assistance, and we will be able to extend our operations and influence. There should be no misunderstanding between the east and the west. If jealousy existed—a fear that the majority of the west would be in opposition to the interests of the east—it would be better that no amalgamation took place at all.

Prof. Bell said there was one point to which he would advert, and that was the idea broached of want of confidence. He deprecated that idea. They fully conceded the superiority of the west, but at the same time thought that five to four was a sufficient majority. Perhaps the feeling was somewhat sentimental, their pride being a little wounded by being placed in such a small minority; but there was no want of confidence in the good faith of the gentlemen of this Association.

Mr. Farrington said it was contrary to all usage for man to have any confidence in man, except what could not be fixed by law. He recommended that the report be amended, granting the east four directors to our five.

Prof. Bell agreed to this. If there was any want of confidence, let it be on their own side, so that if there was any future dissatisfaction, the responsibility would rest upon their own shoulders.

Mr. Chadwick had no desire to prolong the discussion further than

was necessary. He thought there had been large concessions made to the east in the proposed basis. Reference had been made to feelings of a small sentimental character. Our feelings were as much entitled to consideration as those of our eastern friends. He thought the proposed basis was one on which we could readily agree as being just and fair. In justice to ourselves, he thought, we should take the stand and claim the position we were plainly entitled to.

On motion of Mr. Yates, referring the report back to the committee to be amended, it was lost, and the report adopted.

Prof. Caldwell then delivered an address on "Tainted Milk," which will be found elsewhere. The lecture was listened to with great interest, and at its conclusion a hearty vote of thanks was given the Professor for his excellent address.

The Convention then adjourned till 1:30 p. m.

AFTERNOON SESSION.

The President called the meeting to order at half-past one o'clock, and stated that the next question for discussion was

THE BEST PASTURE FOR DAIRY STOCK.

Mr. Farrington was called upon to open the discussion. He said that all he could say on this question would be to give his experience and observation. Herkimer County, N. Y., was his birthplace, and his place of residence for the greater part of his life, until nine years ago, when he came to Canada. When a boy he frequently heard it said that Herkimer was the best grazing county. As he grew up he went into the business of cheese-making, and pretty soon into cheese-buying, in which he was engaged in Herkimer for perhaps 12 years. He soon observed a marked difference in Ohio cheese and that made in Herkimer. He had yet to see as good cheese made in Ohio as is manufactured in Herkimer. He afterwards visited the dairy districts of Ohio, and observed, instead of the green, fresh-looking white clover, a kind of dried up spear-grass as red as a fox's back, and very little white clover. On visiting the factories, and examining the cheese, he found it nothing like that made in Herkimer. He then understood that it was the white clover which abounds more in Herkimer than any

other county he ever visited, which caused the cheese to be of a superior quality. He was satisfied that white clover produced the best cheese. It was far better than red clover for dairy stock. Its growth might be greatly increased by a free application of plaster, a great deal of which, a few years ago, was used in Herkimer. They used to lay in a good stock of plaster in the spring.

Mr. Burrell was asked if they still used plaster freely in Herkimer. He replied that they did.

Mr. Butler, being called upon, said what he knew about it was this. In order to have a good growth of any kind of grass, underdraining must be attended to, so that the cold water might be kept off, allowing the roots to penetrate to a sufficient depth. He liked timothy and red clover, especially for meadows; but it was of the greatest importance to underdrain the land, and then use all the manure you can get. Alsike clover was a good kind. As a supply of feed, when pasture was low, he would sow our early corn and the Western.

Mr. Warren Harris said he listened with interest to this discussion on the best pasture for dairy stock. Some of those present knew that he was an old dairyman. He wished especially to endorse the sentiments of the first speaker in regard to the value of white clover. During one severe winter he lost 17 head of fine cattle by feeding what was called Indian grass. They were well taken care of in other respects. It seemed to be deficient in blood-producing ingredients. White clover, no doubt, was the best grass for cows. He had no experience with Alsike clover.

On motion, the question was laid on the table.

THE PACKING AND EXPORTATION OF BUTTER.

Mr. Casswell called upon Mr. Webb, a gentleman who had considerable experience in dairy matters on the continent of Europe, especially as a dealer in butter. Mr. Webb said that in Sweden, and other countries of the Baltic, they had large creameries for the manufacture of butter, which, they found, paid them better than cheese. The product of those creameries brought the highest price in the markets. Prices, of course, varied according to the season, &c. Then, they had what was called farmers' butter, which corresponded with our Canadian

make. It is not usually packed by the farmers, but by men who make butter-packing a business. They turn out an excellent quality of butter. In the British market the principal opposition to Canadian butter was that from Russia and Finland. Canadian butter generally had to be re-packed. They could get about 30 shillings more for it by putting it through the process of re-packing. When Kiel butter would average 130 shillings, and Normandy 140, Canadian butter would bring but 80 shillings.

Mr. Casswell said that Brockville stood well in England in the character of her butter. She was ahead of us. We lost from four to ten cents a pound on our butter. We had the land to produce it, and the women to make it, yet we lost millions of dollars because of improper handling. He lost between $5,000 and $7,000 in one month's operations. It was a great pity—a great calamity—that such vast sources of wealth should be destroyed by mismanagement. There should be a cash basis for butter the same as cheese. The way dry goods men handle it—throwing all kinds together in a mass, good, bad and indifferent, and often all sold at the same price—was the reason why no better prices were obtained, and there was no encouragement to first-class makers. So long as this system was continued, so long would Canadian butter be a nuisance in the British market. If our best butter was properly packed and sent to market it would command a good price. Mr. John White was the most successful packer he knew. Inspectors were also required.

Mr. Vandewatter said there had been inspectors appointed in some localities, and he believed the quality of the butter had very much improved. Our butter was over-salted and injured by the use of poor salt. As long as Canadians will use coarse salt, and be so careless in the handling, we will see but little good butter. He believed that by proper management the quality of Canadian butter might be raised 100 per cent.

Mr. Morrison said that in the vicinity of Brockville many of his acquaintances thought that cheese at 10 cents paid better than butter at 20 cents. He saw no reason why this locality should not produce as good, if not better, butter than they. Perhaps one reason was because the western men left their women to do all the work of milking, churning, &c. He had heard it said that the Scotch and Irish were

harder on their wives than other classes. Down with them, most every farmer has a thermometer, and churning machines, &c.—facilities for lessening the labor, and also for doing the work efficiently. They pack in 100-pound packages, adding a little saltpetre. They fill within an inch or two, and put a piece of thin cloth on the top of the butter. When it is examined you do not have to scrape away an inch or two of salt to get to the butter. Some do not approve of the inspectors very much. For the last 10 years the average price was from 16 to 20 cents.

The Chairman remarked that butter-making about Brockville was a speciality, and its sale conducted on business principles.

Mr. Farrington said they had heard stated many good things on this subject. He would like to impress on the mind of every woman who has the care of milk, and the manufacture of butter, the importance of keeping their milk cellars clean and sweet, as well as using the utmost care in its management.

QUESTION DRAWER.

The questions were now collected, read and answered.

Question.—Does Mr. James grind his curds before or after salting? Answer.—Before salting.

Ques.—How will tainted milk, when put into the testing cups, show itself? Ans.—By the Chairman—By the taste and smell.

Ques.—What is the best method or arrangement for curing cheese?

Mr. James Harris was requested to answer this question by giving his method of heating and ventilating his curing rooms. He said they had a stove, or furnace, enclosed in a tight chamber beneath the factory, with an arrangement for admitting the cool air below, in contact with the stove. To save wood, and increase the heat, they had four drums on the stove, in the hot air chamber. By this arrangement there was a great saving of wood, and there was obtained an excellent ventilation and even temperature in all parts of the factory, the size of which was 30 feet wide and 70 feet long, and three stories high—yet the one fire was sufficient to cure on the three flats. The cost of the whole apparatus would not exceed $60 or $70.

Ques.—What kind of potash is used to dissolve annattoine?

Mr. Burrell said it required potash made from hard-wood ashes. A great deal of the potash we buy is nothing more than caustic soda.

Ques.—How is annattoine produced or made?

Mr. Burrell said it was the product of a tree that grows in Brazil, the berries of which are about the size of a horse chestnut, in which there are 20 or 30 seeds, surrounded by a pulp. This pulp, which dries on the seeds, is annattoine. When the shell bursts open, the seeds are taken out and soaked in cold water, when the pulp comes off in the shape of a fine powder. One pound would cover 1,000 pounds of cheese.

Mr. Farrington said he had tried annattoine for three years, had made careful experiments with different preparations for coloring cheese, and he was satisfied that annattoine was the best. He had a certificate from Prof. Caldwell that it was free from impurities. He could recommend it with confidence.

Ques.—How should a floating curd be treated?

Mr. Lossee—By adding more acid and salt. When you have a curd mill, he would prefer grinding the curds. Give it all the air you can, and let it lie in the sink longer.

Ques.—What is the best way to tell when to dip the curd?

Ans.—By trying with a hot iron—if it comes off in fine, hair-like threads, it may be dipped.

Mr. Galliver said he did not see that there was hardly any reason for having floating curds. If he saw he was likely to have a floating curd he would hurry it off as soon as possible, and not give it time to float.

Ques.—Is Goderich salt equal to any other kind?

Mr. Farrington said he found Goderich salt good for curing purposes, and he thought home products should be patronized, if found good.

Mr. Casswell thought there was a preference for Liverpool. It had maintained its good character for a long time. Last year, however, there was not so much imported.

Mr. Lossee had not used Goderich salt for two years. Previously, however, he had used some of it, but it had necessitated the trouble of drying, as much of it was very wet.

The Chairman said he understood they were manufacturing a very superior article of salt in Clinton, especially designed for dairy purposes.

Ques.--What are the advantages of the gang press?

Mr. Burrell said the gang press was a horizontal one, pressing 15 or 16 cheeses at one time, saving much time and labor, and secured a greater equality in the pressure.

Moved by Mr. Hamilton, seconded by Mr. Chadwick, that a committee of three, consisting of Messrs. Ballantyne, Noxon and Phelan, be appointed to take a note of any changes or improvements in the manufacture of cheese which would be beneficial to dairymen, and report the same to the next meeting of the Association. Carried.

The Finance Committee then presented their report, as follows:—

To the President of the Canadian Dairymen's Association:

Your Finance Committee beg to report that they have examined the Treasurer's books, and find the receipts and expenditures to be as follows:—

RECEIPTS.

To balance in Treasurer's hands from last year		$161 98
Cash received at Convention		304 20
Cash borrowed		50 00
Cash from members		2 00
Total		$518 18

DISBURSEMENTS.

By publishing reports	$171 25	
Prizes at fair, on cheese	25 00	
Addresses last year	125 00	
Secretary's salary for 1871	100 00	
Other expenses	82 80	
	$504 05	
Balance on hand		$14 13

DANIEL PHELAN, Chairman.

Ingersoll, Feb. 6, 1873.

The President, thanking the members present for their attendance and attention, declared the meeting adjourned till next year.

AN ADDRESS,

DELIVERED BEFORE THE CANADIAN DAIRYMEN'S ASSOCIATION, AT INGERSOLL, CANADA,

FEBRUARY 6, 1873,

BY

PROFESSOR G. C. CALDWELL,

Of Cornell University, Ithaca, N. Y.

Only a few weeks ago I was invited by your Executive Committee to deliver an address before this meeting on "Tainted Milk." It seems, as I said in my reply to your secretary, as if all there is to be be said on this subject has been said, and that it has been so frequently spoken about, and so fully treated at dairymen's conventions in the course of the last few years, that even hardly a new way can be left to say what is old concerning the matter. Everybody knows that there is no necessary reason why there should be such a thing as tainted milk to annoy and worry the dairyman. Putrefying milk, and bad butter and poor cheeses, or cheese so very bad as to make those who partake of them almost sick, are the results of bad management somewhere. Such bad management may be the consequence of ignorance; but in these enlightened times, when good agricultural papers cost so little that they are within the reach of every man who can own a few cows; when dairymen's associations are everywhere formed, and the reports of their conventions, full of matter of great value to every dairyman, are distributed by thousands all over the country every year; when such comprehensive works as that of Mr. Willard on "Practical Dairy

Husbandry" are issued from the press—ignorance is but a lame excuse for bad management. The folly of ignorance, under such circumstances, is hardly less than that of the man who, though possessing sound eyes and a sound mind, should grope about with eyes closed, stumbling over every obstacle in his path.

The unquestioned importance of the matter, however, as shown by this very fact that there has scarcely been a meeting of dairymen lately where it has not been brought up for discussion, may justify the wisdom of your Executive Committee in indicating it for the subject of my address. But if I shall be so unfortunate as to tell you nothing new, or to present nothing to you in a new light, I shall not be so much surprised as you may be disappointed.

Milk is composed mainly, as all of you know, of water, butter and cheesy matter. The cheesy matter is more appropriately known to all dairymen as caseine, and it is distinguished for the complexity of its composition and the readiness with which it passes, apparently spontaneously, into a state of decomposition, the final products of which are very offensive, at least to all delicate noses. Besides these three substances, milk contains a small proportion of a certain kind of sugar and a very small proportion of matter, which, unlike the caseine, fat or sugar, remains behind, when the milk is heated, till all the water is driven off, and then still further heated until completely burned up. This is sometimes called the salts of the milk, but better, the non-volatile part, or ash.

Milk contains these five substances in somewhat variable proportions; but no one of them can be entirely absent, nor can the proportion of any one vary beyond certain narrow limits without essentially altering its character.

Milk is in the highest degree susceptible to alteration, and, so far as superficial observation shows anything, this alteration is spontaneous. There appears to be no cause operating from without to produce it. It will go on if the milk is kept in a tightly-closed bottle, from the moment it is drawn from the cow, as well as if left exposed to the air. From what has been said above in regard to the alterability of caseine, it appears—and correctly, too—that this susceptibility of milk to change is associated with the presence of caseine in it. In fact, if we remove all the caseine from milk, as well as all the albumen, which is also

present in milk in very small proportion, and which closely resembles caseine in respect to alterability—the residue, consisting simply of water, fat, sugar and non-volatile matter, is easily kept unchanged—only we find, if we attempt the experiment, that we have to be very particular to extract the caseine and albumen completely; if but traces of them are left the experiment fails.

This great susceptibility to change is not peculiar to milk. The same property belongs to all matter that is rich in substances like caseine. Animal flesh, blood, skin, and other such substances, will begin to change even more speedily than milk under like favorable circumstances. These favorable circumstances required are simply a moderately elevated temperature—about that which we call comfortable in our sitting rooms, or on a summer day—and the presence of enough water to make the substance at least moist.

The alterations which caseine, albumen, and other like substances, suffer under these circumstances are chemical decompositions, which apparently result in their complete destruction. Instead of caseine or albumen we have in the first stages of the change a number of new compounds of simpler composition. These are in their turn still further decomposed, and, after a succession of such decompositions, we have nothing at all left behind—the final products being entirely gaseous, they have passed off into the atmosphere.

It was once supposed that the presence of the element—nitrogen—in these substances was one of the main causes of their passing so readily into a state of decomposition. All chemical compounds—such as the water we drink, the salt with which we savor our food, or the sugar with which we sweeten it, and all the various substances of which the bread, the meat, and the vegetables we eat, are mixtures in a great variety of proportions—are made up by the union of chemical elements —such as oxygen, hydrogen, nitrogen, potassium, calcium, etc.; and these elements are held together by bonds, which apparently differ widely in strength in different compounds. Sodium and chlorine in common salt are held together by stronger bonds than the carbon, oxygen and hydrogen in sugar. Hydrogen and oxygen in water are much harder to separate from one another than the silver and sulphur on a tarnished silver spoon. Nitrogen is characterized by the weakness of nearly all the bonds by which it is united with other elements, and

when it comes to enter into a compound consisting of several elements the same weakness is carried with it into that compound. No chain can bear a strain greater than that which its weakest link is able to withstand, however great may be the toughness of the iron and the strength of the links of the rest of the chain. So in a compound like caseine, consisting of five elements—carbon, hydrogen, oxygen, nitrogen and sulphur—whatever may be the strength of the bonds that unite the carbon, hydrogen, oxygen and sulphur together—and this strength is very great, at least in some compounds—nevertheless the chain must be a weak one, because of the presence of nitrogen; hence, some have said, one reason why such compounds are easily decomposed, and can even, to all appearances, pass spontaneously into a state of decomposition.

But later examinations of this subject indicate that this decomposition is not spontaneous, but that there is a cause acting on the substance from without, and bringing its decomposition about. The chain does not fall to pieces by its own weight, as it were, breaking where the weak links are, but it breaks because something is consuming it and weakening it; in other words, it appears to be proved that the development and growth of very minute forms of vegetable life, of exceedingly small plants, are the cause of these destructive decompositions—that these plants feed upon these substances, and so destroy them, as we destroy the loaf of bread or leg of mutton off of which we make our dinner.

These organisms are so minute that it is not to be wondered at that for a long time they escaped detection, and that these alterations caused by them were supposed to be spontaneous. Some of them require the highest magnifying powers of 1,500 or 2,000 diameters, used by well-trained and skilful eyes, in order to make them out successfully, and prove that they have life; and some even skilled observers, not finding these evidences of life in all cases of decomposition of this kind, are disposed to deny that there is an invariable, unfailing connection between the two. But the balance of the best evidence is in favor of the view that there is such a connection between the processes of decomposition, that ordinarily go by the name of fermentation and putrefaction, and the life of minute vegetable organisms.

These organisms are assigned by botanists to the class of fungi, the same class to which the well-known toad-stool and puff-ball belong; and

if it be really the case that they are the cause of these alterations of matter rich in nitrogen—such as we are only too familiar with in spoiled meat, mouldy bread, rancid butter, tainted milk, and the like—some acquaintance with their habits cannot but be of assistance in fighting against their inroads on our property.

Fungi are composed, like all plants, of carbon, hydrogen, oxygen, nitrogen and sulphur and non-volatile matter. They are distinguished from most other plants—and particularly from those that have a green color—in that they must live, in part at least, on already formed organic or volatile matter. They are not able, like other plants, to work up the simple materials derived from the atmosphere and the soil into the starch, cellulose, and other complex compounds, of which the main part of the structure of every plant consists. As their own structure must be built up likewise mainly of these substances, if they cannot manufacture them themselves; they must get them directly or indirectly from plants which are able to do this. Some fungi derive their nourishment from living bodies—others from dead bodies. We need to consider only the latter class.

Most fungi have what is called the mycelium—a network of long, tubular cells, crossing one another irregularly in every direction, and ramifying all through or over the material on which they grow. From this mycelium the fruit-bearing part of the fungus springs. This is often the most striking part of the plant, and is, indeed, usually mistaken for the whole of it. When we see the mould on a piece of bread, we naturally take that to be all there is of it, when, in reality, the bread from which the mould springs is penetrated through and through by the threads of the mycelium, that serve in a measure like roots, through which the plant draws from the substratum the nourishment required for the visible fruit-bearing portion.

This fruit-bearing portion may present a variety of appearances even on one and the same kind of fungus. We may have the appearance of a broad, thin skin, covering the whole surface of the substratum on which the fungus grows; or the fruit-bearers may be raised above the surface on stems, as in common mould; or we may have sacks of considerable size, which are divided within into a great number of chambers, like the common puff-ball. The real germs of the fungus are the spores, as they are called, borne on this fruit-bearing portion. These

spores are usually colored, as seen in the greenish-blue spores of common mould—the brown spores of the puff-ball. Some of them have coats or outer coverings, which are endowed with a remarkable power of withstanding the action of strong chemical agents—such as oil of vitriol. Most of them are ready to germinate as soon as they fall from their attachments, and some of them retain their power of germination for three or four years. Most of them will germinate in pure water, but some only on such substrata as can supply the nourishment for a new mycelium. Many fungi will live only on one or on a very limited number of substances. A few have the power of extracting their nourishment from a great variety of substances.

Such are some of the main features in the natural history of that form of fungus with which we are all familiar in the mould that grows on stale bread, on fruit, and other like substances. Here the agent that spoils our possessions becomes visible to the eye, at least after a time. As long as we see no mould gathering on the surface of the contents of our fruit jars, we feel sure that nothing is going wrong. But everyone knows that meat will spoil without this accompaniment of a visible mould. In this case we have a fungus still, just as much as in the other; but it is of a kind in which every cell has reproductive power, and lives for itself. From every cell new cells may grow by a process of budding, or the mother cell may burst open and set free a number of germs, each one of which may become a new individual. Of such a nature is the common yeast plant, which we use in raising our bread, or fermenting our beer or ale. A sound potato will become rotten very speedily if the growth of another form of fungus of this character—the micrococcus—be started on it. The cells divide into twos very rapidly, and each one of these two new cells divides again, and so on.

I have said that the fungi feed upon the substances they occupy, and destroy them as we destroy the loaf of bread or leg of mutton. But the two cases are not altogether parallel; for while all that we destroy —or, to speak more correctly, all that we convert into other forms of combination by processes of animal digestion and assimilation—passes into and through our bodies, on the other hand, only a small portion of the substance, upon or in which the fungus grows, appears to serve for its nourishment; but nevertheless the rest of the substance does not,

like the meat which we leave on the platter, remain good for another meal, but it also is decomposed, as well as the part consumed by the fungus for food. Invested with such a property as this, not merely to decompose and put out of their way what they directly feed upon, but also a much greater portion of the substance besides, over and above what they need for food, it is not surprising that their power, whether for good or evil, should be so tremendous, notwithstanding their minuteness.

This great destructive power of the fungi is due in part also to the marvellous rapidity with which they can multiply and produce new cells, each one of which can in its turn act as a starting point for new and distinct growth. One of the most common and widely-diffused of the mould fungi can run through its whole course of life in 48 hours, at the most, if kept at a temperature of from 50° to 60° Fah., and produce a new crop of several hundred spores from each old one; and, in 48 hours more, each spore of this first crop of several hundred will produce several hundred more, and so on. At such a rate of multiplication it would require but a few days to reach numbers almost too great for our conception. And, what is more, this is not the only way, nor even the most rapid way, in which this fungus can propagate itself; for under favorable circumstances, and by other methods of multiplication, a single cell may, at a low estimate, produce 400,000,000 new cells in 24 hours.

Again, the germs of fungi are able to withstand great degrees of cold. Some spores have been submitted to a temperature of 100° below zero without impairing their germinating power. Nothing will effectually kill them but exposure to elevated temperatures, or to the action of some of the materials used as disinfectants. Exposure to the temperature of boiling water, till thoroughly heated, will kill many, if not most, germs; but a greater heat is sometimes necessary, particularly if the substance containing the germs is perfectly dry.

Besides these great powers of multiplication and endurance, some fungi are endowed with a remarkable facility for adapting themselves to different kinds of substrata, so that if any substance or any circumstances are unfavorable for their growth in one form, they can assume another shape, which is better suited to the actual condition of things. I cannot illustrate this interesting feature in the natural history of fungi

—a feature that is of particular importance to us—better than by a quotation from my address delivered at the American Dairymen's Convention, four years ago :—

"The pencillium crustaceum is found almost everywhere on the surface of the earth, constituting generally the greenish-blue mould that appears on vegetable and animal matters, and is concerned in all the common processes of fermentation and putrefaction, such as beer-brewing and the manufacture of wine and vinegar, and the decomposition of dead animal and vegetable matters when left to themselves. Its visible part is composed of delicate white filaments, or threads, that bear on their ends the groups of spores or germs, which, to the naked eye, appear like a fine bluish-green dust. Scatter these spores or this dust over a substance similar in chemical constitution to that which produced the mould, and we have more mould of the same kind and a new crop of spores. The general appearances of the fungus may vary somewhat with the rapidity of its growth, and the more or less firm consistency of the substratum on which it grows, but nevertheless it is the same thing —pencillium crustaceum reproduced—and it can be reproduced in the same manner again, and so on for generation after generation, *ad libitum*.

"If these spores are sown on pure water they swell up and finally burst, with the expulsion of a great number of minute bodies, called zoospores. These zoospores move about rapidly in the water for a short time, and finally come to rest; then each one begins to lengthen, and partition walls are thrown across it as it elongates, so that the one cell or sac becomes several. These new cells remain partially connected together in the form of delicate brittle chains, which are called *Leptothrix* chains. The multiplication of cells in this growth is wonderfully rapid, and from a single zoospore an almost incredible number of new cells can be produced in a few hours.

"According to Hallier—a most distinguished authority on these matters—these Leptothrix chains are formed in great numbers every night, in the mouth, throat, and all the digestive organs.

"If, in the second place, instead of putting the spores of the mould in distilled water, we put them *under the surface* of a liquid rich in nitrogen, they swell up and expel the zoospores as before, and the zoospores come to rest after a time; but then, instead of the production of long chains of cells remaining connected together, we have each zoospore

sending out a little bud that soon becomes detached from the mother cell, and, in its turn, produces yet another cell by budding. All these new cells are disconnected from each other, and are very small. To this form of the fungus the name *micrococcus* has been given, and Hallier considers it to be the cause of all putrefaction, and calls it also *putrefactive yeast*. According to the same authority, both rennet and cheese are highly charged with this yeast.

"If, in the third place, a cell of leptothrix or of micrococcus is put in a liquid rather poor in nitrogen, it enlarges considerably in the course of one or two hours, a nucleus becomes visible—that is, an apparently solid mass about the centre of the cell—and we have now the common yeast of the housewife, which multiplies as the micrococcus does by throwing off buds, and causes the common alcoholic fermentation. This form of the fungus is also called the *cryptococcus*.

"Fourthly, put some spores of pencillium crustaceum in milk that has been boiled 20 or 30 minutes to kill all germs in it, and within two days we have the same result as when they were sown in a liquid rich in nitrogen, viz., the expulsion of the zoospores, which, by subdivision, produce micrococcus cells. So soon as this micrococcus appears we have also souring and curdling of the milk, and when a small quantity of lactic acid has thus been formed, a new condition is assumed by the fungus; the minute micrococcus cells enlarge, as they do when about to pass into the cryptococcus, but with quite another result, viz., the production of elongated cells, four-sided, and often with abrupt square ends, possessing a peculiar lustre, and multiplying by subdivision, in the same manner as the leptothrix—that is, by new division walls thrown across the elongated cell; this is called *arthrococcus*, or jointed yeast, and it is the ferment which attends the formation of lactic acid in the souring of milk.

"Fifthly, if a pencillium spore germinates on milk, or just beneath the surface, we have, instead of the real pencillium mould again, another sort of mould, called the oidium lactis. It is composed of branches, the terminal cells of which break off easily and germinate like spores, producing more oidium mould if at the surface, or jointed yeast if below the surface.

"These two forms are never found except in liquids containing *free* lactic acid, and are then always present. If the free acid is removed

in any way as fast as it is formed, a new portion is produced immediately, but by means of the micrococcus, no other form of the fungus appearing.

"Sixthly, if pencillium spores are sown on completely fermented wine or beer, wherein all the sugar has been converted into alcohol and carbonic acid, we have still another form of yeast, viz., elongated cells with pointed ends; this is the yeast concerned in the formation of vinegar, bearing the same relation to the acetic acid of the vinegar that the jointed yeast does to the lactic acid of the sour milk, and, like that, it has, when growing at the surface, a peculiar form corresponding to the oidium lactis. This yeast is called the *mycoderma aceti*.

"Thus, under different circumstances, we can obtain, directly or indirectly, at least six different forms of cells from the spores of pencillium crustaceum, each form representing a different kind of decomposition; and that these are all only so many different stages of development of the fungus with which we started, is further indicated by the fact that each and every one of these forms, if sown on a liquid similar to that which will produce the mould itself directly from the spores of the mould, such as a solution of impure sugar, or beer, or wine will produce the same mould again. Any one of them is at any time convertible *into* pencillium crustaceum as easily and with as much certainty as we can at any time, by properly modifying the circumstances, get any one of them *from* the pencillium.

"Finally, by proper modes of cultivation, we are able to get from the spores of pencillium crustaceum still another form, which, in distinction from all those hitherto described, can produce regular spores of its own, and is considered as a distinct species of fungus—cormuracemosus; and, by suitable cultivation of the spores of this new species, we are able to obtain the pencillium again, as readily as we can get it from pencillium. Moreover, this new fungus can be made to yield its own form of micrococcus and cryptococcus, etc.

"And so we might proceed, if the time allowed, to enumerate and describe other fungi still, which, treated in a suitable manner, yield their special forms of micrococcus, etc. In some cases those micrococcus cells are so minute that, with the very high magnifying power of 1,000 diameters, they appear as mere points."

From another fungus, that appears in the form of a blight on wheat,

we can, by proper culture, obtain several of these forms, which can be produced from the mould. This interesting property of the fungi distinguishes them widely from the higher plants. If we give to the potato soil and culture that are not suited to it, but to corn, we get merely a very poor crop of potatoes, not a crop of corn.

This description of the transformations that a species of mould fungus may undergo, under varying circumstances that affect its nourishment and growth, shows that the character of the alteration caused by the fungus depends quite as much upon the stage of development as upon the particular species of fungus engaged in the operation; and since the stage of development depends largely upon the chemical composition of the substance, it will be seen how the nature of the decomposition depends mostly, after all, on the nature of the substance itself that is decomposing. The micrococcus, for instance, appears only in substances rich in nitrogen; but when it does appear, no matter from what fungus it may come, it causes putrefaction. The cryptococcus not only causes the particular kind of decomposition called alcoholic fermentation, but appears only in solutions that are fit for that kind of decomposition, and so on.

We have seen that the fungi have great powers of multiplication and of endurance, and that they possess a remarkable facility for accommodating themselves to different forms and conditions in which the nourishment they need may be presented to them. Still another property belongs to them that adds yet more to their efficiency as friends or enemies. I refer to the wide diffusion of their germs, especially in the air around us. When dry, these germs are so light that they can remain floating about in the air for a long time. Everyone knows how readily mould will appear on any article of vegetable food that is left exposed to the air. A liquid suitable for the nourishment of blue mould, if boiled ever so long, so that all germs in it will be completely killed, is yet not safe from attacks of the fungus unless the air is most carefully excluded by tight-fitting covers, such as we put on our fruit jars. That solid particles, such as these germs must be, are contained in the air, and which, getting access to the liquid, cause the formation of the mould, is proved by those experiments in which air that has been drawn through cotton may be allowed to come in contact with the fermentable liquid without the appearance of mould; the atmospheric

dust is entangled in the cotton as the air passes through it; and that this dust is the source from which the mould springs is further shown by the experiment of causing mould to grow on a liquid fit for its nourishment, but containing no living germs, by simply mixing with it the water with which this cotton has been thoroughly washed, or even by putting in the cotton itself, with the adhering dust. The same experiments may be performed in another more simple way, and with no less striking results. If a vessel made of thin glass, so that it can be heated, is partly filled with any decomposable organic liquid, and the vessel is heated till its contents have been well boiled, and it is then closed with only a plug of clean cotton in its neck, the liquid will remain unaltered for any length of time; if a few mould spores are introduced into the flask the usual decomposition will soon set in.

No solid particles, though so light as to be set in motion by the slightest current of air, can yet long remain suspended in a perfectly still atmosphere; hence, the dust which settles from the air on all objects in a still quiet place, must contain many of these germs. If these germs are deposited thus by their own gravity on moist substances rich in nitrogen, and the temperature is not too low, they germinate and grow, and, simultaneously, decomposition of the substance begins. If they do not settle on any such object they will remain inactive, but still ready for operation, and patiently waiting till taken by currents of air to other substances upon which they can grow.

These fungi require for their food, besides organic matter and nitrogen in some form, also some non-volatile matter, especially phosphoric acid. Provide all these needed elements of their food, and moisture and a moderate heat, and their settlement and growth is sure to follow. It is not necessary at all to plant the field, as when we want to raise a crop of corn or wheat. Everyone of our articles of food, whether vegetable or animal, contains all these necessary ingredients of the food of fungi; and therefore, the germs being always at hand in the air, no kind of food can be exposed to the air for any length of time, unless thoroughly dried or kept at a very low temperature, without becoming occupied by them, or, in other words, without becoming rancid or mouldy.

Animal liquids appear to have these lower organisms, in some shape or another, already formed in them. Milk, white of egg, blood, and all

animal pieces, even when fresh from the living bodies, contain them in abundance.

Several different kinds of decomposition are produced by these fungi, as shown in the account of the transformations of the pencillium. If ammonia, with which you are acquainted in the spirits of hartshorn, or the salts of the smelling-bottle, is one of the products of the decomposition, it is called putrefaction, in contradistinction from fermentation, when ammonia is not produced; and usually the ammonia is accompanied in this decomposition with ill-smelling gases. Only such substances as are rich in nitrogen putrefy; those that contain but little nitrogen can only ferment or decay. The richer a substance is in nitrogen in the form of albuminoids, such as caseine, the more prone it is to putrefy; hence, animal substances are more liable to suffer decomposition by putrefaction than vegetable. The looser a substance is in texture, the more readily it putrefies. Some compact substances, like horn, though rich in nitrogen, are not at all prone to decomposition.

The germs of fungi that produce putrefaction appear to be more tenacious of life than those that produce fermentation. While the latter may usually be killed, by exposure for 15 or 20 minutes to the temperature of boiling water, the former may not yield unless the temperature is carried to from 20° to 30° above the boiling point, and maintained there for half an hour or an hour.

The difference between the character of the decomposition produced by putrefaction and fermentation, as well as the fact that the same fungus may bring about the one or the other in the same substance, under different circumstances, is very neatly illustrated by a simple experiment with an egg. In one case some spores of blue mould were sown on the moistened shell, and the egg was put where the shell would not become dry. The egg began to putrefy shortly, as the fungus growing from the spores penetrated the shell into its contents, and, on opening the egg, millions of leptothrix chains were seen under the microscope, and the usual odor of rotten eggs was evolved. In another case the white of the egg was put in a shallow dish; the spores were sown over this, and the whole was simply protected from dust, while free access of air was allowed. The same substance, which before gave only too strong evidence of its having entered into a state of putrefaction, remained quite odorless for four months, while mould grew very

slowly over its surface; an odor was after that time given off, like that of boiled glue, but very different from the sickening stench from the real rotten egg. If this dish, with its contents, was covered up in such a way that the air was excluded, real putrefaction soon set in. In another experiment with a liquid rich in nitrogen—urine—and ordinarily very ready to putrefy, the spores were sown on it, and free access of air was allowed. The mould grew very rapidly, and no particularly offensive odors were evolved until the surface of the liquid became covered with a continuous layer of the mould. This excluded the air, and putrefaction began.

These experiments show plainly the importance of exposing a putrescible substance as freely to the air as possible, if we desire to avoid offensive decomposition. Even though, in doing this, we expose the substance also to the germs of fungi in the atmosphere, yet we prevent the decomposition caused by these germs from becoming putrefactive, although we cannot prevent any decomposition at all from taking place. The only other alternative consists in killing all the germs in the substance by heat, which, as we have seen, is not so easy in the case of putrefaction, and then completely excluding the air by sealing up in tight jars. A substance like meat—very rich in nitrogen—can be kept only in some such way as this; for, however freely we may expose it, the air can reach only those portions of meat at the surface—the rest must putrefy, just as the putrescible liquid did in the experiment just described, as soon as the air was excluded by the film of mould covering the surface. But a liquid like milk can readily be kept from putrefying, with comparatively little difficulty, by the application of this principle, at least for a length of time, which may in some cases be of no little account.

But some of you are perhaps wondering what all this discoursing about fungi and their habits, and possible transformations, has to do with taint in milk, and are perhaps thinking that I have forgotten what I was expecting to talk about. But not so. The influence exercised through the growth and development of fungi of one kind or another upon the operations of the dairyman is to all appearances very favorable; and it is of no small importance for him to know what these minute but multitudinous organisms can do for or against him, and how they perform their good or evil work.

One of the most important manifestations of this powerful influence exercised by the fungi is found in the readiness with which milk will absorb any taint to which it is exposed. The mere absorption of an odor or taint from the surrounding air, which, while strong enough to cause serious injury to the milk, is often scarcely perceptible to the senses, could not of itself do much harm; it must be that the taint is still further developed in the milk; it must be that the milk absorbs not simply an odor that it gives out again, but it absorbs something that develops and produces more of its own kind—or, in other words, the milk absorbs germs which vegetate in it, and communicate to it a disagreeable putrefactive odor and flavor, coming from the products of its own decomposition. How else can the well-known cases of taint, apparently communicated to milk in the bag by means of foul air from putrefying matter, be explained. You are familiar with the accounts of such cases that have occurred in the course of the last four years, where a taint in the milk at the factory was traced to the pasture of a patron, who carelessly allowed a dead animal to rot in the open field near where his cows roamed.

No mere odor could be transmitted through the lungs of the animal to the milk to such an extent as to make the milk of a few cows contaminate the entire contents of a cheese vat; nor does it seem to me possible that any germs could make their way through the tissues of the lungs into the blood, and then into the milk glands. It is far more likely that some of the germs that must have been given off in great numbers from the putrefying mass, and carried through the air by the currents of wind, adhered to the bag and teats, and were brushed or shaken off into the milk when it was drawn, or that they were taken into the stomach of the animal with the grass upon which they had settled.

The first explanation derives some support from the cases where contagious disease has been widely spread by means of milk, three remarkable and unmistakeable instances of which are given in the first number of the London *Milk Journal*, in 1871.

In one of these cases the daughter of a milkman was brought home in the early stages of a fever, and the disease was taken by other members of the same family. The mother, who was the nurse, milked, and the milk was brought into the kitchen where the sick children

were, and poured out into pails and pitchers for distribution. In a short time the fever appeared among children and young persons in seven of the fourteen families to which this milk was supplied, while at the same time there was almost no other fever in the place. The milk-carriers did not have the fever; they stopped but a moment at the door of each house, and, in most of the cases, did not see or come near those who were sick. On the other hand, all of those who were taken sick were proved to have drunk the milk. The same thing happened, under the practice of the same physician, 13 years later.

If we suppose that the germs of the disease fell into the milk from the mothu-musis odors, or from the atmosphere of the sick room, and there, finding the needed material for their further development, did grow and multiply with the rapidity of reproduction, of which these organisms are capable—so that, before the milk came to be consumed, it was well charged with them--we suppose nothing that does not accord with their habits, which we have a reasonable—and, in fact, the only satisfactory—explanation of the spread of the disease.

In another instance, scarlet fever broke out among the servants and students of a seminary, and in several families of the place, making its first appearance on the 9th of May. It was ascertained by the physician that the wife of the farmer who supplied the milk had returned on the 1st of May from a visit at a place where two deaths from scarlet fever had occurred, and that in a few days she had fallen ill. A boy who assisted her in milking, and who was the milk-carrier, had the disease also lightly, but continued all the time at his work. On investigation it was found that, besides supplying the school with milk, this milkman also supplied all those families in which the fever had appeared, and that the physician's round of visits to scarlet fever cases coincided, including the seminary, in every instance except one, with the milkman's round. Just one family supplied with this milk escaped. When the students of the seminary went to their homes, at the end of July, two families of visitors to the place were supplied with milk out of the surplus left on the milkman's hands, and, on the 8th and 9th of August, members of both these families were attacked with the disease.

No one can doubt but that the milk served as the carrier of the germs of the fever into these families; and though we have no proof that the germs multiplied in the milk itself, yet, taken in connection

with the well known and universally acknowledged fact that milk has an unusual power of absorbing and retaining *something* from the effluvia given off by putrefying matter, and with the other well established fact that putrescent germs can find in the milk the conditions fulfilled that are required for their further development, it is not unreasonable to suppose that in this, as well as in other cases where putrefaction or disease is spread by means of milk, something more goes on in the milk than would go on in so much pure water.

The third, and still more striking, case of the propagation of disease by means of milk, recorded in that journal, was made out in 1870 by Dr. Ballard, health officer for Islington. Over 150 cases of typhoid fever broke out in that place, in a semi-circle of less than a quarter of a mile radius, within two weeks, and mostly in wealthy families, and it was found that out of 140 families supplied from a certain dairy, the members of 70 were attacked with the disease; and that the disease followed the milkman's rounds in separate streets and squares, and attacked especially women and children, who are in general the largest consumers of milk, and in some families the only persons attacked were those who partook of the milk. On visiting the dairyman's premises, the only thing found out of order was an underground wooden tank, which had partly rotted and given away, and from which ran several rat burrows. The physician was of course assured that no water was mixed with the milk. Charitably allowing this to be true, he suggested that, as the water was used for cleaning the cans, enough might remain in them, after rinsing, to poison the milk. There was no other possible explanation of the origin of the disease than that of the admixture of this water with it, or at least there appeared to be no other, to those who investigated the matter.

These affections of milk resulted from causes that unquestionably acted upon it after it was drawn. But it is also well established that causes operating on the cow may result in the production of abnormal fungus growth in the milk, before it is drawn, that seriously injures it. At your meeting of last year, I believe Mr. Arnold gave you an account of the successful manner in which one of my colleagues at the University —Dr. Law—having had his attention called to the fact that something was wrong in the milk supplied at his house, detected the presence of fungous growth in it, and traced the same from the water consumed by

the cow into the blood and the milk; and it was observed that the presence of these organisms was accompanied by a feverish condition of the animal. There was no proof that this milk had caused any disease among those who used it before its circulation was stopped by the milkman; possibly it did, without attracting sufficient attention to call for any investigation—but certainly no one knowing its condition would use it.

The strong prejudice against the use of milk from cows that are even only slightly ill, especially by children, is of itself proof enough that there is something unwholesome in such milk. And some observations that have been made by physicians go to show that disease may be so easily and insidiously communicated in this way that even the greatest watchfulness may sometimes not avail to prevent it. In a recent number of the *British Medical Journal* a physician expresses the belief that animals suffering from the foot and mouth disease may transmit some poison through their milk. An infant in one of the families visited by him, which was carefully fed on cow's milk—the nurse being sent every day to see the milk for the child drawn always from the same cow—was taken with an eruption that appeared all over his body. The physician was puzzled to account for this attack, till he found that the cow was suffering from the foot and mouth disease. Another child, fed with the same milk, was attacked with an eruption on the head and face.

These facts and observations prove most clearly that the presence of contagious disease, not only among the animals which supply the milk, but among those who take care of it, or even of putrefactive germs in the water used for cleansing purposes, or for drinking, may communicate most dangerous properties to milk which is exposed to influences emanating from these sources. It may not yet be proved that the germs which in some cases have been actually found even in the milk of cows that were in only a slightly disordered, feverish condition, and which presumably may exist in the milk of cows suffering from contagious diseases generally, go into the butter and cheese, and cause injury there. But it is so entirely reasonable that they should do so that dairymen may well beware of all shapes in which these germs may be brought to them.

But even when the cow is in a perfectly healthy condition, and her

milk is all that it should be, there is that in it naturally which will communicate a bad taint if the milk is not properly handled. I refer to what is known as the animal odor. This appears to be intensified in the milk of cows in a feverish condition, but still it is never absent. This odor must be due to something in a gaseous form ; for only when matters are in that form do they affect the sense of smell. At the same time, as it can be to a very great extent reduced by simple cooling from the natural temperature of the milk when drawn, down to the ordinary temperature of a cool atmosphere, and converted into a flavor which will remain in the milk a long time if kept sufficiently cool, and can be again converted into an odor by the application of heat, as Mr. Arnold has shown by some of his experiments, it would appear that the gas or vapor that causes the odor can be reduced to a liquid. In fact, whatever it be that is the cause of the animal odor, it behaves precisely like what is known to the chemist as a *volatile oil.* The odors of flowers, the *bouquet* of wine, and a great many other odors and flavors, are due to volatile oils, each particular odor being due to a special oil ; and it is eminently characteristic of these oils that their power of communicating odors or flavors is very great—a very small quantity can affect the odor or taste of a very large quantity of substance. Each particular kind of wine owes its peculiar flavor—or its *bouquet,* as it is termed—to some one or more of these oils, formed, in the course of the transformation of the grape juice, into wine, by fermentation ; and it has been estimated that their proportion in the wine is rarely over one part in two thousand, and sometimes not over one part in two hundred thousand.

It is also very characteristic of these oils that their effect is very persistent. The odor of wine will remain in an emptied, but not cleaned, glass for a long time ; and this is not unlike the behavior of this particular flavor of milk. Some people cannot drink fresh milk without carrying its disagreeable flavor in the mouth for hours afterwards.

All milk contains gases in solution, which can be pumped out of it with an air pump ; but nothing has been found in this mixture of gases which satisfactorily accounts for the animal odor ; no more could we find anything in the mixture of gases that wine would give up, which would account for the flavor of the wine. In the one case it appears to be as it is in the other—a very small quantity of a volatile oil to which the property is due.

According to Mr. Arnold, the amount of this volatile oil—or gas, as he calls it—is smallest in the healthy animal, more abundant when she is actively exercised or when worried, as by dogs, and most marked in animals in a feverish condition. He considers it a cause of the spreading of taint in milk, and a more potent cause in some cases than in others. The spreading of a taint in milk—that is, the transmission of a certain offensive property from a small quantity to a large one in undiminished intensity—must, however, be accompanied by the production of an additional quantity of the taint-giving substance, so that every quart of the larger quantity will contain as much of it as every quart of the smaller quantity had, from which the taint originated. But this is not a property of either a gas or a volatile oil; it is rather characteristic of a process of putrefaction, transmitted to the larger quantity of milk from the smaller by means of germs contained in the latter, and by which offensive matters are produced from the decomposition of the milk—one of the products of this putrefaction being the same volatile oil which gave the taint to the milk in the beginning. Such oils are often products of fermenting or putrefactive processes. A part of the peculiar flavor of cheese is probably due to one or more of these oils which do not exist in the fresh curd, but are the products of the putrefaction that takes place during the ripening. All the circumstances under which taint is communicated originally from the animal odor, from one portion of milk to another, are such as are favorable to the putrefaction of the milk. If the milk is shut up, while yet warm, in a can, it becomes badly tainted; but we have then precisely those conditions fulfilled which are most favorable for putrefaction, for the beginning of which the germs are already present in the fresh-drawn milk. Again, Mr. Arnold says that the milk of feverish cows, which is highly charged with animal odor, is particularly disposed to communicate or spread the taint; but we have learned in a previous part of this lecture that such milk, when subjected to microscopic examination, has been found to contain an unusual number of germs of fungi.

But although we cannot allow that this volatile oil can spread itself without losing strength, from a small through a large quantity of milk, we must nevertheless grant that its presence does in some way modify these processes of putrefaction; for Mr. Arnold asserts very positively that milk does not become tainted, but sour, if left to itself under

circumstances favorable for putrefaction, after the animal odor is removed. This is, however, possible without assuming that the original animal odor is itself the cause of the spread of the taint. In describing the various modes of growth of which one fungus is capable, it was shown that the effects of that growth may be very different in liquids of different chemical composition; so it may be that the presence of this volatile oil so modifies the manner in which fungous growth and putrefaction go on, hand in hand, as to lead to the production of an additional quantity of the same oil, or it is possible that the oil is always accompanied by a particular kind of germs that induce in the milk that kind of putrefaction of which the oil is one of the special products.

Calling an object by another name does not, however, make it another thing; and this animal odor remains the same thing in respect to the bad effects it produces—and these evil effects are to be avoided in the same way as before.

How to check the putrefactive processes, which, started in one way or another, are so ready to spoil the milk, or to keep them under control, is one of the most important questions with which the dairyman has to deal.

From the moment that the milk leaves the cow, the work of the fungi commences. They begin to increase, and simultaneously the milk begins to change, both operations going on with a rapidity that varies according to the circumstances of temperature and exposure, and never ceasing entirely till the milk or its products are digested in the stomach, or have putrefied and decayed in the air—producing results that vary according to the product, whether butter, or cheese, or simply the milk itself, and, what is very important, according to the kind of fungus that gets a foothold in the substance.

The elements of fungi that are already in pure, clean milk to begin with, or that are added in the rennet, appear to do comparatively little harm; but, on the contrary, by their legitimate growth and action on the substances in the midst of which they find themselves, to bear at least an important part in the elaboration of the very principles which give the final product in the manufacture of cheese, its savor and its value. But the case is quite different with such fungi as are introduced from without, and which originate in putrid matter of any kind. Their whole influence is harmful in a high degree. A particle of taint in the

air, or on the walls of the dairy or factory, or in the pails and vats, means a quantity of fungus germs—often a multitude of them—all ready and most willing to take possession of the milk, and to hold it, too, when once in possession, with such pertinacity that no process will expel them except such as will ruin the cheese. It is this very obstinacy with which these fungi hold their own that makes them most dangerous and the worst enemy of the dairyman; and his whole treatment of the milk must consist largely in a steady, unremitting fight with this enemy.

The thorough removal of all putrefying matter, or matter in which germs of putrefactive fungi can find a congenial home and opportunity for further development and multiplication, is of course one of the fundamental means of securing good manufactured products from milk, on the importance of which I need not enlarge. This may be done by thorough cleansing with brushes and boiling hot water, the great value of the latter consisting in the fact that most germs cannot withstand a thorough exposure to it and penetration by it. But some germs, especially those of disease such as we have seen may be transmitted in milk, are not killed with certainty in this way. Scarlet fever has been propagated by clothes that have been through the laundry. Hence, Professor Gainger very properly regards the use of some disinfectants, in connection with thorough cleansing, as necessary to insure perfect freedom from contamination. Such disinfectants, in solution in pure, clean water, may be injected into the milk can, or other utensil, in the form of a fine spray, so that every part of the surface will be touched by the solution without the necessity of using any large quantity of it.

A new disinfectant—chloralum—much advertised in the English papers, seems to be finding great favor in that country. Mr. Gainger says that a very small quantity of this left in the milk can imparts no flavor or hurtful property to the milk, while it will effectually destroy fungi or their germs. He recommends, after cleaning and scalding the vessel as usual, to hold it for a moment inverted over a spray-producer, which throws up a spray of a solution of this chloralum in water; the excess of the solution will flow out at the mouth of the vessel, and the small quantity that adheres to the walls will do good rather than harm. A really good disinfectant that could be used in this way—one possessing no decided taste of its own, as the ordinary carbolic acid does, so that its presence in the milk in small quantity would do no harm—

might be very valuable to the dairyman. Whether this chloralum will perform all that is claimed for it by Mr. Gainger, I cannot say; but it certainly appears to be worth trying.

Free access of air to the fresh milk does much to give a favorable turn to the processes of decomposition that naturally tend to take place in it. In illustration of this, permit me to make another quotation from my first address at Utica:—

"Alexander Mueller, till recently of Stockholm, Sweden, found that milk turned sour much more rapidly in closed than in opened vessels. In one experiment he put the milk in two vessels on a stove, where its temperature rose to 65°, one of the vessels being closed and the other open. The cream and milk in the open vessel were perfectly sweet after 12 hours, while in the covered vessel not only were both sour, but a disagreeable odor, like that of sweat, was emitted. This result shows that if pure, sweet milk is essential to success in the manufacture of cheese, the practice of transporting milk warm from the cows is injurious; and if it could be cooled down to near the freezing point, before putting it into the cans, less harm would result from confining it in closed vessels while moving it to the factory, and that by all means it should be kept as cool as possible from the time it leaves the cow till it goes into the vats of the cheese-maker. The preservative power of a free exposure of the milk to the air was repeatedly proven by Mueller. He found that the shallower the vessel in which the milk was allowed to stand, the longer it would remain sweet, and that, moreover, if a current of atmospheric air, or of oxygen, was forced through the milk after it was drawn, it remained sweet longer than other portions not so treated."

It accords with what is known of the chemistry of the volatile oils to suppose that the oxygen of the air will oxidize and so destroy a part at least of the oil which I have assumed to be, in fresh milk, the cause of the animal odor.

The value of any contrivance for aerating the milk without too much labor is plainly indicated by these considerations, as well as by those experiments described in an earlier part of the lecture, where fungous growth was allowed to operate on putrescible substances with and without access of air. In the one case the result was decomposition without offensive odors—in the other, with offense of the worst kind. I

do not suppose the value of any simple contrivances for aeration is questioned by dairymen who have given them a fair trial. At all events, if no attempt is made at aeration by forcing air through the milk, as much exposure to the air as possible should be provided for while the milk is on its way from the milk pail, into which it is first drawn, to the cheese vat in the factory.

With reference to the effects of taint or impurities in milk, on the character of the butter produced from it, I do not know that I have anything new to offer you; you know well enough that the best butter can only be made from the cleanest and purest cream. But, besides this, the presence of foul, putrefying matter in cream is said to sometimes cause it to foam up, when churned, instead of yielding butter—so much foam being produced that it flows out at the mouth of the churn. Dr. Julius Lehmann, who investigated this matter quite thoroughly, found that cream which behaved in this way was characterized by a rancid odor and unusual acidity—the cause of it he believed to be uncleanliness of the milk vessels, especially wooden ones, but sometimes the character of the foddering, as when passing from winter to summer feed, or feeding a large quantity of beet leaves. To insure cleanliness of the milk utensils, he advises rinsing them out with soda lye, after having cleaned them thoroughly in the usual manner, and then rinsing with pure water. At his recommendation, soda lye was also added to cream affected in this way, with the best results in a large number of cases.

Fungous growth is the cause of the rancidity of butter; the germs that are in the milk or cream may pass unchanged into the butter, and, unless it is carefully kept in a cool place, they find all the conditions favorable enough for their further development; and the substances that give to rancid butter its disagreeable odor and flavor are the products of the fermentation that ensues.

A well ripened and good cheese is almost entirely the product of the action of a certain kind of fungous growth on the pressed and salted curd that is put in the curing room. If a good cheese is not obtained, it is because the fungous growth was not of the right kind. In a curd from tainted milk, for some reason or other, the tendency is toward the wrong kind of fungous growth, whether it be because there are germs of fungi in such a curd that are not present in a curd from good milk, or because the conditions are so changed in the tainted curd that the usual,

right kind of fungous growth cannot go on; for aught we know, or do not know, it may be the former reason, or it may be the latter—for we have learned in a previous part of the lecture that the same germs will yield quite different products under different circumstances. The rennet with which coagulation is brought about appears to be highly charged with fungous germs, that, if left to do their work without hindrance, and under favorable circumstances, produce a good cheese. In the tainted curd they are hindered in this work.

Mr. McAdam, of Montgomery County, N. Y., and one of the best cheese-makers in the State, seems to have succeeded very well in removing this hindrance, in part, by keeping the milk at a higher temperature, while standing over night, before coagulation. In doing this he gets rid of a part of the offensive matters, or the excess of volatile oils, and so brings the milk back towards a good condition to a greater extent than if he cooled it and kept the offensive matters in.

I intended to say something about poisonous cheese. But I have already taken more than my share of your time, and have taxed your patience as much as it will bear the strain; and, besides, I find that Mr. Arnold has almost, if not quite, exhausted the subject in the paper which, I believe, he read before you at your last meeting. There is no doubt but that the poisonous property sometimes—though fortunately rarely possessed by cheese—is communicated to it by an improper, unnatural fermentation. Other articles of food, like some varieties of sausage prepared and used for food in Germany, which have to suffer a sort of putrefactive, ripening process before being considered ready for consumption, are sometimes poisonous, and produce much the same effect as poisonous cheese. But further patient investigation only can determine what the harmful constituents of such cheeses are, and why they are formed. There cannot be much doubt that the first trouble is in the milk; but it seems to me that it must be something more than the ordinary taint which is perceptible to the senses, and the particular fungous growth that accompanies such a taint, if, as I have presumed, there is a fungus causing the production of this taint—for we all know that cheese can be made from such milk without being poisonous, though it may not be of the best quality. Perhaps milk which yields poisonous cheeses has been exposed to some such influences as in these cases when scarlet and typhoid fever were spread through the community

by the milk-carrier's wares—influences so subtle that their impressions on the milk have thus far escaped detection except by the final results produced.

But it is of little profit to speculate on these things, except in so far as we may supply some hints that may possibly serve the microscopist and chemist, who only, by their combined efforts, can get at the root of this evil, and a good many others that afflict the dairyman. Let us wait patiently for the good results of their endeavors, in the confident trust that by and bye, when called upon to give to such audiences as this the benefit of their labors, they will not so frequently be obliged to say, "it appears to be," or "may possibly be," and can, much oftener than now, say, "it *is*," or "will certainly be" thus and so.

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AN ADDRESS,

DELIVERED BEFORE THE AMERICAN DAIRYMEN'S ASSOCIATION, AT UTICA, N. Y.,

WEDNESDAY, JANUARY 15, 1873,

BY

L. B. ARNOLD, ESQ.,

OF ROCHESTER, N. Y.

WORDS TO AMERICAN DAIRYMEN AND CHEESE-MAKERS, REVIEWING GENERALLY THE CONDITION OF THE CHEESE INTEREST IN THE UNITED STATES.

MR. PRESIDENT AND GENTLEMEN OF THE AMERICAN DAIRYMEN'S ASSOCIATION :—The annual gatherings of your Association have not only been profitable, but they have proved to be annual feasts, both intellectually and socially, to the dairymen attending. Intent upon progress, it is always interesting for men of the same vocation to meet for mutual improvement, but the meetings of your Association have been most emphatically so. All of its conventions, which I have had the honor of attending, have, if you will allow me the use of a dairyman's simile, been composed of the cream of the dairying public. They have been made up for the most part of intellectual men who have taken a leading part in their calling. A conference of such material could hardly fail to be interesting, or to radiate an influence that would tell well upon any cause in which they were engaged. And this, I claim, the

discussions here conducted have done. Points which have most needed elucidation have been raised and considered—queries which single-handed experience might not have solved in years, if ever, have been answered on the spot. Here, from the practical man, have been drawn the lessons of his successful experience. Here the investigator has unfolded the new facts or laws which his hard labor or far-reaching thought has evolved. Here the scientist has been called to pour out from his storehouse of wisdom so much of his knowledge as applies to the branch of the industry you represent. Every class of attendants has been made to contribute something to the general good; even the inventor, whether he comes here to unburthen himself of a fancied shining conception of genius or mechanical skill, or to advertise his wares for gain, is sure to contribute something to the welfare of the cause by making yearly some valuable addition to our already large stock of dairy apparatus. The thousands of watchful eyes observing, and of thoughtful brains laboring, in the cause of dairy husbandry throughout the country, cannot fail, in the course of a year's experience, to develop some new facts or features relating to the dairy, and your conventions are, as they have been, the most appropriate and natural channel through which to bring them before the public, after they have passed the hard ordeal of your criticisms. Much has been accomplished in this way. The production of milk as affected by food and drink, by health and disease, by treatment, mental as well as physical; the peculiar properties of milk, the character of its composition, and the laws of preservation and destruction, its astonishing susceptibility to the action of ferments, have been thoroughly investigated and brought effectually to the attention of dairymen. New points in the management of milk and in the manufacture and curing of cheese have yearly been brought forward; the keen eyes of discovery have pierced the dark recesses of the condensing factory, and the studiously concealed processes of the condenser's art have, through your agency, been brought to light, and made accessible to all who may desire to know them. The organic nature of the active agency in rennet, and the theory of its peculiar mode of action, which has been a profound mystery for ages, have been explained and published at your conventions; and the astounding discovery that organic germs may be taken in the food or drink of a cow, and carried through her digestive and vascular system, and appear in her

milk with vitality retained, and there grow and multiply and affect the milk and its manufactured products, has been made and demonstrated.

These are proud achievements for any Association, and their record on the pages of your valuable reports are an eloquent testimony to the thoroughness and efficiency of your investigations, and the ability, as well as variety, of talent embraced in your Association. And yet the organization is only in its infancy. It is but eight years old. Its present success is but an earnest of its future usefulness. But I do not propose to look into the future. I have only desired to call your attention briefly to some of the results already attained, and in the furtherance of this end I may say that the Association has not only put the dairymen throughout the United States and Canada *en rapport* with each other, but it has put them in communion with other nations, and made the reading dairymen at least acquainted with the best dairy practices and the state of the art in all the leading countries of Europe, and enabled them to appreciate the relation in which they stand to the dairy interest of the whole civilized world. In its practical effects it has greatly improved the quality of American cheese, and enlarged the channels of commerce to relieve the market of its surplus production. That much of the improvement in the quality of our cheese has grown directly out of the system of associated dairies is evident; but that this Association directly, and with the aid of its ramifications in the form of State, District and County Associations, has been a prominent cause of that improvement, is equally evident.

The part it has played in this respect may be seen by a comparison of the present condition of butter and cheese-making. Upon going into a hundred cheese factories in any district, the visitor will be struck with the almost exact sameness in the modes of procedure, and in the quality of the goods turned out, which he will find varying scarcely more than half a cent per pound in value. He will notice that the same treatment is given in them all to the milk on being received into the factory; it is heated to the same degree for receiving the rennet; coagulation is made to begin, after an equal lapse of time, in all alike; the time to commence cutting and working the curd goes on as if by electrical signals; the temperature for scalding, the time and manner of working, the condition of the curd when put to press, and the salting, vary but little. On all these, and many other points, large numbers of cheese dairymen,

in convention assembled, have compared notes and experiences; they have been the subject of earnest discussion and sharp criticism, till their merits have been sifted out and determined, and whatever has been found worthy has been very generally adopted. With butter-making it is different. Though an older and larger interest in the United States than cheese-making; though the press publishes very much more on the former than the latter, because editors and correspondents of newspapers, agricultural and otherwise, all know something about the former, while very few are familiar with the latter; though, to less extent than cheese, butter is largely made on the associated plan, and ought, for all these reasons, to have the rules of manufacture better systematized than cheese. But it is the reverse. Among butter-makers very little is settled—they are at loggerheads on almost everything. The temperature at which cream rises best seems to be but little regarded, and is known to but few; the best depth for setting milk is argued all the way from one inch to twenty; the number who know just when is the best time for skimming milk is very small; the time, temperature and manner of churning; the effects of churning sweet or sour; and whether it is better to churn the whole milk or only the cream, are questions in dispute.

These differences grow out of the habit of working privately and alone, where each sees or knows little else than his own experiences. Improvements move slow when they go single-handed. Rapid progress in all the affairs of life comes from learning of each other. Difference in butter-making could be as readily reduced as in cheese-making, by a comparison of results. But butter-makers are very little organized. Vermont, it is true, is working systematically to improve her butter interest, and the market reports of St. Albans show how well she has succeeded. I am glad to know that the champion of her noble work is to mingle in the discussions of this convention. The butter-makers of Western New York are following in the same course, and I hope they are also represented here. These are good beginnings, and worthy of all praise. But what butter-makers now most need, with such minor organizations, is a National Association, either independent or in connection with this, where large numbers from all parts of the country could compare practices and results, exposing defects and bringing the better practices before the public. We would gladly welcome them

here. We believe the two interests are most appropriately discussed together. The manufacturer of either butter or cheese ought to be familiar with both, and it is to be hoped that not only the other wing of the dairy interest will be more and more fully represented here, but that all branches of dairy husbandry shall be more completely centered in one grand National Association.

There are other ways in which your Association has contributed to the cheese interest of the country, which it might be interesting to pass in review; but there are other points which I wish to present for your consideration to-day, and I must pass on. I will close this part of my remarks by expressing my conviction that a large amount of useful knowledge relating to the art of cheese-making has been developed and conveyed, through the agency of this Association, to the dairymen of the country that is now enjoyed and utilized by them, which, without that agency, would not only never have reached them, but would have been left for some future generation to disclose and publish.

From whatever cause produced, American cheese has been rapidly raised from a depressed to an elevated reputation, and the improved condition has been made to contribute to the welfare of producers. It has enabled them to dispose of their surplus goods not only, but it has allowed a large expansion without so glutting the market as to depress prices below a profitable trade. From the sudden expansion of the export trade, and the brief period of its existence, and the fact, generally recognized, that the price of the whole American product is controlled by the English demand, has all along raised a feeling of insecurity in regard to the permanency of the cheese interest that is not yet obliterated. Can we depend on a uniform trade with the English that will always relieve us of our surplus cheese? is a question which is still agitating the minds of many dairymen. I will answer this question by saying, probably not. Change is stamped upon the face of all things. There is nothing permanent but the laws of nature. They alone continue uniform forever. I know of no reason why the dairy interest should be exempt from the rule. War may vary our relations with the English. The vicissitudes of the seasons may cut off our supply, and the English trade run into some other channel and be taken away from us—some other people may supply them cheaper, or we may not care to sell cheese to them forever. We are a very changeable and progressive people. We may not be

to-morrow what we are to-day, nor our wants of to-morrow those of to-day. We move with tremendous strides and energy. A large city may be burned in a day, and be rebuilt so soon that its absence is hardly noticed. A territory equivalent to a whole State is transferred from forest and prairie to cultivated fields, and peopled in a single year. With the rapid and vast mutations that are going on around us, can you expect that our condition as dairymen will remain always the same. Notwithstanding the vastness of the dairy interest, and almost astonishing progress in the quality of its goods, the work of manufacturing dairy products, even in its present improved condition, is very imperfect, and in some respects wasteful. It is but a temporary economy, and very unlike the results of other manufacturing. The man who spins and weaves the fibres of wool and cotton adds the value of his labor to the value of the raw material, and his goods go to the consumer with this increased value, who is but too glad to pay for what has been added at a cost much less than he could have added it himself. So the man who grinds our grain and smelts our ores increases the value of his raw material by the value of the labor he has added to it. Not so in the manufacture of dairy products. Milk, by being manufactured into cheese, acquires no additional value as food. It is even less by one-tenth that is left in the whey. Nor has it any higher commercial value —for if the milk of which it was made were placed in the same market with the cheese it would bring a greater amount of money.

The dairyman gives two-fifths, or 40 per cent, of his raw material for manufacturing, and pockets a loss of 10 per cent, making 50 per cent in all, which he gives, not for increasing its inherent value, but simply for the sake of diminishing its bulk and prolonging its keeping qualities. The loss of food in converting milk into cheese is not, to be sure, of much account, as it is mostly of the kind called carbonydrates, and is cheaply supplied in other food in which it is in excess. But in converting milk into butter the process is wasteful in the extreme. Very nearly all that is valuable as a means of sustaining life is cast away. All the cheesy or flesh-forming material in the milk, which constitutes its intrinsic value as food, is essentially lost as a means of sustaining human life. The present process of butter-making is too wasteful of human food to be long tolerated where economy is required to obtain the means of subsistence, or where the means of sustaining life

have any considerable value. To use milk only for making butter in the way it is now generally done is just as wasteful as it would be to slaughter a fat ox, and strip from his sides so much of the fat as could be readily separated, and then to throw in the carcass to the pigs. You may think this an extravagant comparison, but I appeal to the considerate reflection of you all for its justness. We object to converting grain into alcohol because of the attendant waste of food. I will not compare butter with alcohol, but in its manufacture is the waste any less? Milk is not only the best animal food, but is very much cheaper than meat. It contains as an average 13 per cent of solid nutriment, and meat 26. Two pounds of milk, or one quart, is equal to a pound of lean meat. A quart of milk can be produced and sold at less than half the cost of a pound of meat. It is therefore the cheaper. Its equal healthfulness can hardly be questioned. That it is perfectly adapted to the use of infants and children is a fact too well established to need any confirmation, and when it has been deprived of a part of its water—*i. e.*, condensed—it is equally good for adults. This is now done on a large scale at a small cost, and the only obstacle in the way of bringing condensed milk into general use as a substitute for butter and cheese, and other animal food, is the great cost of apparatus for doing it. That the perishable nature of milk can be counteracted, and a part of its water evaporated on a scale commensurate with the capacity of factories and dairies, is possible and even probable, and hence I point you to the use of condensed milk as likely in the future to modify our export trade and the cheese interest not only, but the whole business of dairy husbandry.

I see nothing in the immediate future to indicate any sudden change in our exports, and yet I do not think the probabilities of holding an unvaried continuance of the British trade as good as they were a year ago.

The question of our ability to compete with English skill in satisfying English taste I consider settled. Nor is there anything unusual to be anticipated from German cheapness; and that the large extent of grass land in the north of Europe will be studded over with cheese factories, and fill the markets you have learned to supply, there is no fear at present. I anticipate that the shipping interest of the United States will meet with more formidable competition nearer home. I allude to

our Canadian neighbors. A brief sketch of the Canadian cheese interest will indicate the bearing that interest is likely to have upon our own. During the year which preceded the abrogation of the Reciprocity Treaty, which occurred in March, 1866, our bill against Canada for cheese was, in round numbers, $200,000, which represented something like 1,500,000 pounds of cheese. The almost prohibitory tariff which was then laid upon that luxury compelled the Canadians to rely upon supplying themselves with their own make. They started on the associated plan, which proved there, as well as in the States, a perfect success, and there has been built up from that beginning, in the short space of six years, an interest that has grown into an important branch of commerce. I have not the figures to show the rate of progress any further back than 1869, in which year I find them supplying their own necessities, and exporting to the mother country 5,827,782 pounds—almost six millions. This is progressing with an impulse that indicates American blood.

The next year (1870) ending June 30, 1871, they added 2,443,657 pounds more, making a total export that year of 8,217,439 pounds. I have not the figures for the year ending in June, 1872, but in my visits to Canada last winter and spring I found that the best informed shippers estimated the increase of that year from 5,000,000 to 8,000,000. The lowest estimate for that year would make a total of 13,250,000. With a laudable animation and zeal, extensive preparations, I learned, were everywhere being pushed with a view to a still greater increase during the season just past. I do not, of course, know precisely, but I think it fairly probable, that their fiscal year, which will end with June, 1873, will show that instead of purchasing from us, as formerly, from 1,000,000 to 2,000,000, they have taken the place of our exports to the extent of 20,000,000 pounds. Whether this estimate is too large or too small, the fact must be apparent that Canadian cheese must before very long seriously affect our trade in the English market. They learned to make cheese of us, and they make it after our pattern. They have not yet attained to the excellence of our dairying districts, but there is enough of the American element among them to perfect the art by and by. They have a vast extent of country, with a soil favorable for the production of the best grasses, and well watered, and with a climate suited to cheese-making, and last, but not least, both land and labor are

cheaper with them than with us. They have the elements for producing excellent cheese at a less cost than we can, and, when the price of our exports shall be reduced to the bare cost of production, our Canadian friends will be able to sell at the same price, and have a margin left for profit. The circumstances which surround the Canadian cheese interest are suggestive, and, like coming events, cast their shadows before. But that interest is already affecting us. A place for 20,000,000, in addition to our present exports, would have a stirring effect upon prices.

The cheese interest rises or falls with the price cheese can be sold for; and, as with everything else, that price is controlled by the relations of supply and demand. Enlarging the demand makes trade brisk and prices high, and prosperity to dairymen follows. Without attempting or desiring to depreciate the value of our exports in the past or the present, I think the question may here be fairly raised whether catering to a foreign instead of a home market is now the most efficient way of creating a demand.

The propriety of cultivating a home market has been often and ably discussed, and I shall perhaps appear stale in noticing it to-day. But there are some considerations connected with the course dairymen are pursuing, with regard to home and foreign markets, that I must ask your indulgence for calling up at this time.

The home trade affords a much larger field for operating in than the foreign one, the latter being almost entirely confined to England, and a small per cent gain in the former might easily be supposed to produce a larger result than in the latter. But it may be asked—Why not cultivate both? I answer, because it is written—"No man can serve two masters." To maintain a good reputation in the English market, it is necessary to send our finest goods there, and to keep the poorer class for ourselves. Most of the poor cheese will neither bear nor pay transportation. The effect of this is to depress the standard of cheese in our own markets, to diminish consumption, and lower prices. To make cheese for the English market is to unsuit it for our own. Its maturity is so much hastened, in its passage across the ocean, that, to prevent it from becoming over-ripe before it reaches its destination, it must be made firmer and dryer than our own people desire it. If the practice of making this style of cheese was confined to what is actually shipped there would be less cause for objection. But most of the factory cheese,

including what remains at home, being made with the supposition that it will be shipped, is made too dry and hard for home use.

So long as we continue to send out of the country so much of the best cheese, both factory and dairy, the home market will be comparatively inactive, and cheese-eating in little favor. This state of things is incident to a large shipping trade. It is not peculiar to us. The Canadians are in a similar situation, and even worse. They ship their choice cheese even closer than we do, and leave little else than the very dregs for home use.

I have spent most of the past year in the city of Rochester, and have looked somewhat after the condition of cheese in that market. It has been very difficult to find such as I could call either palatable or wholesome. What is true of Rochester, I suppose, is true of most other cities in the Union. But very little cheese is offered which is either inviting or satisfactory.

I do not say this to make out a strong case. I speak of the trade just as I see it, and just as consumers speak of it. I only declare to you the opinion they entertain, and I speak thus plainly in regard to it because I consider it is exerting a tremendous influence for evil to the cheese interest of the country. Having thus called to attention to it, I have perhaps said all I ought to say on the subject. But this state of things is exerting indirectly an influence in another way. The opinion which has to some extent prevailed that cheese, even in its best estate, was unhealthy and must be used sparingly, has, from the frequent occurrence of poison cheese, and from the faulty condition of the cheese in our markets, swelled almost to a universal conviction.

When I wrote the essay, in which I endeavored to demonstrate that cheese was wholesome as well as economical, I felt strongly the necessity of replying to this charge, which I then knew lay heavily against it.

It seemed appropriate that a more full statement of the sanitary effects of cheese should accompany that paper. But, being admonished that brevity was desirable, it was omitted, with the hope that some other pen would take up the subject. I am not aware that there has yet appeared any clear or full statement of its hygienic effects. As it is important that consumers should know its true relations to health, and that you, as cheese-producers and makers, should be familiar with all that pertains to the goods you offer the public, I will, with your

permission, state my convictions on the subject. Besides the occurrence of poison cheese, and certain varieties that seem to be allied to it, there is a pretty common belief that the use of cheese tends to constipate the action of the liver and bowels, and hence disturbs the general health. That the effects, as stated, follow the use of cheese, I am not disposed to deny. I am not bold enough to dispute or question the experience of a whole community.

But I may, without presumption or arrogance, question a conclusion drawn from that experience. The fact that all the cheese used by an individual or a community may have been followed by certain effects is not conclusive that all cheese would be followed by the same effects; and this is what I shall attempt to show.

Before going further, let me call your attention to the nature of the changes which occur in the manufacture and curing of cheese. I have stated to this Association on former occasions, and I will remind you again now, that the changes which occur in converting milk into cheese are of a digestive character, and are produced by the use of the gastric yeast applied to the milk under the name of rennet. From the use of this agent certain changes uniformly occur in the cheesy matter as it passes from its liquid state in the milk to the solid-pressed curd, and then to its soft, salvy condition in mature cheese. These changes are regular in their course, developing certain products at each stage, and varying the condition of the caseine all the way along. The first new product is the whey; then the development of lactic acid, and then a little vinegar; then the changes assume a putrefactive character, and ammoniacal gases are evolved, followed by soluble substances that resemble gum, and an oil to which is ascribed the peculiar flavor of cheese, and finally, the caseine begins to degenerate into several fatty matters, and the whole mass becomes salvy, rich and soluble, and, as we call it, cured. It is the rennet which was put into the milk, and which was inclosed in the curd, that has occasioned all these changes, and which has itself varied with the varying condition of the mass in which it was contained. I wish you to mark the fact that the caseine does not become soluble till the latter stages of maturity, and that not till then does it take on its fatty appearance.

Curd, so long as it remains such, is soluble only by the aid of some alkali. It does not, as you know, dissolve in water, nor in acid whey.

If taken into the stomach, it is neither digested nor dissolved till it is changed, or meets with an alkaline liquid. And here you may see the indigestibility charged upon cheese. It is not a quality that is inherent in the cheese, but is one which attaches only to its curdy state. American cheese-makers have brought their cheese into disrepute with our people, and subjected it to the disreputable name of indigestible, by thrusting it upon the market before it is properly cured. A very large percentage of cheese we find on sale is little less than half dried curd. It is not cheese in the proper sense of that term.

It is doubly unfortunate to offer such green curdy stuff to American people. They are notoriously a nation of dyspeptics, and a more unfit class of consumers could not be found to cope with such indigestible matter. It could hardly do otherwise than to disturb the stomach and the geueral health, and to produce disturbance mentally and morally, as well as physically. I should, from *a priori* reasoning, consider it a matter of prudence to keep a respectful distance from a dyspeptic with a meal of green cheese in his stomach.

It would be very natural to suppose that the tendency to constipation complained of in cheese would follow from such difficult digestion, and it may have something to do with it, but I think it is not the principal cause. Rennet in its natural state, or as used in cheese-making, has, if taken alone, just the constricting tendency of green cheese. It is taken up in the curd in an unaltered condition, and, if carried into the stomach, must produce its specific effect. Fortunately it does not always retain that action—for, as I have before stated, it changes as the curing process goes on—a fact which is in perfect accordance with the usual behavior of ferments. The same yeast that produces lactic acid changes that acid into alcohol, and the alcohol into vinegar, and in each of these changes is itself changed, and assumes a new form. Thus with the digestive yeast or rennet. When the ripening process has reached the stage in which the caseine becomes broken down and soluble, and fatty matter begins to be freely formed, the rennet, without losing its vitality, is itself so changed as to lose entirely its constricting tendency, and becomes laxative instead.

Cheese needs to pass through a period of ripening the same as fruit, and for a somewhat similar reason. Green cheese is no more fit to eat than green fruit. But when it has, like fruit, reached a proper stage of

ripeness, it is as easy of digestion and as wholesome, and may be used as freely as any other equally concentrated food. The English generally use mature cheese, and hence can eat it as freely as other food, and with equal safety, while we, by using it green, can take but little, and often find that little too much.

An expert can distinguish the different conditions of cheese at a glance; but consumers are not generally experts. Their acquaintance with the characteristics of cheese is so slight that but few are able to distinguish the good from the poor, and they purchase, if they buy at all, just what happens to be set before them. It is not easy to make this discrimination with words. Experience and observation must be the only true guide. The extremes of maturity and immaturity may be easy enough to define, but it would be as difficult to describe the intermediate stage as it would be to state the precise time when an apple is ripe. But I will name some of the external indications of fitness and unfitness for use. The proper stage of ripeness is characterized by a total want of elasticity when pressed with the finger. The cheese feels as if breaking under the finger, and the dent remains; has a salvy and oily appearance when mashed between the thumb and finger, and melts on the tongue, like a ripe pear, when taken into the mouth; and it retains, when cut, a soft, oily surface for a long time, not readily drying up. The opposite indications mark the unripe, indigestible cheese, viz., elasticity when pressed; a hard or tough structure when mashed between the thumb and finger; drying and cracking readily when exposed to the air; a harsh and dry appearance in the tier; and a want of fat and disinclination to melt when masticated. It is not enough that a cheese is soft or free from objectionable flavors. It must have had its caseine changed, and its tough, curd nature broken down, so as to dissolve easily. Cheese that dries rapidly on being cut may always be relied on as not having yielded up its curdy nature to the cheesy fermentation, and is subject to the charge of difficult digestion. The water in curd is feebly retained—most of it mechanically held in minute cavities—while in ripe cheese it enters into chemical union with the new products formed by the more complete fermentation, and contributes to the buttery appearance of ripe cheese, and hence does not evaporate away readily.

I find but little cheese among the retailers so well cured as to be free from the charges imputed to cheese generally, but which really lie

only against imperfect cheese. And why is there so little? Perhaps the first reason is that dairymen are often in a hurry for returns, and push their goods off green to make quick sales. This course saves room in the factory or dairy, and care and shrinkage. The individual may gain a little by such a course, but the dairy interest loses much. But dairymen are often driven to this course because their cheese might decay before it would be properly cured, and, if perchance it reached the desired condition, it might not remain long enough in that stage to be disposed of to advantage.

Cheese made from milk that is tainted, or otherwise imperfect, will not live to a respectable old age. There is plenty of cheese of this sort that must be disposed of prematurely to save it. This kind of cheese is very much in the situation of a certain farmer's hogs last fall. The owner had made up his mind to keep them till New Year's because he thought they would not be fit for market sooner; but, to the surprise of his neighbors, he was seen making hasty preparations to kill them in November. When asked the cause of this sudden change in his determination, he replied with much earnestness: "They have got the epizootic, and I have got to kill them to save them."

It is very much so with cheese made in the hot part of the season from milk that is tainted, or so faulty as to incline the curds to float. It has got the seeds of destruction in it, and the dairyman has got to get rid of it, or it will spoil on his hands. American cheese generally is too short-lived. It does not give the producer a sufficient latitude to dispose of it to the best advantage. It must go to the consumer within a comparatively short time, for its perishable nature will not allow it to remain. This is a great misfortune to the cheese interest. It stagnates the markets, and drags down the reputation of, and casts a suspicion upon, all cheese. There is no necessity for this short-lived tendency. Milk that comes from healthy cows, that have been fed upon wholesome food, have had pure water to drink, and pure air to breathe, will, if properly handled and manufactured with a fair degree of skill, make cheese that will keep one, two, or even three years, with perfect safety. This is not a difficult thing at all, if only the circumstances connected with the production and management of the milk are properly attended to. The Swiss are notorious for making such goods. You may say that the sweet feed upon the Alps, and the pure breezes that fan the

mountain pastures, and the crystal waters that ripple down their slopes, give them advantages over dairymen on lower lands. That may be so. But the people of England, in the low, moist climate of that island, do the same thing. I have seen English cheese, as doubtless many of you have, two years old that was right in its prime. I dare say there are mauufacturers in this room who have made cheese that would hold out good for two or three years. Samples of this kind are often on exhibition at our agricultural fairs. But such cheese can't be made of tainted milk, nor milk in which the inclination to tainting has been started.

What has been done can be done again, and it seems very desirable to repeat these examples of perfection in the details of milk production, and handling, and manufacturing, which, while they insure long keeping, insure also purity of flavor, and healthfulness, and remunerative prices.

Our cheese is not only too short-lived, but, with all the improvements yet made, it is largely imperfect in flavor.

The flavor of cheese seems not to have been looked after as much as some other features. Perhaps one reason for this is the fact that buyers have looked more to texture than to taste. And the towering advantage derived from bringing large masses of milk together to be benefited by the skill of one man, and the great saving of labor and expense in manufacturing and curing, and in giving a uniform appearance and quality to cheese, seem to have satisfied dairymen, and they have not given the consideration which is due to some practices that affect the keeping and flavor of cheese, and they have been allowed to remain. I will notice a few particulars of this kind.

The present practices of dairymen in handling and carrying milk to factories are of this sort. They promote a tendency to decay in milk before the rennet is applied, giving the germs of putrefactive fermentation the start of the action of the rennet.

That milk which is sound when the rennet is applied will make a cheese that will keep sound longer than one that was made from milk that was tainted, when the rennet was applied, needs no argument to prove ; and that a tendency to tainting will produce an effect proportionate to the progress made is equally evident. That large masses of milk spoil sooner than small ones, and warm milk sooner than cold, and milk in confined air sooner than in open air, are facts well known to

every dairyman, and yet they are ignored year after year by the patrons of almost every factory in the country. The milk of a dairy massed in a body, warm and closely covered, is moved from the dairy to the factory in this condition. What more favorable circumstances could be desired to induce taint and insipient decay? I have no doubt, from what I have seen by watching the practice, that more progress is made in milk thus treated in one-half hour than would be made in 12 hours in milk cooled and open to the air. If taint, actual and sensible, is not produced, the germs of putrefactive fermentation, which are always in milk, will be started at once, and a tendency to taint begun, which will be sure to go on—for a taint once started never lets go its hold. All the progress it has made will be kept. Just how much advancement has been made every patron can decide for himself when he lifts the cover from his can on reaching the factory. Whatever progress has been made may be counted as so much done towards shortening the life-time of the cheese to be made from it. If perceptible taint has been produced it will be likely to spoil the cheese before the curing process can be completed. If it is less, the cheese will last longer, but, at any rate, will fall some ways short of lasting as long as cheese from sound milk. All this, it would seem, is so plain that the way-faring patron could not help seeing it. But somehow the practice goes on, and is almost universal. I know it can be said that the hot weather, and the food and drink and air, of which the cow partakes, and her treatment, all conspire to the unfortunate result; and that is undoubtedly so. But notwithstanding that, there is but very little milk that is so unsound when it comes from the cow that it will not make excellent cheese if it is at once properly aired and cooled, and allowed free access to the air on its way to the factory. Milk, as it comes from the cow, is never perhaps in its best condition for making cheese. It needs to be improved by airing, at least. But the present practice of dairymen makes it worse instead of better—for the milk which appears sound at the dairy appears unsound at the factory.

The injury resulting from the practice alluded to is not confined to enhancing the perishable nature of cheese. It injures the flavor as much. There are numerous agencies in milk of a putrefactive character, of which the basis of "animal odor" is but one. Whatever will develop one will develop all. If the cultivation they have received at the hands

of the dairyman does not set them so far ahead of the rennet as to keep them in advance of it, they will at least act with it, and modify the flavor of the cheese, and every such modification produces an unfavorable effect. The purest flavor and best keeping qualities are obtained when the rennet acts alone without any modifying influence. Clean flavor and long keeping are correlative qualities, and go together. The presence of one is an evidence of the other. All the strong or offensive flavors that attach to cheese, of whatever name or nature, are of a putrefactive character, and injure keeping as well as taste. And it requires but a slight putrefactive agency to render the oily matter in milk or cheese rancid, and a further injury to flavor and healthfulness follow. When you consider, in all its bearings, the treatment milk is accustomed to receive before it reaches the factory, I think you will agree with me that it is pregnant with evil, and that it is a serious obstacle in the way of improved cheese-making.

The want of pure air in factories, especially in manufacturing rooms, is another defect that has been allowed to follow the factory system. There are but few factories that, to an outsider, do not smell more or less of sour or stale whey. The inmates of the factory soon become accustomed to this odor, and fail to recognize it unless it is pretty strong; and hence it is not uncommon to find the air of a factory conveying emanations to an extent sufficient to affect the quality of cheese. The emanations are absorbed by the milk standing through the night in the manufacturing room, and by the cheese while curing. I am not going to complain of the manufacturers for a want of common cleanliness—the fault is perhaps more in the arrangement of factories than in the workmen. Milk ought not to stand through the night in a manufacturing room with a porous wooden floor full of seams and joints, and perhaps holes that will allow whey and wash-water to fall through; neither ought the cheese, while curing, to be allowed the contact of odors from such a room.

It would be much better if the milk brought to the factory at night could stand in a building apart from the manufacturing room, and entirely out of the reach of its odors, and be wheeled into the manufacturing room when ready for working. The cheese made of milk that has been permitted to stand where it will absorb the fumes of sour whey is inclined to be drier and less adhesive than it otherwise would be; the

process of curing is partially counteracted and retarded, and it acquires a lifeless and insipid flavor, and, if the fumes have been pretty strong, will take in a distinct odor and flavor of the stale whey.

Lest some of my hearers may think I am ascribing effects too large for the cause, I beg leave to remind you of the absorbent properties of milk, and how readily ferments take root in it and grow and multiply. It is a matter of common observation that milk standing in a cellar in which are any strong-smelling vegetables, as onions, cabbages or turnips, will invariably smell and taste of those vegetables, or of any other peculiar scent that may be in the cellar. An expert in handling butter assured me that he could unerringly distinguish, by the taste and smell, the difference between butter made from milk kept above ground and that kept in a cellar, no matter how neat that cellar might have been kept. Well authenticated cases have been published in which small-pox, typhoid fever, scarletina, measles, and other infectious diseases, have been conveyed through the virus absorbed by milk which has been allowed to stand in the sick room, or been handled by parties before fully recovering from such diseases. The common souring of milk proceeds wholly from an agency it absorbs from the air. There is no air so pure but that milk will, in a few minutes, absorb from it the seeds of a ferment thas will cause it to become sour. This may be easily proved. Take, say, two quarts of milk, and heat it to the boiling point to kill all the germs it may chance to contain, and, dividing it, seal up, while hot, each half in separate cans, just as you would canned fruit, and then let the cans stand till the milk is cooled down to 70°. Now open one of the cans and let the milk be exposed to pure air 10 minutes, and then seal up again as before, and let both cans stand together at a temperature of 65° or 70°. The milk in the can which has been opened will sour in 36 to 48 hours, and the other will keep just as well as any canned fruit, and remain unchanged for any indefinite length of time. In the 10 minutes' exposure, it must be remembered, this infection was given from pure air, in which nothing could be detected.

Now, if such a result can be brought about by so slight an exposure to pure air, what must be expected from milk standing in an atmosphere so loaded with infection as to be easily recognized by the olfactory nerves? Is it any wonder that the fumes of sour and stale whey should make their mark in the cheese made from milk to which they have been

exposed? It would be a wonder if they did not. I wish to press upon the attention of dairymen, and especially of cheese-makers, the fact that all odorous vapors that mingle with the air of a factory, whether they come from whey and slops spilled upon the floor, or from draining under the floor, or around the factory, or from too near proximity of a hog-pen, make their impress upon the milk or cheese with which they come in contact. By mingling with the odors of the curing cheese they may become, if not very strong, so altered and obscured as not to be easily identified, but they will nevertheless do their certain work in modifying unfavorably the characteristics of the cheese, making it undesirable and short-lived.

The floors of but few factories are so perfectly constructed as not to allow whey and wash-water to soak into them, or lodge in cracks and crevices, or to leak through them and to soak into the ground below; and whenever this happens it is impossible to keep the scent from rising and spreading through the factory. Such occurrences, though not universal, are so common as to have a depressing influence on the character of factory cheese.

To illustrate the difference between having pure or impure air in a factory, I will make a few extracts from the notes of two factories, taken in the fall of 1870, while visiting factories in the Valley of the Mohawk. Omitting names, I will designate the factories by numbers :--

No. 1 was built over a small stream of pure water, three feet or more from the ground; received its supply of milk from some of the oldest and best pastures in the watershed of the Mohawk; floor of manufacturing room bored full of holes, through which whey and wash-water fell upon the ground and run into the stream or soaked into the ground, according as the amount was large or small; hillocks of mould and filth accumulated on the ground under each hole in the floor; much whey spilled, spattered and leaked from the whey shutes, sinks and presses, through holes or crevices on the ground below; curds skillfully handled, and appeared fine, but smelled and tasted of the air in the factory; fumes had free access to curing rooms above, which looked clean and tidy; cheese looked nice--bored several, all of which tasted of sour and stale whey; in the tier, appeared lifeless and curdy, and evidently not curing down well; cheese occasioned considerable trouble, and sold below par.

No. 2 was built on a dry incline, with the lower side three feet or so above the ground; received milk from flats and gravelly soil; floor perfectly tight, not a drop leaking through; especial pains taken to prevent whey from being spilled or spattered on the floor; wash-water and drippings from presses conducted away in open gutters—kept sweet by frequent scalding; air in factory pure as out-of-door breezes; milk and curd handled in the usual manner—almost precisely the same as in No. 1; curing room in separate building, neat and ventilated; cheese looked fine—bored several, all fine-flavored, meaty and rich, gave no trouble, and sold at top of market. It will be no disgrace to No. 2 to say that, in competition with some of the best factories in Herkimer County, it took the first premium at the New York State Agricultural Fair, which I was satisfied it merited from the unusual purity of its flavor.

Nothing could be clearer to me than the different atmospheric influences of these two factories; yet the manufacturers in No. 1 had not the least suspicion that their skill was being thwarted by the unnoticed fumes of sour and stale whey. The influence of such odors is insidious, but powerful, and, if obviated, would raise the standing of many a second class factory. It operates to an extent, though little suspected, so wide as to affect the national reputation, and needs the watchful attention especially of cheese-makers.

In glancing at some of the leading circumstances that affect the cheese interest, the defects in curing and in the quality of rennet, as well as some other items, deserve consideration; but I have detained you too long already, and I shall pass them by. I will remark in regard to rennet that there is a possibility that it may be dispensed with, and electricity used in its stead. Professors well acquainted with the science of electricity assure me that milk may be coagulated even more rapidly by it than by rennet, and a cheese-maker, who claims to have used it for the purpose of cheese manufacture, informs me that he has found the curd made by it to cure into fine-flavored cheese. He reports it as having extraordinary efficiency in reducing the curd of skim milk into salvy, rich-appearing cheese, but it did not restore the flavor that was lost by the removal of the cream. It was said to have just the flavor which the milk, in its skimmed or unskimmed condition, would produce. I have no experience of my own to verify these assurances. The matter is now undergoing a thoroughly scientific investigation, and, if the

coagulation proves as stated, it will be put to practical tests at the opening of the season, and the result reported to the next convention. It was not my purpose to say anything to go before the public on this subject until it had been tested, lest I might give rise to expectations that would never be realized; but, from the allusions made to it in the secretary's circular, I have deemed this notice appropriate.

I most earnestly hope that good may come out of it, for the odoriferous matter that goes with the rennet into the cheese has a distinct influence in modifying flavor and longevity. All that gives odor to rennet is a modified concentration of animal matter and odor very putrefying in its influence, and entirely extraneous to, and unnecessary for, the action of the little giant that is so efficient in the soaking of the stomach.

The active agent in rennet, when separated from its disgusting accompaniments, is entirely tasteless and inodorous, and adds no peculiar flavor to the cheese, nor does it produce any cavities, or huffing, or any sort of porosity in the cheese while curing. All that kind of effect comes from some kind of ferment outside of rennet.

The remedies for the defects which follow in the wake of the factory system, for the most part, suggest themselves, or have already been discussed by the convention.

For the injury now done to milk before it reaches the cheese-maker, airing and cooling at the dairy and on its way to the factory, and the continued application of these means by the manufacturers, are the efficient remedy. Airing and cooling should go together—neither is sufficiently effective alone. Cooling stops no tendency to putrefaction, and kills none of the germs that produce change in milk—for the moment the temperature is raised to a favorable pitch they spring into vigorous activity, like vegetation in the spring. But it retards their progress—and this is important. Air absorbs away the filthy odors, and kills all the growing germs it touches. It kills no undeveloped spores or seeds. Until germination takes place, they may float on the air with perfect impunity; but, the moment they begin to grow, the contact of oxygen puts them *hors du combat* instantly.

In all the means now before the public for airing milk, the air that goes into it is itself loaded with seeds that are pregnant with change and decay. The office which the air performs, besides cooling and carrying

off odors, is to kill off the growing crops of germs in the milk, and plant in their place a more slowly-growing variety, and thus gain time for the cheese-maker to forestall their action by the seeds of coagulation. It would be much better if the air which was to come in contact with the milk could be deprived of the millions of germs it contains, so as to prevent this receding of the milk, but as yet no means are before the public for doing it.

I have been informed, however, since I came here, that a gentleman well know to many of you for his unusual aptitude in mechanics and invention—Mr. Stewart Perry, of Newport, N. Y.—has devised a simple and inexpensive method of doing this. It is simply causing the air that is forced into the milk to pass through gun cotton, cotton wool, or some similar fine, fibrous substance, which catches and filters out every seed of infection. Pasteur did this most effectually on a small scale, and if the plan proposed shall be found effectual on a larger scale —and it certainly appears feasible—it may prove a valuable discovery for the dairyman. But taking the air as it is, without any unusual infection, it is a most valuable and efficient means for improving the condition of milk for cheese-making.

The means of improving the atmosphere will occur to the owners of factories and the cheese-makers. I have said all I have need to in pointing out its effects.

And in regard to rennet I will only say that so long as its use must be continued, or until some future genius shall rise up and make an inodorous extract holding the active agent in solution, the objectionable features of the steepings may be very nearly wiped out by putting a bag of charcoal in the jar, and weighting it so it will sink.

In this hasty survey of the cheese interest I do not wish you to draw the inference that I have dwelt upon some of its attendant defects from choice, or because I see none of its better features. Defects must be pointed out and be seen to be corrected. While I am grieved and ashamed of the very large defects in flavor and quality which attach to much of our cheese, especially of that which falls into some of our home markets, and of the unhealthful condition in which it is offered, lowering its high reputation and restricting its use, I am not insensible to the high reputation which American dairymen have earned for themselves.

That we supply a million and a half per week to the most fastidious cheese-eaters on the globe, who themselves boast of their time-honored skill, and acknowledge that we satisfy their taste and crowd their own goods out of market, is an achievement of which any dairyman may feel proud.

Every dairying country has its excellencies and defects, and of course we must share with the rest. The Swiss can boast of an Alpine luxury; the French have their Gruyere and their Roquefort; the English rejoice in their Cheddar and Stilton; and we have our Herkimer County—a full match for the best of them.

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The following Table
from which we ha
Average Wei
Made, o

Name of Factor
Addington
Allen's Settlement
Anvern
Anvern
Avon
Bastard
Beaver
Black Creek
Bloomfield
Bogart
Brand's
Brownsville
Brucefield
Burgessville
Burnside
Caistorville
Cedar Spring
Cherry Ridge
Cherry Valley
Clinton
Cromarty
Dairy Fogarig
Dairy
Dorchester
Dereham Centre
Dulsemane
East Nissouri
Embro
Ellersly
Elzivin
Escott
Excelsior
Farmersville
Falls Spring
Forfar
Frankfort
Front-of-Sidney
Fullarton
Golden
Gore
Gram's
Harriettsville
Henderson's
Hungerford
Ingersoll
Island Dale
Junctown
Lansdowne

CONDENSED REPORT.

The following Table gives the Names of all Factories, with their P. O. Address, from which we have received reports, together with the No. of Cheese Made, Average Weight, No. of Inches in Diameter, No. of Lbs. of Cheese Made, and the No. of Cows represented at each Factory.

Name of Factory.	Post Office.	No. cheese made.	Av'g weight	No. in. Diam'r	No. lbs. cheese made.	No. of Cows.
Addington	Newburg	2075	62	15½	128965	505
Allen's Settlement	Cooper	1015	67	16	68531	250
Anvern	Fairfield, East	1300	65	16	84500	380
Anvern	Brockville	1450	64	15½	9280	365
Avon	Avon	1920	73	16	140143	....
Bastard	Newboyne	.....	60	15	.....	500
Beaver	Lansdowne	1000	60	15	60000	275
Black Creek	Sebringville	3095	73	16	225850	1000
Bloomfield	Bloomfield	1500	65	16	104000	... ..
Bogart	Tweed	550	64	16	35200	168
Brand's	Forest	329	57	15	18753	65
Brownsville	Brownsville	7341	71¾	16	527619	1600
Brucefield	Seaforth	2300	63	15	144900	600
Burgessville	Norwich	1880	69	16	130781	450
Burnside	Putnam	782	66	16	45000	250
Caistorville	Caistorville	691	64	16	44235	170
Cedar Spring	Farmersville	1200	62	15½	78400	250
Cherry Ridge	Newboro	730	60	15½	44350	190
Cherry Valley	Picton	1163	69	16	80354	325
Clinton	Clinton	890	55	15	44565	....
Cromarty	Cromarty	661	65	16	42979	200
Dairy Fogarig	Brockville	190	50	16	9500	30
Dairy	Farmersville	262	65	15	17066	54
Dorchester	Henry	225	65	16	14625	80
Dereham Centre	Mount Elgin	1108	57	14	64000	142
Dulsemane	Lansdowne	1022	62	15	63361	265
East Nissouri	Ingersoll	5202	65	15	338183	1400
Embro	Embro	800	69	16	55500	250
Ellersly	Gananoque	906	61	14	58884	230
Elzivin	Queensborough	510	63	16½	32529	102
Escott	Mallorytown	1242	66	15½	83214	276
Excelsior	Simcoe	1000	70	16	70000	300
Farmersville	Farmersville	1200	62	15½	78900	250
Falls Spring	Lansdowne	1000	64	15	64000	260
Forfar	Forfar	1400	64	15	89600	350
Frankfort	Warwick	1200	68½	15	81801	350
Front-of-Sidney	Belleville	4600	66	15½	305705	1000
Fullarton	Fullarton	955	66⅓	16	63350	250
Golden	Eldorado	748	69	16	51825	200
Gore	Ingersoll	547	75	16	41289	141
Gram's	Derwent	1025	73	16	64671	200
Harriettsville	Ingersoll	3980	70	16	497500	1000
Henderson's	Ingersoll	850	71	16	60265	220
Hungerford	Hungerford	1306	62	15	80972	288
Ingersoll	Ingersoll	2841	70	16	198840	800
Island Dale	Ernestown	860	50	14	43000	220
Junctown	Mallorytown	900	65	15½	58534	200
Lansdowne	Lansdowne	1724	64	15	110918	420

CONDENSED REPORT (Continued.)

Name of Factory.	Post Office.	No. cheese made.	Av'g weight	No. in. Diam'r	No. lbs. cheese made.	No. of Cows.
Lawson's	Salford	2438	68	16	165784	550
Littlewood's	London	220	50	16	10672	35
Londesborough	Clinton	1206	57	15	69194	360
Maple Grove	Strathallan	1360	71	16	96849	320
Maple Leaf	Ingersoll	1351	70	16	94298	....
Maple Dell	Woodstock	320	64	16	20224	85
Maple Grove	Gananoque	402	60	15	24141	110
Melrose	Melrose	1003	68	16	68895	219
Milverton	Milverton	900	70	16	63000	....
Morton—No. 1	Morton	1106	70	14¼	77806	280
Morton—No. 2	Elgin	2203	65	14¼	144042	450
Morton—No. 3	Southlake	2108	70	14¼	147009	450
Morton—No. 5	Gananoque	1792	68	14¼	122116	375
Mountain	Shannonville	1295	59	15	76405	250
Otterville	Otterville	261	59	16½	15397	55
Oxford	Norwich	1757	65	16	114127	400
Platt	Adolphustown	1300	58	15½	76068	250
Plum Grove	Wellman's Corners	766	64	15½	49073	190
Phillipsville	Phillipsville	2660	63	15½	167580	500
Portland	Forfar	1000	64	15	64000	250
Quinte	Northport	1857	59	15	109708	400
Ridgetown	Ridgetown	689	71	16	49473	....
Rymph's	Tilsonburg	550	70	16	38179	150
Riverside	Prescott	454	63	16	28602	100
Rockford	Vittoria	1189	69	16	83127	275
Robbin's	Chapman	1514	71	16	107581	333
Sager's	Troy	770	75	16	57750	250
Sedley's Bay	Lansdowne	965	68	15½	65620	270
Silver Bank	Farmersville	1150	60	15½	68252	300
Silver Springs	Gananoque	950	65	15	63750	250
Sidney	Belleville	1000	66	15½	66000	200
Sparta	Sparta	523	65	16	33880	160
Starr	Lynn	2425	66	15½	160000	500
Springfield	Lyndhurst	500	65	16	30000	90
Springfield	Kingston	200	52	15	10417	45
St. George	St. George	1883	73	16	138778	420
South Augusta	North Augusta	1200	60	15½	80000	400
Sidney Town Hall	Walbridge	2820	66	15½	186000	610
Summerville	Otterville	901	71	16	63971	260
Sydenham	Sydenham	150	65	16	57000	150
Syn	Farmersville	2440	64	15½	155160	500
Thomasburg	Thomasburg	2000	72	16	144036	450
Thompson's	Arkona	400	76	16	31172	90
Tyrconnell	Tyrconnell	1015	67	16	68200	250
Unionville	Cedar Grove	600	50	14	30000	....
Union	Canifton	2232	66	15½	148238	500
Villanova	Villanova	424	65	16	27587	130
Victoria	Odessa	350	50	13	17500	150
Victoria	Strathroy	1096	70	16	76754	250
Victoria	Tweed	1700	68	16	115600	400
Victoria	Kerwood	3000	75	16	225000	800
Webb's	Ridgetown	600	73	16½	43803	200
West Magdala	West Magdala	850	62	16	52729	180
Young Canada		900	76	16	65000	225

No. of Cows.
550
35
360
320
....
85
110
219
... ..
280
450
450
375
250
55
400
250
190
500
250
400
....
150
100
275
333
250
270
300
250
200
160
500
90
45
420
400
610
260
150
500
450
90
250
....
500
130
150
250
400
800
200
180
225

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