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PRESENTED BY
PROF. CHARLES A. KOFOID AND
MRS. PRUDENCE W. KOFOID
AN ACT to prevent the adulteration of food or drugs.

[Chapter 407, Laws of 1881.]

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. No person shall, within this state, manufacture, have, offer for sale, or sell any article of food or drugs which is adulterated within the meaning of this act, and any person violating this provision shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be punished by fine not exceeding fifty dollars for the first offence, and not exceeding one hundred dollars for each subsequent offence.

§ 2. The term "food," as used in this act, shall include every article used for food or drink by man. The term "drug," as used in this act, shall include all medicines for internal and external use.

§ 3. An article shall be deemed to be adulterated within the meaning of this act—

a. In the case of drugs.

1. If, when sold under or by a name recognized in the United States Pharmacopoeia, it differs from the standard of strength, quality, or purity laid down therein.

2. If, when sold under or by a name not recognized in the United States Pharmacopoeia, but which is found in some other Pharmacopoeia or other standard work on Materia Medica, it differs materially from the standard of strength, quality, or purity laid down in such work.

3. If its strength or purity fall below the professed standard under which it is sold.

b. In the case of food or drink.

1. If any substance or substances has or have been mixed with it so as to reduce or lower or injuriously affect its quality or strength.

2. If any inferior or cheaper substance or substances have been substituted wholly or in part for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of, or be sold under the name of, another article.

5. If it consists wholly or in part of a deceased or decomposed, or putrid or rotten, animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the produce of a diseased animal.

6. If it be colored, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contained any added poisonous ingredient, or any ingredient which may render such article injurious to the health of a person consuming it: Provided, that the state board of health may, with the approval of the governor, from time to time declare certain articles or preparations to be exempt from the provisions of this act: And provided further, that the provisions of this act shall not apply to mixtures or compounds recognized as ordinary articles of food, provided that the same are not injurious to health and that the articles are distinctly labelled as a mixture, stating the components of the mixture.

§ 4. It shall be the duty of the state board of health to prepare and publish from time to time, lists of the articles mixtures or compounds declared
to be exempt from the provisions of this act in accordance with the preceding section. The state board of health shall also from time to time fix the limits of variability permissable in any article of food or drug, or compound, the standard of which is not established by any national pharmacopoeia.

§ 5. The state board of health shall take cognizance of the interests of the public health as it relates to the sale of food and drugs and the adulteration of the same, and make all necessary investigations and inquiries relating thereto. It shall also have the supervision of the appointment of public analysts and chemists, and upon its recommendation whenever it shall deem any such officers incompetent, the appointment of any and every such officer shall be revoked and be held to be void and of no effect. Within thirty days after the passage of this act, the state board of health shall meet and adopt such measures as may seem necessary to facilitate the enforcement of this act, and prepare rules and regulations with regard to the proper methods of collecting and examining articles of food or drugs, and for the appointment of the necessary inspectors and analysts; and the state board of health shall be authorized to expend, in addition to all sums already appropriated for said board, an amount not exceeding ten thousand dollars for the purpose of carrying out the provisions of this act. And the sum of ten thousand dollars is hereby appropriated out of any moneys in the treasury, not otherwise appropriated, for the purposes in this section provided.

§ 6. Every person selling or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any public analyst or other agent of the state or local board of health appointed under this act, who shall apply to him for that purpose, and on his tendering the value of the same, with a sample sufficient for the purpose of analysis of any article which is included in this act, and which is in the possession of the person selling, under a penalty not exceeding fifty dollars for a first offense, and one hundred dollars for a second and subsequent offenses.

§ 7. Any violation of the provisions of this act shall be treated and punished as a misdemeanor; and whoever shall impede, obstruct, hinder, or otherwise prevent any analyst, inspector or prosecuting officer in the performance of his duty shall be guilty of a misdemeanor, and shall be liable to indictment and punishment therefor.

§ 8. Any acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

§ 9. All the regulations and declarations of the state board of health made under this act, from time to time and promulgated, shall be printed in the statutes at large.

§ 10. This act shall take effect at the expiration of ninety days after it shall become a law.

STATE OF NEW YORK,

Office of the Secretary of State, § 55.

I have compared the preceding with the original law on file in this office, and do hereby certify that the same is a correct transcript therefrom, and of the whole of said original law. Given under my hand and the seal of office of the Secretary of State, at the city of Albany, this 8th day of June, in the year one thousand eight hundred and eighty-one.

ANSON S. WOOD,

Dep. Secretary of State.
In the Court of General Sessions in and for the City and County of New York, at the December Term, 1870.

Hon. JOSIAH SUTHERLAND, Presiding.

THE PEOPLE vs. DANIEL SCHRUMPF. MISDEMEANOR: ADULTERATION OF MILK.

RECORD, TESTIMONY AND PROCEEDINGS.

W. P. PRENTICE, Counsel to the Board of Refuge, and O. S. HASTINGS, Counsel for the People.

LAWRENCE A. WASSNER, Counsel for Defendant. SCHUMPF.

NEW YORK: MARTIN L. BROWN, PRINTER AND STATIONER. NO. 19 AND 20 RUSH STREET. 1871.
In the Court of General Sessions in and for the City and County of New York, at the December Term, 1876.

Hon. Josiah Sutherland,
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Counsel for Defendant Schrumpf.

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Nos. 49 and 51 Park Place.

1881.
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THE PEOPLE AGAINST SCHRUMPF.

NOTE.

The great importance of the testimony in the case of The People vs. Daniel Schrumpf, tried at a Court of General Sessions held in and for the City and County of New York at the December Term, 1876, and the great interest constantly manifested in the determination of the value of the lactometer and of the practical tests used by the Board of Health in the detection of the adulteration of milk in the City of New York, have led to the reproduction in this form of the Judgment Record and of the evidence from the official minutes.
The People

vs.

Daniel Schrumpf.

Indictment—Misdemeanor,
Adulteration of Milk.

Before Judge Sutherland and a jury, December 15, 1876.

W. P. Prentice and George S. Hastings, Counsel for the People; Lawrence & Waehner, Counsel for Defendants.

The jury was sworn, and Assistant District Attorney Rollins in opening the case said that a conviction would be claimed upon the 186th section of the Sanitary Code.

Mr. Waehner—Inasmuch as Mr. Rollins has stated that he claimed a conviction upon the 186th section of the Sanitary Code, I would say that the indictment charges two distinct statutory offenses, one being the violation of the act of 1864 and the other being the violation of the Sanitary Code; it seems therefore that this indictment as far as the form of it is concerned, not alleging the further step of the finding by the grand jury upon the second count—the paragraph, which is not, in fact, a count, and defective for that reason, I move to quash the indictment upon the ground that it is but a single count, charging two distinct statutory offenses.

Mr. Rollins—It is distinctly announced as a second count.
The Court—Probably both counts refer to the same transaction. It is not a ground for quashing the indictment.

Mr. Waehner—I ask that they be put to their election upon which count of that indictment they will proceed.

The Court—I won't now. Wait till the evidence is through and we will see about that. I deny your motion to call upon them to elect, and I deny your motion to quash.

Mr. Waehner—I except to each of the refusals; I move to dismiss this matter or to quash this indictment upon the ground that the indictment as far as the second count is concerned does not state an offense; that all the statutory prerequisites to constitute an offense against what is called in that indictment the Sanitary Code of the act of 1866, under which the Board of Health of the City of New York was first organized, empowered that Board to pass certain ordinances, rules, and regulations for the government of the health of the City of New York; that under that act they were obliged to publish those ordinances for a specified time before those ordinances could go into any effect. I refer to the case of the People vs. Reed, 1 Parker's Criminal Reports, page 481.

The Court—I deny your motion.

Mr. Waehner—Note an exception.

Mr. Prentice opened the case for the prosecution.

William A. Wall, sworn and examined, testifies as follows:

Q. Mr. Wall, you are connected with the office of the City Record, are you not? A. Yes, sir.

Q. The official journal of the city of New York? A. Yes, sir.

Q. How long have you been connected with that office? A. Since June 7, 1873.

Q. Have you with you a file of the City Record, representing the daily issues of that paper during the months of February and March last? A. Yes, sir; I have it here.
Q. I show you the section under which this indictment is drawn and ask you if you find that section in the issues of the City Record on that page?

(Objected to on the ground that it is irrelevant and immaterial; objection overruled; exception.)

A. Yes, sir.

Q. State when you find that first publication.

(Objected to; objection overruled; exception.)

A. I find that published the first time February 24, 1876.

Q. Published in the City Record, was it, of that date? A. Yes, sir.

Q. State how long it was published?

(Objected to; objection overruled; exception.)

A. Ten days.

Q. By the Court—Successively? A. Yes, sir.

By Mr. Prentice—The first publication was on the 24th of February? A. Yes, sir.

Q. It was published throughout that week, was it, each day except Sunday? A. Yes, sir; except Sunday.

Q. On the following week each day except Sunday for a period of ten consecutive days? A. Yes, sir.

Q. That ordinance is the ordinance I have read to the jury, was it? A. Yes, sir.

Mr. Hastings—We offer in evidence these two numbers, one in the first week and the other in the succeeding week which contains the ordinance in the City Record. We shall then follow it up with proof of the ordinance itself under the statute.

(Objected to on the ground that it is incompetent and immaterial; objection overruled; exception.)

Cross-examined:

Q. The first publication you say was on February 24th? A. Yes, sir.

Q. Was it published the next day? A. It was.

Q. And for how many days succeeding the 24th in all? A. I find it running along until March 3d, including March 3; there is a Sunday intervenes; the paper is not published that day, but all week days up to and including March 3.
Q. And that is the only publication there is of that ordinance in that paper? A. Yes, sir.

Mr. Prentice—Now we offer in evidence a copy of that ordinance with a copy of the certificate of the Board of Health, authenticating and certifying the foregoing. It was passed February 23, 1876, and has the seal of the Health Department attached; said certificate being given under section 12, chap. 636, of the Laws of 1874. (Marked People's Exhibit A).

(Objected to on the ground that it is incompetent and immaterial; objection overruled; exception.)

Defendant's Counsel—I will admit that Emmons Clark is and was the Secretary at the time of this authentication.

Section 186 of the Sanitary Code, is as follows:

"No milk which has been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream, shall be brought into, held, kept or offered for sale at any place in the city of New York, nor shall any one keep, have or offer for sale in the said city any such milk."

Tuesday, December 10, 1876.

Caspar Golderman, sworn and examined, testified as follows:

Q. Golderman, you are an assistant of the Secretary of the Board of Health, are you not? A. Yes, sir.

Q. And were upon the organization of the Board of Health in the spring and summer of 1873? A. Yes, sir.

Q. At that time who was the Secretary of the Board of Health? A. Emmons Clark.

Q. You know his handwriting, and have seen him write frequently? A. I do.

Q. Look at his signature to the certificate attached to the ordinance numbered section 186; look at the signature attached to that paper, Exhibit A; in whose handwriting is that? A. That is the handwriting of Mr. Hill, a clerk in the secretary's office.

Q. The signature is what? A. The signature is Emmons Clark's, Secretary of the Board of Health.

Q. Look, if you please, at this book indorsed "Minutes of Board
of Health"; is that book in your charge, and has it been in your charge since 1873? A. Yes, sir.

Q. Is it an original book of minutes of the proceedings of the Board of Health? A. It is.

Q. During June, July, and other months of 1873? A. Yes, sir.

Q. And contains a full record of all the proceedings?

(Objected to.)

Q. Look at that part of the book included from pages 26 to 38? A. I have.

Q. Of what is that a record?

(Objected to until that book is properly proven to be a record.)


Q. By COUNSEL FOR THE PEOPLE—Of what is that portion included between the pages named a record?

(Objected to as incompetent.)

Q. By the COURT—Whose handwriting is it? A. Mr. Hill, a Clerk of the Board.

Q. By COUNSEL FOR THE PEOPLE—Are the minutes entered in that book under your supervision?

(Objected to.)

Q. By the COURT—Where is that book kept? A. In the office of the secretary of the Board of Health.

Q. By COUNSEL FOR THE PEOPLE—in whose charge? A. In my charge.

Q. By the COURT—you are the secretary? A. His assistant.

Q. By COUNSEL FOR THE DEFENDANT—is Mr. Hill alive or dead? A. He is in the office to-day.

COUNSEL FOR THE PEOPLE—We have offered in evidence section 186 of the Sanitary Code. I deem it material to prove what that Sanitary Code was, and that this is a branch of it, because section 82 of the law of 1873 makes it a misdemeanor to violate the Sanitary Code. We have proved a detached section.

The COURT—You want to prove that there was such an ordinance passed?

Mr. PRENTICE—Yes, sir; we propose to show not only the additional ordinance, but the code to which this refers.

The COURT—that is the original code in that book?
Mr. Prentice—Yes, sir; we will submit that with other evidence.

The Court—Proceed. I am inclined to think the proof sufficient to show that there was an original ordinance passed by the Board of Health.

Mr. Prentice—I offer in evidence that portion of the book of minutes of the Board of Health marked D, embraced between pages 26 and 38 inclusive, and certified by Emmons Clark, Secretary of the Board of Health.

Q. I will ask him to look at the signature at the end of those minutes, and state in whose handwriting it is? Witness—The signature is Emmons Clark's, the Secretary of the Board.

By the Court—Q. And was at the time? A. At the time and is now.

Q. And is yet? A. And is yet.

Counsel for Defendant—I object to the introduction of this in evidence upon the ground that it is irrelevant and incompetent as evidence and upon the specific ground that there is no allegation in the indictment to the effect that these Code of Health ordinances were ever conformed by the Board which went into office in 1873, to the act of 1873, under which they were empowered to act as Health Commissioners.

The Court—It is possible you ought to call Mr. Clark, but I think it is sufficient. Is this an indictment for a breach of the ordinance thus adopted by the new board, or is it an indictment upon an additional ordinance?

Counsel for People—It is pleaded in the indictment as a violation of the Sanitary Code, bringing it within the language of section 82, which declares that any violation of the said Code shall be treated and punished as a misdemeanor. It is proper to show what the Sanitary Code was.

The Court—You object and take an exception.

Counsel for the People—Q. Look at the signature shown in that certificate; do you recognize it? A. I do.

Q. Whose signature is it? A. Emmons Clark's, the Secretary.

Counsel for the People—we now offer in evidence that portion of the book included between pages 33 to 89, with the authentication of the Secretary of the board, being the Sanitary Code so certified.

This certificate is as follows: "I, Emmons Clark, Secretary of the
Board of Health of the Health Department of the City of New York, do hereby certify that the foregoing printed ‘Sanitary Code,’ namely, from page 38 to page 94, both inclusive, is a true copy of the original ordinances and amendments thereto, on file in my office, and the whole thereof, and are now in full force and effect, and entitled to full credence as such ordinances and amendments and were duly adopted and confirmed by said Board of Health, agreeable to the provisions of the law of the State of New York, entitled ‘An act to reorganize the local government of the city of New York,’ passed April 30, 1873, as amended by an act, entitled ‘An act to amend chapter 335, of the Laws of 1873,’ and passed June 13, 1873.

In witness whereof I have hereto set my official hand

and affixed the great seal of the said Health Department, this 10th day of October, 1874, A. D.

EMMONS CLARK,
Secretary.”

Then we offer as to the certificate, section 12, chapter 636 of the Laws of 1874, which is as follows:

“Copies of the record of the proceedings of said Board, with its rules, regulations, ordinances, bills, and books, and papers constituting part of its archives, when authenticated by its Secretary, or Secretary, pro tem., shall be presumptive evidence, and the authentication be taken as presumptively correct in any court of justice or judicial proceeding, when they may be relevant to the point or matter in controversy, facts, statements, and recitals therein contained.”

(Objected to on the ground that it is incompetent and irrelevant; objection overruled; exception.)

JOHN BLAKE WHITE, sworn and examined, testified as follows:

Q. What is your profession? A. Physician.
Q. How long have you been a physician? A. About two years and a half.
Q. Are you connected with the Health Department? A. Yes, sir.
Q. In what capacity? A. Assistant Sanitary Inspector.
Q. How long have you been so associated with the Health Department? A. I will have been a year next May.
Q. Since May, 1876, then? A. Since May, 1876.
Q. Have you been detailed for special duty in the Health Department?  A. Yes, sir.

Q. What is that special duty?  A. Inspection of milk.

Q. From what time?  A. Since June last.

Q. Did you undergo any preparations for this special duty?  A. I did.

Q. State what that preparation was?  A. It was the use of the lactometer and the analysis of milk.

Q. What instruction did you undergo?  A. I do not understand your question.

Q. I asked you what preparation you went through with before entering upon those duties—how were you informed as to the use of the lactometer?

(Objected to.)

A. I studied the use of the lactometer and the analysis of milk under competent instruction.

COUNSEL—I move to strike out the words "competent instruction" as stating a conclusion.

The COURT—Leave that in.

COUNSEL—Note an exception.

Q. What experience have you had in the examination of milk?  A. I have tested a number of specimens of genuine milk and analyzed quite a number.

Q. Have you repeatedly compared your analyses with other tests?  A. I have, sir.

Q. Were those other tests compared with the analyses?  A. Compared with the lactometer.

Q. Have you the lactometer with you?  A. I have, sir.

Q. Is this lactometer an instrument that you have used in your milk examinations?  A. Yes, sir.

Q. Who furnished you with this lactometer?  A. It was furnished me by Dr. Waller, by direction of the Board of Health.

Q. He is a chemist connected with the Board of Health?  A. Yes, sir.

Q. Is this an instrument that you yourself have verified?  A. Yes, sir.

Q. State to what standard of milk it is adjusted.  A. It is adjusted to the lowest, 1.029 specific gravity.
Q. The lowest quality of genuine milk?  A. The lowest quality of genuine milk.
Q. At what temperature?  A. At the temperature of 60 degrees, Fahrenheit.
Q. State how your tests as to the quality of milk are made with this lactometer?  A. Where the temperature of the milk is—
(Objected to.)
Q. When did you visit the place of business of the defendant?  A. I would like to refer to my books, so as to be sure. August 25, 1876.
Q. Where was his place of business?  A. At that time, 206 Avenue B.
Q. What was his business?  A. He kept a milk depot.
Q. Did he keep a large quantity of milk for sale?  A. Yes, sir.
Q. Furnished retail dealers and milk wagons?  A. He was selling milk at retail.
Q. And sold also wholesale?  A. Yes, sir.
Q. About how much milk did you find the morning or the day you visited it?  A. As far as I can remember there was almost half a can at the time.
Q. Half a can in the depot?  A. Half a can from which I procured the specimen. He was selling this milk at the time. I asked him when I entered the place if this was milk he was selling; I took it out of that can.
Q. Were there other cans there?  A. There were other cans in the depot.
Q. Your examination was confined to half a can of milk?  A. To a can of milk, from which he was selling that day; the dippers were in the can, which furnished me sufficient evidence that he was selling from the can.
Q. How much milk was in the depot?  A. I could not possibly say because I did not look into the other cans.
Q. Was there more than one can?  A. There was more than one can.
Q. More than five or six?  A. I do not remember that; I have been to a great many places since then.
Q. How large was this can?  A. A can containing about forty quarts of milk; the usual size of milk cans.
Q. What test did you apply to the milk he was selling at that time?  

A. I first observed the milk as I always do observe, whether the milk adheres properly to the side of the glass as milk generally does; then I tested the temperature at sixty degrees Fahrenheit; I placed the lactometer in the glass containing milk, and it stood at 85.

Q. What amount of adulteration was shown by your examination?

(Objected to on the ground that it has not been shown upon what principle this lactometer has been constructed; objection overruled; exception noted.)

A. It shows 15 per cent. of water by the lactometer; 15 per cent. of added water I should say.

Q. What was your observation as to the milk clinging to the side of the glass?  

A. It behaved as milk does which has been adulterated; it did not cling well, and it looked bluish and light.

Q. I think you stated pure milk generally clings to the sides of the lactometer?  

A. To the lactometer and also to the sides of the glass, when the glass is shaken in which the milk is placed.

Q. Have you ever made any analysis to confirm the reading of the lactometer?  

A. I have, sir.

Q. At 85?  

(Objected to as incompetent, irrelevant and immaterial; objection overruled.)

Mr. Hastings—We withdraw the question.

Q. Have you made repeated tests with this lactometer?  

A. I have, sir.

Q. About how many?  

A. I made about 147 tests of genuine milk.

Q. What steps have you taken to verify the reading of the lactometer on those tests?  

A. I visited the country and tested milk direct from the cows.

Q. Have you ever watered these samples of milk to see how it would vary on the scale of the lactometer?  

A. Not these particular samples, but I have others.

By the Court—The lactometer which is presented here is the one with which you tested the milk in the can you found in the possession of the defendant?  

A. Yes, sir, that is the lactometer.
TESTIMONY OF JOHN BLAKE WHITE.

By Mr. Hastings—Q. And this is the one you received from the Board of Health, did you? A. Yes, sir.

Q. And what is the standard at which it is graduated? A. At the specific gravity of 1.029.

Q. What is the specific gravity adopted by the Board of Health? A. 1.029 is the lowest, which is equal to 100 upon the lactometer scale.

Q. Now, sir, explain the manner and use of the lactometer, and its theory?

(Objected to; objection overruled; exception.)

A. The lactometer is an instrument used to test the specific gravity of any fluid, and it is called a lactometer because it is used to test the specific gravity of milk.

Q. How do you use it in testing milk? A. It is placed in a glass containing the fluid.

Q. And then what? A. The fluid should stand at the temperature of 60 degrees Fahrenheit.

Q. Does this sink? A. And that sinks and indicates upon the scale there the specific gravity of the fluid in which it sinks to that point.

Q. Does the temperature have any effect? A. The temperature does, for I have just stated the temperature of the milk should be at 60 degrees Fahrenheit.

Q. Now, sir, you have made a great many tests and experiments with the lactometer, have you? A. I have, sir.

Q. Have had large experience in its use? A. Yes, sir.

Q. From your experience and your tests, have you determined it to be a reliable instrument in testing the specific gravity of milk?

Counsel—Objected to.

The Court—I cannot exclude this question and answer. You can cross-examine as much as you have a mind to.

A. I have.

Q. State what tests and what methods you have used for determining its reliability by comparison or otherwise, by analysis or in whatever way? A. I have tested it in solutions of known specific gravity in which it indicated the specific gravity—a solution which I had previously known.
Q. By analysis?  A. No, sir; by the hydrometer, indicated by the hydrometer.

Q. Have you tested it by analysis?  A. I have tested it by analysis also—that is, I have proved it by analysis.

Q. Now, sir, in making the test of milk, you have already stated that you, in the first place, observed the appearance of the milk?  A. Yes, sir.

Q. What other methods of observation, or testing do you take; do you use the tongue?  A. Yes, sir; I taste it.

COUNSEL—We object to this question unless it is confined to this particular case.

WITNESS—Yes, sir; this particular case.

COUNSEL FOR PROSECUTION—Did you taste it?  A. I did, sir.

Q. And do you use the nose too, in testing milk?  A. Yes, sir.

Q. Did you in this case?  A. I do not remember whether I did or not in this case; it was hardly necessary however, because it was not sour milk.

COUNSEL—Objected to.  (Objection overruled; exception.)

COUNSEL FOR THE PEOPLE—Well, sir; upon this day you tested this milk?  A. Yes, sir.

Q. By the COURT—With that lactometer?  A. Yes, sir, with that lactometer.

Q. By COUNSEL FOR THE PEOPLE—What was the result of the test that you made of that milk at that time?  A. It stood at 85 by that instrument, at a temperature of 60 degrees Fahr.

Q. Now, I ask you what was the condition of that milk at that time?  A. The milk did not appear to me to be perfectly good milk.

COUNSEL—I move to strike out that answer.

WITNESS—I have already stated that the milk behaved as adulterated milk behaves.

COUNSEL—We object; this is the very question involved in the case, whether the article sold here was impure milk.

Q. By COUNSEL FOR PEOPLE—Well, these various tests that you made at that time with this instrument and with your observations, you determined, as I understand you to say (if not correct me), that it had been adulterated by water at the rate of fifteen per cent. of water added?  A. Yes, sir.
Q. Was there any evidence that the defendant knew that it was watered?

(Objected to as calling for a conclusion.)

Q. What occurred between yourself and Mr. Schrumpf, the defendant in this case, about that? A. After I left the store Mr. Schrumpf's son approached me and touched me on the shoulder and asked me—

COURT—You cannot state that unless you returned and told the defendant afterward.

A. No, sir; I had no conversation.

Q. By Counsel for the People—Was this young man about whom you began to speak, in the store at the time you were there? A. Yes, sir; and he told me that he was the son of Schrumpf.

Q. This son of Schrumpf's was in the store at the time you made this experiment? A. Yes, sir.

Q. And did he see the test made? A. Yes, sir.

Q. Was anything said by him in the presence of Mr. Schrumpf and yourself, or did Mr. Schrumpf say anything to you? A. Mr. Schrumpf said something to me.

Q. What did he say? A. The prisoner stated that the instrument stood higher than I read, because the instrument was vibrating and had not settled.

Q. Did he say anything more? A. I do not remember anything more that was said upon that point.

Q. Did he watch your test? A. Yes, sir.

Q. And took a reading himself? A. He stated that which I have already stated; while I was waiting for the instrument to settle he was looking at it and made that statement.

Q. Did you tell him the milk was bad? A. I did, sir; I told him how it read.

Q. What did he say to that? A. I do not remember any conversation; there are so many places that I visited I do not know what they all said to me, you know.

Q. Where were you when this son of Schrumpf came to you, outside the building or in? A. I was outside.

Q. What season of the year was this? A. This was in August.

Q. Was the door open? A. I do not remember.
Q. Do you know whether Schrumpf saw him approaching you?  
A. I do not.

Q. Now, sir, among the experiments that you have made to test the reliability of this instrument, have you ever made a test to show the amount of water when the lactometer should stand at 85?  
A. I have, sir.

Q. And what amount of water did it show?  
A. Eighteen parts added water.

Q. What was the test?  
A. By analysis.

Q. So that the analysis showed more water than the lactometer.

Counsel—We ask to strike that out, because it is improper in this case.

The Court—Leave it in.

Counsel—Your Honor overrules the motion?

The Court—Yes, sir.

Counsel—I except.

Counsel for the People—You said that this instrument was vibrating when the defendant Schrumpf was reading it?  
A. Yes, sir.

Q. Now, the reading you took was after it had settled, as I understood you?  
A. Yes, sir.

Q. And at that time it stood at 85?  
A. Yes, sir.

Cross-examined:

Q. Did you take any of this milk away with you, Doctor?  
A. No, sir.

Q. And no analysis of this milk was made?  
A. No, sir.

Q. Now, Dr. White, you entered the employ of the Board of Health last May, I believe?  
A. No, sir; I have been there over a year, a year last May.

Q. How many times have you seen the defendant?  
A. I have seen him, counting every time that I have met him in Court, I have seen him fully three times.

Q. Is that the individual? (pointing to the defendant).  
A. Yes, sir.

Q. Now, sir, you testified that the accused was engaged in the business of selling milk at wholesale, how did you know that?  
A. I stated that he kept a milk depot and had a number of cans; I
have subsequently visited customers of his who have purchased at least fifteen or twenty quarts of milk from him, who stated to me that fact; I presume that would be called wholesale.

COUNSEL—I ask your Honor that there be stricken from the evidence what the customers of the defendant said to this witness.

The COURT—Yes, sir; strike it out.

Q. Do you know that this man was engaged in selling milk at wholesale on the 25th of August? A. No, sir; I do not know he was selling milk at wholesale.

Q. May you not be entirely mistaken in your estimation that he is anything more than a retail milk dealer? A. He may be a retail and he may be a wholesale dealer; he kept a milk depot at the time I visited it; I make that statement now.

Q. What is the difference between a milk depot and a milk shop? A. A milk depot means that he has a large quantity of milk on hand to sell.

Q. How much milk will you state that he had on hand that day, how many cans did you see? A. I do not remember the exact number of cans; there were more than one.

Q. How many contained milk? A. I do not know.

Q. Did more than one? A. I do not know, sir.

Q. You do not know that more than one can contained milk, and yet you swear that he had a quantity of milk there, is that it? A. No; I do not swear that he had a large quantity.

Q. What quantity had he? A. He had at least twenty quarts in the can.

Q. That is what you call a large quantity kept by a wholesale dealer? A. No, sir.

Q. Now I understand you, that you have tested 147 samples of milk in the country? A. Yes, sir.

Q. You have also added water to the milk and tested it then with the lactometer after adding water? A. Yes, sir.

Q. Did you do that with the genuine milk which you tested in the country? A. No, sir.

Q. Well, this milk that you added water to and then tested with the lactometer, where did you get that? A. I got it in the city here.

Q. Did you know it to be genuine milk? A. It was a specimen of milk that was analyzed.
Q. How much water did it contain when analyzed? A. It contained about the usual amount; I do not think I have my book here.

Q. I did not ask for your book? A. I do not remember because I made several analyses; it did not contain more than it ought to by actual analysis; I remember that fact.

Q. What month was it that you made these 147 tests in the country? A. The months of June, July and August, I think; the latter part of June.

Q. Will you look at that copy of the City Record and say if that does not contain published accounts of your doings in that direction? A. It has not my signature.

Q. Is that the published report of your investigations? (Paper shown and marked Exhibit B for identification). A. Yes, sir.

Q. How many different places were those 147 analyses made? A. They were made I think at 6; if you will pass me the paper I would be able to observe that accurately.

Q. Now in one instance you found milk which at 60 temperature registered 95, did you not? A. Yes, sir.

Q. And that is 5 per cent. below the Board of Health standard? A. Yes, sir.

Q. Now, Doctor, I want you to state to the jury exactly all that you did in the store of the accused on this day in last August? A. I visited the store and asked the dealer if he had any milk for sale; he replied yes; I asked him where it was, and he showed me a can in which I saw several dippers; I procured some of it and stirred the milk up in the can first and placed some in a glass, observed it and tested the temperature of the milk; I forget now whether it was then at 60, but I waited until it was 60 Fahr; I placed the lactometer in it and it was 85; I tasted the milk and it did not taste like good milk; I told him it was bad milk, adulterated milk.

Q. Well, sir; how did you get at the temperature? A. With the thermometer.

Q. Have you that thermometer with you? A. I have the thermometer. (Thermometer produced.)

Q. Do you know by whom this thermometer was made? A.
No, sir; I do not; I procured that from Dr. Chandler, I think, or from one of his assistants—from the Board of Health.

Q. Have you tested this thermometer? A. I have not, sir.

Q. Then you do not know it to be accurate? A. I think it is accurate.

Q. Do you know it to be? A. No; I cannot swear it is.

Q. Then from this thermometer, the accuracy of which you do not swear to, the milk was at a temperature of 60? A. Yes, sir; excuse me one moment, that thermometer was used in the country with other specimens of pure genuine milk when the lactometer was tested.

Q. And this is the same lactometer with which you made 147 tests? A. No, sir; part of them.

Q. What proportion? A. Fully 40—there may have been over 40.

Q. You cannot swear to the correctness of the temperature in 40 cases? A. I did not make the thermometer; that has been tested, but I did not test it.

Q. Did you notice? A. I did not notice.

Q. Why did you say so? A. Because those instruments are always tested by others before they are handed to me.

Q. Now, doctor, I would like you to take some of this and pour it into this tube, and show the jury how you make the tests.

(A bottle of milk was handed to the witness.)

COUNSEL FOR THE PEOPLE—Before this is made, if this is an experiment to be made with milk, we desire to know if this is milk.

COUNSEL FOR DEFENDANT—I propose to ask this gentleman to taste that stuff, be it what it may, benzine or anything else, and see if he knows the difference. I propose to ask him what it is.

WITNESS—I do not propose to taste anything.

COUNSEL FOR DEFENDANT—I assure him that it is not poisoned.

COUNSEL FOR PEOPLE—If this examination be directed to the point whether this witness be an expert or not, I presume he has been admitted as an expert; if it be directed to the point whether this instrument will determine milk, we must be assured that the article is milk. When a bottle labeled from a chemical laboratory is presented, we are not sure from past experience what it is—we are inclined to doubt it.
COUNSEL FOR DEFENDANT—I simply ask that he be allowed to test that before the jury, just as he tests fluids which he supposes to be milk. I propose to ask that gentleman what he can tell from his taste. The Board of Health proposes this method, and we wish to investigate it.

COUNSEL FOR PEOPLE—We must be sure that it is milk from a healthy cow.

The COURT—I think there is something in the objection. It may be a very unsafe proceeding what you propose to do. How can the jury know, and how can we tell, without going deeply into chemistry or some of the natural sciences, but that you may manufacture and put together certain elements which are not milk?

COUNSEL FOR DEFENDANT—I propose to ask that gentleman to take that fluid and apply the same test to it that he did to the fluid in the store of the accused. If he object to taste it, I won't insist on that.

WITNESS—The taste forms a very important part, and I would object to tasting it.

COUNSEL FOR THE PEOPLE—The purpose as announced by the learned counsel, and the reason given for not stating what that fluid is—his object is to endeavor to institute an examination which I think the Court will rule out as entirely immaterial and irrelevant. The question is not if the witness should find some other substance in the store of the accused, that he should report it to the Board of Health.

COUNSEL FOR DEFENDANT—I want to demonstrate how imperfect this test is.

The COURT—If you are going to prove that that is milk, I will let you proceed. I do not say that I will reject the evidence finally.

COUNSEL FOR DEFENDANT—I do not want to put the witness on his guard.

The COURT—I will think more about it. It seems to me it would be opening the door on a critical point which might be dangerous and perhaps wrong.

By COUNSEL FOR DEFENDANT—Q. Now, doctor, you have before you a lactometer as used by the Board of Health? A. Yes, sir.

Q. You have also a glass jar as used by the Board of Health in which milk is usually tested? A. Yes, sir.
Q. I now hand you a whitish fluid in appearance resembling milk contained in a bottle which is before you, and ask you to pour it into that glass jar and test it with the lactometer as you did the fluid in the shop of the accused.

COUNSEL FOR THE PEOPLE—(Objected to on the ground that it is not claimed that this substance is milk, and secondly, that the experiment is irrelevant and incompetent; and I desire to add an offer that the witness may test milk with the lactometer.)

The COURT—It marks a certain degree. What is your argument from that?

COUNSEL FOR DEFENDANT—It depends what the degree is.

The COURT—Let it be 85; suppose it says that; what is your argument?

COUNSEL—If the subsequent proof shows that to be pure milk it will not only be an argument but a demonstration that the lactometer is imperfect.

The COURT—Unless you intend to prove or should prove afterwards that the fluid there is milk, I do not see that the experiment would be useful or advance the truth. I think I will exclude the question, but I may alter my mind when I learn more about the lactometer.

COUNSEL—Note our exception.

Q. Doctor White, there is before you a fluid which appears to be milk; I ask you to pour that into the glass jar used to contain milk when you make tests of it, and test it with the lactometer and state the result by the lactometer.

(Objected to on the ground that it is not relevant to the issue; that the issue to be determined is the specific gravity.)

(Objection sustained; exception.)

Q. Now, Doctor White, when you go into a milk shop and a fluid is given you which looks like milk, and you test with the lactometer and thermometer and note the result, can you tell whether that fluid is milk or not?

(Objected to as irrelevant; objection overruled.)

A. I always inquire from the man first if he has—

Q. I ask you from that test whether you can tell that is milk?

A. I ask the person if he has milk for sale before I proceed any further.
Q. When you enter a milk shop and a fluid resembling milk which as far as you can tell by the exercise of your senses is milk is given you, and you test it with the lactometer and thermometer and note the result, can you tell whether the fluid you have tested is milk or is something else; I ask an affirmative or negative answer.

(Objected to as uncertain in this, that it does not appear by the question whether the test proposed is by the lactometer and thermometer alone.)

The COURT—I think I will permit you to ask this question,—whether he knows enough about the lactometer to say whether by inserting it in a fluid looking like milk to know whether it was milk or not.

By COUNSEL—Q. Can you tell by inserting the lactometer in a fluid that looks like milk whether it is milk or not? A. No, sir; I cannot.

Q. When you visit a milk shop and a fluid is presented to you resembling milk and you test it with the thermometer and the lactometer as you used those tests in the case of the accused, can you tell from the result whether the fluid tested is milk or something else?

(Objected to; objection sustained; exception.)

Q. Dr. White, have you tested the milk of other animals besides the cow with the lactometer?

(Objected to as irrelevant; objection overruled.)
A. I have not.

Q. Have you ever tasted as far as you know the milk of any other animal than the cow? A. I do not remember whether I have or not; yes, I do remember, certainly; it is so long ago that I forgot it, I thought that was taken for granted.

Q. Now, doctor, from the tasting of the milk, from noticing whether it clings to the glass or the lactometer and from the test usually made by you and as made in the present instance in the case of the milk of the accused, can you tell whether the fluid you tested is milk? A. I think I can.

Q. Will you swear positively that you can tell whether the fluid you have tested is milk from these means? A. I do not know that that is required.
Q. Will you swear positively whether you can or not?  
A. I can swear I have often tested what I thought to be milk and analyzed it and found it to be milk.

By the COURT—Q. Can you swear any more positively than you have?  
A. No, sir.

By COUNSEL—Q. Now, sir, can you from the various tests enumerated by me swear positively whether the fluid tested was milk or not?  
A. I have made my answer to that question already; I have said that I could tell milk by those tests.

Q. Are you sure that you can?  
(Objected to.)

The COURT—We must be content with the answer.

By COUNSEL—Q. Can you not from such tests swear whether the fluid was milk or not; I ask you to answer yes or no to that question?  
A. I have already replied to that.

By the COURT—Q. What is your answer?  
A. I have said I thought I could.

COUNSEL—I ask the Court to request the witness to give a categorical answer.

The COURT—I refuse.

COUNSEL—I except to the Court's refusal to direct the witness to answer that question directly.

Q. Now, Doctor, you say you think you can; how strong is your impression?  
A. As strong as I have expressed it; I have made a reply.

Q. Then it is simply a thought, is that it?  
A. I have not tried the specimen to tell you.

By the COURT—Q. How sure are you? If you can say anything further, doctor, you may do it?  
A. I do not see how I can answer any differently.

Q. You say you think you could?  
A. I say, sir, it is my impression and belief that I can tell good milk from these tests.

By COUNSEL—Q. Now will you swear, Dr. White, that the article which you tested in this case was milk or won't you?  
A. I do not understand your question at all, I do not see what you mean to imply by that—such milk as I have already tested in that man's store I have already passed upon.
Q. On the 25th of August last in the store of the accused did you notice a certain fluid?  A. Yes, sir.

Q. From the tests made by you, will you positively swear that that fluid was milk?  A. Yes, sir; I will.

Q. Then, how is it that when in another case, the hypothetical case which I put to you just now, you, combining all these tests, only think it was milk?  A. I said it was my firm impression, I could tell it.

Q. How is it that in one case you swear positively and in the other you have only an impression?

The COURT—I do think you have gone as far as I ought to permit you.

By COUNSEL—Q. Now, Doctor, what portion of the test made by you in this case enables you to be so positive that what you tested was milk?  A. The lactometer sank so low as to show that there was more water in that specimen of milk than there ought to have been.

Q. In case a fluid in appearance resembling milk is given you, you pour it into a glass jar such as is commonly used for testing milk, you test it by inserting the lactometer in that glass jar, you test the temperature by an accurate thermometer, you notice whether the milk clings to the glass or to the lactometer, can you positively swear that the fluid you have tested is milk—and in addition to the tests you taste the fluid and look at it, will you then swear it was milk?

(Objected to as hypothetical and irrelevant, and as not based exactly upon the facts in this case.)

A. I cannot answer it; I go into a milk store and look for milk.

Q. Why cannot you answer that question?  A. You say, in case a fluid is given me; I do not understand what you mean by that—I enter a store to inspect milk, I understand the man in the store is selling milk, I test the milk to see how much water is in it.

Q. Do you arrive at the conclusion that the fluid is milk, from your supposition or knowledge that the man sells milk, or from the tests which you make?  A. From both.

Q. Can you tell from either, separately?  A. I can be pretty well assured of the latter, although I cannot always of the former.

Q. Can you tell either, separately?  A. I have answered that.

Q. Now, Mr. White, in a case where the supposition in your
mind that the fluid tasted was milk, was absent, could you, from the tests as you have described them in your direct evidence, tell whether it was milk?

(Objected to; objection overruled.)

A. I do not understand your question; to tell milk it would be necessary to use every possible conceivable means to find out whether it was milk or not; we enter upon the presumption that the man is selling milk to dealers and then I taste it.

Counsel—Q. What is your answer to my question? A. I think I have answered that question already.

Q. Now, Mr. White, in a case where the supposition in your mind that the fluid tasted was milk, was absent, could you, from the tests as you have described them in your evidence, tell whether it was milk? A. I think, I could.

By the Court—Can you state any more positively than you have? A. Yes, I can tell milk.

By Counsel—Can you state positively that you can? A. The result of all the experience in all my life is that I think I can tell whether it was milk?

Q. Take this fluid, test it properly by the lactometer and thermometer, and state whether it is milk or not?

(Objected to; objection sustained; exception.)

Q. Now, sir, being able solely from the tests referred to to determine that the fluid tested is milk, can you tell from what species of animal that milk comes?

(Objected to; objection sustained; exception.)

A. Simply by the taste?

Q. Can you state whether milk is pure from any species of animal if less than 1.029 or 100 on the lactometer as at present adjusted?

(Objected to.)

A. I replied earlier in the examination that I had not tested the milk of any other animal.

By the Court—Can you tell the gravity of milk of other animals? A. Certainly, sir; with the same instrument.

Counsel—Have you ever tried it? A. No, sir; I have not.

(Counsel’s question repeated.)

A. I have said I have not tested it.
By the Court—You cannot state that? A. No, sir.

Counsel—Now, sir, how many milk shops do you visit a week, on an average, to test milk? A. I can tell, perhaps, by referring to my book.

Q. I only want an estimate? A. I cannot say without referring to my book, because some weeks I am busy otherwise and do not make as many inspections as I do at others; these courts keep me busy sometimes; I suppose about 20 or 30 a week—between 20 and 30.

Q. Well, sir, in 20 tests of milk made in milk shops in this city about how many samples of milk do you usually find below 100 degrees on the lactometer at 60 Fahr.

(Objected to.)

Counsel—I propose to show that since the use of this instrument began by the Board of Health the traffic in skimmed milk has increased five-fold in this city, and by this and similar questions I propose to reach that; it is one of the arguments I propose to make to the jury against the lactometer.

The Court—My embarrassment in ruling is that you have made this witness your own; I do not see any importance to this evidence; at present I will exclude it, it may be, by and by, I will admit it.

Counsel—Note an exception.

Q. What is skimmed milk? A. Skimmed milk is the fluid from which cream has been removed.

Q. Do all fluids have cream? A. All fluids which nature has put there.

Q. Do you mean to say that skimmed milk is milk with the cream removed? A. Yes, sir.

Q. Is it nutritious as food?

(Objected to; objection sustained; exception.)

Q. Now, Mr. White, suppose a sample of pure milk stands at 105 by your lactometer as you use it at a temperature of 60, and that milk be skimmed and then tested in the same manner, will it be heavier or lighter? A. It will be heavier.

Q. About how much? A. It depends upon the amount of cream that has been removed.

Q. Now suppose a milk rich in cream standing 95 at 60 Fahr. by your thermometer having the cream removed from it so as to make
skimmed milk, be then tested again, about what figure will it stand?

(Objected to as immaterial and irrelevant.)

COUNSEL—I propose to show when the tests applied by the Board of Health are applied to skimmed milk that they mislead.

The COURT—It is difficult to tell whether that evidence is admissible now or not; it depends upon what evidence is introduced hereafter. I think, I will let the witness answer it.

(Question repeated.)

A. It will stand higher, but it is impossible to say how high, unless you tell me how much cream is taken away of course.

Q. Would it not stand several degrees higher? A. It will stand a few degrees higher.

Q. How many degrees are a few? Do you think it would stand 5 degrees higher? A. I have said that it would depend a great deal upon the amount of cream removed.

Q. Assuming it to be a quart of pure milk rich in cream, how much higher do you think it would stand by the lactometer when the cream is removed? A. I have already said it depends a great deal upon the amount of cream taken away from that specimen of milk. To thoroughly skim milk you would have to skim it two or three times, especially an Alderney.

Q. To skim it as many times as is necessary, how high would it stand? A. Several degrees; it is impossible to say.

Q. Would it not stand 10 degrees higher? A. I do not think it will stand quite that much.

Q. Do you know how much skimmed milk is sold daily in this city? (Objected to; objection sustained; exception.)

Q. Can you state the specific gravity of skimmed milk? A. When all the cream is removed, do you mean?

Q. Yes, sir; can you state the specific gravity of skimmed milk? (Objected to; objection overruled for the present.)

Q. Skimmed milk will stand above 118 on the lactometer? A. Yes, sir.

Q. What is the gravity of cream? A. Cream will stand lower than 100; it depends of course upon its thickness, upon its purity; it will stand from 60 to 70, along there; the specific gravity is from 1.012 to 1.019.
TESTIMONY OF JOHN BLAKE WHITE.

Q. What is the average gravity of cream? A. 1.012.
Q. What is that on the lactometer? A. It will stand about 77.
Q. Now, won't you state what the ingredients of milk are and in what proportions?
(Objected on the ground that that is not material.)
A. The ingredients of milk are water, butter, sugar, caseine, and ash.

Q. What are the proportions of each? A. The maximum of water is about 88 per cent.
Q. What is the minimum? A. The minimum I found 86 per cent. in pure milk; the sugar is 4 per cent., the butter about 3 per cent., the ash 0.29 per cent., and the caseine 3.16 per cent.
Q. Are you quite sure as to the correctness of those proportions? A. I have given you them as near as I can.
Q. Let me call your attention to the proportion of ash, have you not misstated that? A. I should like to refresh my memory in regard to the analysis.
Q. By the COURT—Do you mean the notes of the analysis made by you? A. Yes, sir.
COUNSEL—I object to the witness being allowed to refer to his notes.
WITNESS—Well, sir, I have found in one analysis .5 of ash, and I found .29 per cent. in the specimen I analyzed some time ago.
Q. What is the average quantity of ash? A. I should say the average would be near .50 per cent., if not a little more.
Q. How many per cent. of water do you say the accused's milk was adulterated with? A. At least 15 per cent.
Q. Now state what influence the temperature of milk has upon its gravity? A. The specific gravity of the fluid varies with the temperature, because in chemistry fluids expand when warmer, and their specific gravity is lightened.
Q. To what extent does that exist? A. I have found that to vary.
Q. How much? A. From two degrees in specific gravity to three in temperature, about that variance; that is the greatest amount of variance.
Q. Do you always get milk up to the temperature of 60 Fahr. when testing it? A. Yes, sir, I do.
Q. How do you cool it when it requires cooling? A. We cool it with ice water—place it in a glass containing ice water and cool it.

Q. How do you warm it? A. Warm it in a vessel containing warm water, and sometimes with my hands; I have often warmed it with my hands.

Q. Do you state what you do in your laboratory or what you do in the shops? A. I state what I have done in some cases in the shops and always in the laboratory.

Q. Now you said, Mr. White, that the temperature varied 2 degrees of specific gravity for 1 on the lactometer? A. No, sir; I said the average was 2 degrees on the lactometer for 3 in temperature; that was about the variance.

Q. You do not mean then what it varies in degrees of specific gravity, but degrees on the lactometer? A. The lactometer indicates the specific gravity of the fluid when it is tested.

Q. How many degrees of specific gravity are indicated by any degree on the lactometer? A. The 100th mark on the lactometer indicates a specific gravity of 1.029.

Q. What degree on the lactometer indicates 1.018 of specific gravity? A. About 89 I should say.

Q. Now, sir, have you any regular scale of allowance to be made in testing milk if the temperature is above or below 60 Fahr.? A. I have no scale; no sir.

Q. Can you give a regular scale? A. I have just stated that it varies 2 degrees in specific gravity; the degrees on the lactometer indicate the specific gravity of the fluid in which it is placed.

Q. The difference between 100 on the lactometer and 99 on the lactometer indicates 1 degree in specific gravity? A. Yes, sir.

Q. Now you always test the milk exactly at 60? A. Not always; when I first test it, it may be higher and I cool it to 60 afterwards.

Q. Can you state what temperature the milk of the accused was when you went in there? A. I cannot.

Q. Had you cooled it or warmed it? A. I do not remember, it was at 60 when I tested it.

Q. What does it weigh?

(Objected to; objection sustained; exception.)
Q. Mr. White, is whey of a less specific gravity than milk?  

A. Yes, sir.

Q. Much?  

A. A good deal.

Q. Now, Mr. White, will you look at this bottle and see whether you can determine that it is milk or not.  

(Objection to; objection sustained.)

Q. Is the lactometrical test the only test for milk?  

A. It is not the only test.

Q. Have you ever tested milk with the microscope?  

A. No, sir; I have not.

Q. If you used the microscope would you not be able to tell whether the fluid you were testing was milk or an artificial substance made to resemble it?  

A. I have said I have not examined milk under the microscope.

Q. I ask for your opinion?  

(Objection to; objection sustained; exception.)

Q. Mr. White, in going to make tests of milk say out of 20 samples what proportion rises above a hundred—I ask you suppose you go about to milk shops testing 20 different samples of milk what proportion falls below and what rises above a hundred, estimate it?  

A. I could not say unless I referred to 20 estimates.

By Mr. Prentice—Q. You stated, Dr. White, that if the temperature was not at 60 you would cool it to 60 or warm it by placing it in ice water or in warm water.  

A. Yes, sir.

Q. When you say it to what do you refer, the milk itself?  

A. The glass vessel containing the milk, not the milk itself.

Q. Suppose the milk should be, when you take it at a little less than 60—should be a little cooler than 60, would that be more favorable or unfavorable to the dealer?  

A. It would be more favorable to the dealer in this case; I do not always warm or cool it up to 60.

Q. You stated that this milk appeared to your observation to have been adulterated?  

A. Yes, sir.

Q. Was this milk cow's milk or some other milk?  

A. Cow's milk.

Q. Now, sir, your observation to which you testified that it showed you some adulteration as probable, did it have reference to its color and thinness?  

A. Yes, sir.
Q. Is there any difference between the color and thinness of the milk with cream or without it?  A. Yes, sir.

Q. Is there any difference in its appearance on the lactometer as it is withdrawn from the glass?  A. Yes, sir.

Q. And is there any difference as it appears before?  A. Yes, sir.

Q. Let me ask if this paper to which your attention was drawn and which was identified, was a report made by you to the Board of Health?  A. Yes, sir.

By Counsel for Defendant—Q. You have sworn that this milk was cow's milk; how do you know it was—I mean the milk found in accused's place?  A. Because he proposed to sell cow's milk.

Q. How do you know it was cow's milk?  A. It bore all the appearance to me of cow's milk and had the taste of cow's milk.

Q. Would not woman's milk have looked very much like it?  A. No, sir.

Q. In what respect would it have differed?  A. It would have looked thinner and tasted differently.

Q. Would not mare's milk have looked exactly like it?  A. I have not seen mare's milk.

Q. As you are able to tell in the case of the accused suppose you look and see whether this is cow's milk.

(Bottle shown to witness.)

A. I would not be able to apply that test, I used every test in regard to the other.

Q. Used them all?  A. I do not propose to use them all in that case.

Q. As you could tell whether the milk or fluid you found in the shop of the accused was cow's milk can you tell by the same means whether the fluid which I now hold in my hand is cow's milk?  A. Yes, sir; I can.

Q. Will you do so?  A. I won't taste it; the taste would be a part of the test.

Q. You decline examining this?  A. I decline to apply every test.

The Court—I have ruled it out.

Counsel—Note my exception.
Charles F. Chandler, sworn and examined by Mr. Prentice:

Q. Dr. Chandler, you are a chemist by profession? A. I am.

Q. Please state your study and preparation, and your acquaintance and experience with chemistry and that which belongs to your profession? A. I went to the Lawrence Scientific School at Cambridge in 1853, remained there till the spring of 1854, and spent a year at the University of Goettingen in Germany and a year at the University of Berlin, pursuing the study of chemistry in all its branches.

Q. You took a degree, did you, there? A. Took a degree of doctor of philosophy at Goettingen.

Q. Since that time you have been a professor in various institutions? A. I have.

Q. Please state where? A. For about eight years at Union College, and twelve years at the School of Mines in Columbia College; also for ten years at the College of Pharmacy in the city of New York, and for the past three or four years at the College of Physicians and Surgeons in New York.

Q. The lactometers in use by the Board of Health are tested in your laboratory, are they? A. They are, under my direction.

Q. This thermometer which was in evidence this morning, and laid upon the table and taken up by you, has it been tested by you? (Thermometer shown to the witness.) A. It has been tested by me and found to be accurate.

Q. That is the one used by Dr. White, was it, this morning? A. It is.

Q. You were present at his examination? A. I was.

Q. Now, sir, have you made milk a special study? A. I have.

Q. Tell me, what is a lactometer? A. A lactometer is an instrument which belongs to the class of instruments called hydrometers. It is a hydrometer specially graduated to suit the investigation of milk for police purposes. All hydrometers are floating instruments based upon the principle that when a solid substance is placed in a liquid it sinks until it has displaced its own weight. The lighter that liquid is, the deeper it must sink in order to displace its own weight. The heavier that liquid is, the sooner it reaches a point at which it has displaced its own weight. I have a diagram* of a

* See cut on page 37.
TESTIMONY OF CHARLES F. CHANDLER.

HYDROMETER AND LACTOMETERS.
hydrometer and a lactometer which will enable me to explain perhaps more fully the character of the instrument. The instrument at the left is a hydrometer, which is graduated to determine the specific gravity on a unit which represents the specific gravity or comparative weight of water. That instrument, if placed in pure water at a temperature of 60 degrees Fahrenheit, would sink till it registered the upper mark, which is 1 or 1.000, as we choose to call it. If placed in a liquid lighter than water, it would sink to a greater depth; if placed in a liquid heavier than water, it would not sink to that depth, and that particular scale represents the comparative weight of the liquid to the weight of water. If it should sink to a depth of the mark near the bulb, 1.035, that liquid would be .035 heavier than water. In other words, a vessel which had contained 1,000 grains of water would contain 1,035 grains of that liquid.

Q. Now, sir, I see there are a number of lactometers represented upon that diagram; are there a number of lactometers in use graduated at different rates? A. There are in this city.

Q. Is there any indication upon the lactometer itself of the rate at which it is graduated? A. Generally not; I never saw one.

Q. Can you tell one lactometer from another? A. I cannot without testing them.

Q. Describe these various rates? A. The second instrument on the diagram is a lactometer which was originally invented by a French chemist by the name of Dinocourt; he investigated the milk of cows in France and satisfied himself that no cow's milk from a healthy cow ever stood below the specific gravity of 1.029.

Q. State these experiments and investigations, as they are known to experts in your science? A. 1.029 represents the lowest specific gravity of genuine milk; the instrument is so graduated that the zero point, which means no milk, shall be at the gravity of water; the 100 point, which means the weakest milk that any healthy cow gives, is placed opposite 1.029; if the milk is of a fair quality its gravity will be greater than 1.029, and consequently the lactometer will stand at a point above a 100; from 100 to 120: if the milk is of minimum quality, that is either poor in solids altogether or unexceptionally rich in fat, that is cream, then its gravity will ap-
proximate to 100, but in genuine milk from healthy cows the instrument will never reach a point below 100; in selecting this instrument for use in testing milk it was necessary to fix the 100 mark so that in no sample of genuine healthy milk would the instrument ever record below 100; consequently a margin from 100 to 120 has to be granted from the reason that milk is not a uniform fluid; the milk of one cow differs from the milk of another; the milk of one cow is heavier than that of another, and consequently it is necessary to fix the 100 mark on the lactometer at the very lowest point, as otherwise the lactometer might pronounce a sample of milk as standing below 100 when it was genuine, healthy cow's milk. The other three instruments are instruments that have been and are to a great extent in use among milkmen in New York city; the original lactometer introduced into New York had its 100 mark placed at 1.030, and it is one on the right; consequently a very light sample of milk might have registered 99 upon that lactometer and have been pronounced watered, when on the lactometer originally introduced and which is used by the Health Department it would still have a register above 100; many years ago Dr. Chilton of this city investigated this subject.

(Objected to.)

Q. Speak of any other lactometer that has been in use? A. Another standard was introduced subsequently which placed the 100 mark at 1.034, which is very nearly the highest mark of genuine milk, and this of course caused most of the milk furnished by cows to stand below 100; it is the instrument which is 3d on the list; the 100 mark stands opposite 1.034; the makers have gradually dropped their 100 mark to 1.033, consequently the 100 mark on the 4th instrument is opposite 1.033; that instrument is the one commonly used by dealers in milk, and in sampling; milk which has a gravity at 60 Fahr. less than 1.033 will be indicated by that hydrometer as below 100 per cent. of milk; the lactometer used by the Health Department employs the lowest standard, the object being that no sample of genuine commercial milk should ever mark on that lactometer less than 100; about 16 per cent. of water may be added to milk which marks 120 on the Board of Health lactometer, without bringing it quite down to 100; that is a margin of watering which it is impossible to prevent because no matter what method of investi-
gation is resorted to, it is impossible to determine within the range from the two extremes of the best milk and the poorest milk; it is impossible to prove adulteration as long as the adulteration has not carried the sample below the poorest milk that healthy cows produce; no method of investigation will detect the fraud.

Q. Well, now, sir, is it possible to make a lactometer in its appearance exactly like any of these and that in use by the Board of Health, which could not be distinguished from it by its appearance, but would register at a far lower rate? A. It is; such are made and are in use.

Q. Now, sir, is this lactometer an accurate instrument for determining the specific gravity of liquids?

(Objected to as calling for a conclusion; objection overruled; exception.)

A. There are two methods in common use for determining the specific gravity of liquids; both depend upon weighing known volumes of liquid; in the one case the balance and the bottle are employed; in the other case a hydrometer and a cylinder are employed; in both cases the liquid is actually weighed and in both cases a fixed volume is weighed, and the hydrometer involves less sources of error than the use of the balance and the bottle. It is necessary, however, when the hydrometer is constructed, it should be accurately constructed; but the hydrometer having been constructed or the lactometer having been constructed, and its accuracy determined, it then gives as accurate a method as there is known for determining the specific gravity of liquids.

Q. I was about to ask that question whether there is any more accurate method of determining the specific gravity of liquids than by the use of such instruments? A. There is not.

Q. Well, now, sir, are you familiar with the literature of milk and its examination, and all the best opinions of the best standard writers, both in this country and others, on this subject? A. I am.

Q. And what is the best opinion, according to the best authorities, with regard to the use of the lactometer for detecting the watering of milk?

(Objected to as incompetent and calling for hearsay evidence; objection overruled; exception.)
A. It is that the lactometer as used by the Health Department with the 100 mark placed at 1.029, and used in connection with the ordinary senses of sight, taste, and smell, is the most reliable method for determining the excessive watering of milk.

Q. Now, sir, if a sample of milk sold in this city be tested by the lactometer and it stands, with the milk at a temperature by the thermometer of 60 Fahr., at a point below 100, at 90 for instance, what does that determine? A. That it has been watered.

Q. The milk inspectors employed by the Board of Health, are they qualified to test milk; I ask your personal knowledge upon that subject?

(Objected to; question withdrawn.)

Q. You are President of the Board of Health? A. I am.

Q. And you were in the summer of 1876? A. I was.

Q. And the witness on the stand, Dr. White, is one of the inspectors employed by the Board? A. He is.

Q. Now, sir, I understood you to say that the test of the Board of Health was by the use of the lactometer and the thermometer and with the senses, with the smell, the taste, and the sight? A. It is.

Q. Can milk thus be distinguished from cream? A. It can.

Q. Will the inspector using these tests have under his observation conditions in the milk which will enable him to distinguish skimmed milk and other varieties of adulterated milk?

(Objected to as calling for a conclusion.)

Q. Are you acquainted with the kind of milk that is offered for sale in this city? A. I am.

Q. Doctor, I ask you as an expert on this question, can you tell the difference by the use of these tests described as in use by the Board of Health, the difference between milk with the natural cream and skimmed milk and watered milk and milk variously adulterated?

(Objected to; objection overruled; exception.)

A. I can distinguish between cream and milk and skimmed milk by the use of those tests.

By the Court—Q. By the lactometer? A. By the lactometer and by observation; by my senses.

By Mr. Prentice—Q. And a thermometer? A. A thermometer;
that is within certain limits; cream and milk are two extremes between
which there is no dividing line; there is no point at which a fluid ceases
to be milk and becomes cream or ceases to be cream and becomes milk;
it depends entirely on the extent to which the milk is skimmed; if
one per cent. of all the fat contained in a sample of milk is skimmed
from it, it would literally have been skimmed, but it would not be
called skimmed milk; it is only when a considerable portion of the
cream has been removed that we have well defined skimmed milk which
has a gravity considerably greater than the gravity of original milk
and which is thin and watery; with regard to cream if the cream is
so carelessly skimmed that a large proportion of the milk is taken off
with it, it would then be very poor cream and might be but little
lighter in specific gravity than the original milk; when I say there-
fore that I can distinguish cream from skimmed milk and both from
whole milk by the use of the lactometer and the thermometer and
my senses, observe I refer only to such specimens as really repre-
sent fair average cream, fair average skimmed milk and fair average
whole milk; the natural variations in the milk of cows within the
limits above 100 on the lactometer make it impossible to make a
sharper line of division between these three different products from
the cow.

Q. Now, sir, as President of the Board of Health you and your
associates have directed a number of tests and experiments to be
made to determine the reliability of the lactometer?

(Objected to.)

A. We have.

Q. Have you directed a large number of experiments to be made
for the purpose of testing its reliability? A. I have caused to be
made under my direction a number of experiments to determine
whether the standard of 1.029 is the proper one for the minimum
gravity of cow's milk.

Q. And at different seasons of the year have you made that?

A. At different seasons of the year.

Q. And in the country as well as in the city? A. Chiefly in the
country, on the Harlem and the Erie Railroads, in Orange county
and Westchester county, the dairies which supply New York city
with milk, and to a limited extent in the city itself.

Q. I would be glad that you should explain and relate those
experiments and results. A. 505 cows have been milked, each into a separate pail, until all the milk had been removed from the cow. In each case the milk was mixed that there should be no separation, because the first milk that comes from a cow at a milking is heavier than the last that comes from a cow at a milking.

By Mr. Lawrence—Did you see all this, Doctor? A. No; I stated that this work was done under my direction; I stated I caused these investigations to be made.

By Mr. Prentice—Q. By whom? A. By milk inspectors; four officers engaged were inspectors of milk of the Health Department, all of whom had been instructed in my laboratory as to the proper method of testing milk with the lactometer and thermometer and other means of observation; the fifth was Dr. Waller, who is the analytical chemist for the Health Department. These five men made all their observations under my direction after being instructed by me exactly how to make them, and they reported the results to me.

Q. This paper which has been marked for identification on the part of the defense, does it contain one of those reports? (Paper shown to the witness.) A. It does; there were others of a similar character.

Q. Is that another? (Another paper shown.) A. This is another.

Q. You have begun with these 505 cows? A. In each case.

Counsel—I want to have an objection and exception to this gentleman testifying to anything that was not done within his personal knowledge in answer to the questions.

The Court—Take your exception.

Q. Now, sir, if you will go on. A. The strippings from the cow represent only a portion of the milk from the cow’s glands and that portion is cream, or at all events richer in cream than the average, consequently all the milk must be drawn into the pail and mixed to make the average sample of milk that the cow produces. A sample of that in the case of each cow was put into a bottle and corked, and cooled to 60 Fahr., and its specific gravity was then taken by the lactometer. In these 505 cases, 192 were made in the summer of 1875, which was an average summer, and of those 192 cows, not a single cow furnished milk that stood below 102 on the lactometer; the extremes were 102 and 120 on the lactometer in 192 cows. The
past year was a peculiar one, and the inspectors were again sent to the dairies in the hot weather of July. The last week in June and the first week in July, an additional number sufficient to bring the whole to 505 cows were tested in the same way.

Counsel—I move to strike that out as having been outside the knowledge of the witness. Your Honor denies that motion, and I except.

The Court—Yes, sir.

A. The result of this investigation was that four cows were found who produced milk below 100 by the lactometer; one stood at 96, two stood at 95, and one stood at 93, at a time when the pastures were dried up and the cows were in an abnormal condition, a time which was so trying to all animals, and which caused the death of nearly twice the usual number of children in New York, and which was a period which subjected the cows to abnormal conditions; as a proof of this, two cows were found that were sick; one of them had aborted, and the other one was suffering from what appeared to be rheumatism; one of these cows furnished milk which stood at 96, and the other furnished milk which stood at 88 by the lactometer.

By Counsel for Defendant—Q. All that you have testified to is without your personal knowledge?

A. Yes, sir.

Counsel—Note an exception.

By Mr. Prentice—Q. These facts were embraced in reports to you officially?

(Objected to as immaterial; objection overruled; exception.)

A. They were.

Q. Go on, sir? A. Two cows known to be sick furnished milk standing below 100; 4 cows out of 505 not proved to have been sick, though it was a time when all animals were suffering from the unusual heat, furnished milk that stood, the lowest at 93, the highest at 96; that was the result of the observations reported to me.

Q. Have you tabulated these observations of the 505 cows? A. I have caused them to be tabulated and averaged.

Q. Have you that here; have you examined it and know it to be correct? A. I have not.

Q. From your reading and observation, and the experiments that you have caused to be made, has there been any experiment or test of milk from a sound, healthy cow that, under normal circum-
stances, would fall below 100 on the lactometer graduated by the standard of the Board of Health?

(Objected to; objection overruled; exception.)

A. I do not recollect a case in which any cow, under normal circumstances, produced a sample of milk which stood below 1.029, or 100, on the lactometer used by the Board of Health.

Q. Doctor, in regard to experiments and observations made by chemists and scientific men in the determination of the results of scientific inquiry, is there what is called an error of experiment, so that an average has to be taken from a large number of samples? A. There is.

Q. Now, sir, is the lactometer a means of determining the quality of milk, or anything besides its specific gravity? A. The lactometer by itself simply indicates specific gravity.

Q. And nothing else? A. And nothing else.

Q. Now, sir, I will be glad if you would show to the Court and jury the manner of using the lactometer; I ask you to take the milk?

(The witness here made experiments with milk.)

A. We simply place the milk in a cylinder and put in the lactometer, so that the bubbles which may form shall be floated over the side to make a clear surface of milk, and we further take care that the upper part of the instrument shall not become covered with milk; that would, of course, increase its weight, and make it descend to a greater depth; then we introduce the thermometer to ascertain the temperature. I have not taken care to secure exactly the temperature because it is not intended to proceed against the party from whom this milk was obtained; the temperature is actually 67, which is 7 degrees above the proper temperature.

By Counsel for Defendant—Q. What's the gravity of milk? A. The gravity of the milk is 82 by the lactometer.

By Mr. Prentice—Q. Was this experiment made on any ratio of temperature and gravity? A. No. The coefficient of expansion for milk is variable, consequently it is not possible to determine beforehand what the conditions by the lactometer will be for a fixed basis of temperature, and a correct reading of the lactometer for deviations from the standard temperature of 60; the only safe plan is to cool the milk to 60. Any attempt to correct the lactometer by any standard
between the lactometer and thermometer cannot be done; if the milk however stand below 60 by the thermometer, the reading of the lactometer will be in favor of the milkman, because the milk is heavier when cold than it is when warm, and any observation when the milk is cooler than 60 is in favor of the milkman. We are not always particular to order the milk to be warmed up to 60.

COUNSEL FOR DEFENDANT—I ask to strike out that portion of the testimony about the particularity to heat the milk as immaterial and irrelevant.

The COURT—I decline to strike it out.

COUNSEL—Note an exception.

WITNESS—Here I have a sample of skimmed milk, in which the lactometer stands at 114, showing that the removal of the cream has increased the gravity of the skimmed milk, but at the same time it has changed its appearance and made it thinner than genuine milk.

By COUNSEL FOR DEFENDANT—What is the temperature of the latter, Doctor? A. 56.

Q. 114 at 56, is that it? A. Yes, sir. Here I have a sample of cream; the cream stands at 44.

Q. What is the temperature, Doctor? A. 67.

Q. That is the temperature of the cream? A. Of the cream.

By Mr. PRENTICE—Q. Try this; we have cooled it down to 59. A. It stands at 59 now; practically the same, 59 is the temperature.

Q. And what does it stand on the lactometer? A. 90.

By COUNSEL FOR DEFENDANT—Q. Which is that, Doctor? A. That is the first sample.

Q. The one that stood at 82 originally? A. Yes, sir; in the first place in making a test we observe by the manner in which the milk adheres whether it is thick or thin milk; if it is genuine milk it has a consistency which is between that of cream and skimmed milk; the cream is thick and it is yellowish; this peculiar consistency which is so characteristic of cream; the skimmed milk is watery and semi-transparent; it does not form bubbles readily and does not retain the bubbles; the cream has the greatest disposition to retain the bubbles and the genuine milk is between these two extremes.
Q. This milk when you first tested it was at a temperature of 67 and a lactometrical degree of 82; I believe when next tested it was at a temperature of 59 Fahr. and a lactometrical degree of 90; this shows the decrease of 8 degrees of temperature and an increase of 8 lactometrical degrees, does it not? A. I did not follow your figures.

Q. The first temperature was 67, the last 59; the first lactometrical 82 and the last 90; I simply want to see if I am correct? A. Yes, sir; the can which was handed back to me stands at 90 on the lactometer.

By Mr. PRENTICE—Q. Now, sir, go on? A. This one contains a sample of commercial milk purchased in this neighborhood.

Q. Is that pure milk or not? A. It is not.

Q. What does it show? A. It shows that it has been watered.

Q. What does the next contain? A. The next contains skimmed milk that I skimmed myself.

Q. What does it stand at? A. 114.

Q. What is the next one? A. The next one is cream.

Q. What does that stand at? A. 44.

By Mr. PRENTICE—I would submit to the Court and the learned gentlemen it would be agreeable to us if the jury would be permitted to see the milk that is there, the different samples and to read the lactometer.

Dr. CHANDLER—I simply call attention to the fact that the skimmed milk is very thin, consequently when the lactometer is drawn out of it the liquid runs off the lactometer and leaves it clean; it is thin and translucent and the liquid runs readily from the lactometer; in the case of cream the liquid is thick and opaque; it takes a long time, comparatively, for the cream to run off the lactometer; so that observation makes it easy to distinguish between cream, which is thick and makes a coating and skimmed milk, which is very thin; now this watered milk is between the two; it is not as thin as the skimmed milk nor is it as thick as the cream: compared with the skimmed milk, it does not run off as rapidly as the skimmed milk does, but runs off much more rapidly than the cream does, and there is a difference in the color.

Q. Those are all lactometers of the Health Department, are they? A. They are.
Q. Now, sir, you stated that the rule in testing milk was to reduce it to a standard of 60 or below, instead of making any arithmetical computation between the degrees on the thermometer and the lactometer; will you state the reason for that? A. Because there are no two samples of milk in which there is exact regularity in the change of the gravity with the change of temperature; the numbers are variable, that is to say, that one degree of the thermometer does not correspond to a fixed number of degrees of the lactometer or to any fixed fraction of the degrees of the lactometer; it varies at different points on the scale, consequently it is impossible to correct the observation of the lactometer by any calculation when the observation is not made at 60.

Q. Could a determination be made on a single specimen of milk? A. Yes, sir; in the case of a single specimen of milk the variation could be determined, but it would only hold good for that particular specimen of milk, because the proportions of fat, caseine, sugar, and salts and water are variable; they are not the same in any two samples of milk.

Q. In order to bring out more distinctly one fact which I believe you testified to, Doctor; is the lactometer a test of any fluid—is it a test of milk or any fluid? A. It is a test of specific gravity.

Q. And that is all? A. Nothing further.

Cross-examined by Mr. Lawrence:

Q. Doctor Chandler, how many lactometers have you there? A. Four.

Q. Have you tested them all in the same fluid up there? A. Not here.

Q. Will you test them all in one fluid and see if they show the same result—I mean in one of those jars of milk, or whatever it is? A. I am willing to do so; that one stands at 114, that is in the skimmed milk; this stands at 117, I give it the widest variation under the reading; Prof. Silliman gives it 116; I prefer to give it the extreme.

Q. Now, if you will, give the other? A. I should call that 117; Prof. Silliman makes it 116½; we do not consider that the reading should be very sharp, for we never arrest a man unless the milk is below 90.
Q. I ask how the last lactometer stands? A. 114\frac{1}{2}; Prof. Silliman reads it 114.

Q. Now, Dr. Chandler, I ask you to take this lactometer and test it in one of the fluids?

Mr. Prentice—I desire to ask that the temperature of the different liquids in which the lactometers have been placed is taken because it must have communicated some difference to the lactometer itself. The lactometer taken from one fluid there would be a different temperature from that of the other fluid in which another one has been inserted unless it be regarded as unimportant.

WITNESS—115; this liquid is at 60.

Mr. Lawrence—Q. Can you verify the lactometer you hold in your hand, and state whether it is correct according to your standard? A. Not well here, for the reason that we verify with solutions of salt and water, and we introduce them into salt and water of known specific gravity, and ascertain if those gravities correspond.

Q. As far as you can now tell, sir, is there any important variance between the one you use and the one you hold in your hand? A. Not at those points on the lactometer; those are the least important points, however, for the reason that they are above 100.

Q. Well, sir, try it in the cream and see if it makes substantially the same reading as in your instrument, if the temperature be the same? A. It touches bottom; it is too long for this cylinder.

(Another cylinder was furnished the witness.)

A. 67; it stands at 48.

Q. And will you see if the thermometer is the same? A. It stands at 67.

Q. Now will you replace your lactometer in that and state the result? A. It stands at 45; I am not sure that this is the same lactometer; there have been four lactometers here that have been transposed.

Q. Try another? A. Between 44 and 46; I estimate it at about 45; Prof. Barker pronounces it 47.

By Mr. Prentice—Q. Take that one? A. I should call that 45; I would explain in reading the lactometer that as the milk adheres a little on the side of the lactometer the surface is curved, not level, the curved portion is called the meniscus; there is a difference in
the habit of reading; one selects the highest part of the curve, another the lowest, according to habit; in testing milk we select the highest and follow that invariably, in reading as far as we can see the scale, and not attempting to estimate where a line drawn level across the entire surface of the fluid would strike the scale below the visible portion; in all my reading I have read that portion of the scale which was visible to the eye; the milk rises on the surface of the lactometer; I call this one 45.

Q. Try another? A. I call that 46; possibly more than 46, rather than a little less; Prof. Barker says 46.

By Counsel for Defendant—Q. Now, Doctor, can you now tell whether there is any material variance between this lactometer and the one you have used? A. I have not kept those figures in my head; there is a margin of two or three degrees in the five instruments tested.

Q. Could you test this to-night? A. I have other engagements; I don’t care to spend the evening in testing another man’s lactometer; I have a consultation this evening in connection with another law suit, and it would be impossible for me to devote the evening to that investigation; if Dr. Waller is willing to test it—

Q. I produce the same bottle previously exhibited to Dr. White containing the same contents, and ask you to apply the test of the lactometer to that, at a temperature of 60 Fahr., and give the reading?

(Objected to; objection sustained; exception.)

Q. Now, Doctor, how do you test the gravity of the salt solution in which you test your lactometers? A. By means of a balance.

Q. You provide your officers with thermometers, do you not? A. I do.

Q. Have you always done that? A. Originally, in the early stage of this business, the thermometer was sometimes used and sometimes not; when it was used it was simply for a very careful determination of the specific gravity; when it was not used it was because it is possible in testing the milk by means of the lactometer and tasting it to determine whether it approximates to 60 Fahr., and therefore it was not considered necessary to determine with absolute certainty.

Q. I simply want an answer to that specific now; when was it
you began providing your officers who tested milk with thermometers? A. When we found that the milk dealers of the city had banded together, and had employed counsel to press the Board upon every detail on these points.

Q. You found that out after the milk dealers had? A. No, sir; I do not consider it necessary to use the thermometer now; we do use it simply because it becomes necessary in these suits to determine the exact specific gravity; it is not necessary to determine the exact specific gravity in order to determine whether the milk is watered or not.

Q. Every time that your assistant uses the lactometer he uses the thermometer? A. He does it simply because he expects to be met in court by captious opposition to this test.

Q. He does it? A. He does it.

Q. How do you use the balances in determining the specific gravity of the solution with which you test your lactometer? A. I have a delicate little bottle provided with a thermometer and a carefully fitting stopper, so arranged, that I can fill it at any desired temperature absolutely full of pure distilled water; having first ascertained the exact weight of the empty bottle; I then fill it with pure water and at the same temperature and weigh it again; subtracting the weight of the empty bottle from the weight of the bottle filled with pure water, I ascertain the exact weight of the water which that bottle holds at the temperature of the experiment which I select, generally a little above the temperature of the atmosphere at the time; I then fill it with any liquid the specific gravity of which I desire to know; warm it to the same temperature at which I weighed the water and weigh it again; there is an overflow provided on the bottle, so that as the liquid expands until it reaches the standard of temperature for the experiment, the excess runs over and is wiped off; I have then filled my bottle exactly full at say 70 Fahr. with water, and exactly full at 70 degrees Fahr. with a saline solution, having weighed them both upon the balance and on subtracting the weight of the bottle itself from the two weighings I have the comparative weights of pure water and the salt solution; this is the simplest method of arriving at this result.

Q. Is that all? A. Yes, sir.

Q. Now, sir, will you name the authorities to which you referred
in your direct examination as sustaining the lactometer, you stated you were familiar with the standard European and American authorities on the subject; I want you to give the names, as far as you can, of those you referred to? A. May I consult this book?

Q. Yes, sir? A. I have read the *Milk Journal* for a number of years; a year or two, at least; I have examined Wanklyn, Hassall.

Q. What is the full title of those books? A. The first is the *Milk Journal*, an English journal.

Q. What year? A. Somewhere in the year 1870; I have forgotten the exact date; *Du Lait et de l'Allaitement*, by C. Marchand, *Milk Analysis*, by J. A. Wanklyn.

Q. What is that edition of Wanklyn? A. The last edition, I presume; I am not quite sure about that; I will qualify my answer when I have given the titles of these books; *Food, and its Adulterations*, the last edition, by Hassall; *Gmelin's Chemie*.

Q. What edition is that? A. The last German edition.

Q. Do you recollect the year? A. No; because it is in successive numbers, and it has been ten years in publication; *Watts' Dictionary* and supplements.

Q. Which supplements, Doctor? A. Both; *C. Mueller's Anleitung zur Prufung der Kuhmilch*.

Q. When was that published, and what is the edition? A. It was the first and the last edition; I have examined them both.

Q. Is that a New York publication? A. Published in Germany; in Switzerland, rather; I have further read all the papers that have appeared in the *Jahresbericht der Agrikultur Chemie* ever since it was published, I think, about ten years; I have also read everything on the subject of milk that has been published in *Wagner's Jahresbericht der Chemischen Technologie*, and in the *Jahresbericht der Thier Chemie*; these journals contain abstracts of all papers published in Germany on these subjects; I have forgotten whether your question involved my discriminating with regard to the exact opinion which these authors on the lactometer hold.

Q. Any other authorities? A. These are the chief names; I could give them all, if desired to look through my notes carefully.

Q. If you could name any others, I would like them? A. I have read *Von Baumhauer*; I would state that many of these books that I have alluded to contain *resumés* of all the authors on the subject;
most of them are compilations; that is the case with Watts' Dictionary.

Q. How about Quevenne? A. I think that is one of the books in my library that I have looked through.

Q. Is that a standard work; is that authority upon the subject upon which it treats? A. Each of these books is more or less authority.

Q. Do you include Quevenne and Von Baumheaur? A Yes, sir; they are and fifty more if I would recall the names; I have Trommer's works on the examination of milk.

The Court adjourned.

[Chandler's testimony continued on page 60.]

WEDNESDAY, DECEMBER 20, 1876.

CHARLES A. GOESSMANN sworn and examined by Mr. PRENTICE.

Q. Dr. Goessmann, you are a chemist by profession? A. Yes, sir.

Q. How long have you been so? A. About twenty-five years, probably more.

Q. You are a Doctor of Philosophy? A. Yes, sir.

Q. Of what university? A. The University of Goettingen.

Q. And are at present professor of what? A. Professor of Agricultural Chemistry and Chemistry at the Massachusetts Agricultural College.

Q. At Amherst? A. At Amherst.

Q. Will you please state briefly the course of your study and the class of subjects to which you have specially given attention in your profession? A. I have studied for seven years at the University of Goettingen; I was promoted after four years as a doctor of philosophy; was public lecturer for two years afterwards in the university, and assistant in the government laboratory at the University of Goettingen.

Q. Of Hanover? A. Yes, sir; Hanover. I subsequently moved to this country and engaged in technical enterprises. In 1857 I came to this country; I managed for three years and a half a large sugar house; subsequently took charge of the salt works at Syracuse for eight years, and was chemist to the salt company of Onon-
daga for the manufactory of dairy salt, for eight or nine years; in 1868 or 1869, I moved to Amherst, the winter of 1868, and have since been teaching agricultural and general chemistry at the state college of the State of Massachusetts, where I am engaged at present; I have been teaching agricultural chemistry in relation to the dairy to the students for the last six or eight years; private investigation I must say I began two years ago; previous to that my teachings have been taken from the books to a large extent and general collections from experience, but for the last two years I have made a specialty now and then to illustrate to the students practically the analysis of milk and the application of various instruments for the testing of milk.

Q. Now, sir, tell me what is this lactometer? A. The lactometer is a hydrometer for a specific purpose constructed in the same manner as we apply the hydrometer for different other branches of industry, constructed with only arbitrary scales to suit purposes for different branches of industry; for salt works we have the salinometer, for acids, the acidometer, and for alcohols, the alcoholometer.

Q. The lactometer is for milk? A. Is for milk, to test the specific gravity of milk.

Q. Now, sir, is there any more accurate method for determining the specific gravity of liquids than by the use of such an instrument? A. There are different ways by which it may be tested, but I cannot give—

Q. This is as accurate as any other? A. As accurate as any other and in my opinion easier carried out than any other.

Q. Well, sir, there are lactometers graduated at different rates are there, the scales? A. Yes, sir, there are a number which have been introduced in the course of time. We have one somewhat obsolete, Druffle's milk balance, having only 20 degrees.

Q. You have stated that there are others and some that are obsolete? A. Yes, sir.

Q. I will ask you of a lactometer at a standard of 1.029 your opinion of that as a safe test for milk? A. That is Dinocourt's.

Q. Well, sir, what do you think of that standard for milk? A. That is recognized best on the lowest standard of a commercial article of milk.
Q. This instrument is used in connection with the thermometer?  
A. With the thermometer always. Comparative weights are tested by comparative temperature.

Q. A moment ago you spoke of this instrument, if I understand you rightly, as a balance; it is so in effect, is it?  
A. Yes, sir.

Q. And sometimes spoken of as such?  
A. Yes, sir.

Q. Now, sir, at what rate of warmth should the test be made by the thermometer; at what rate of heat or cold?  
A. 60 Fahr. is the temperature agreed upon.

Q. Professor, is the analysis any more accurate method of determining the specific gravity than the lactometer properly used?  
A. As long as we cannot distinguish between the water which milk contains by nature and the water which is added the analysis cannot form a better proof than the comparative test. As long as the minimum of solids is not fixed and recognized among scientific men I cannot see that analysis can give any more definite result at the present time.

Q. Well now, sir, in investigations of milk has there been arrived at among scientific men any fixed standard of specific gravity of milk in a normal condition?  
A. The current of opinion among scientific men is that the average of milk marked varies from 1.029 to 1.033, 1.029 being the hundred scale of the lactometer of the Board of Health as far as I understand.

Q. Well, sir, if milk on the lactometer adjusted at the scale of 1.029, at a temperature of 60 Fahr., should mark 90, what would you say?  
A. I would assume that something lighter than milk had been added.

Q. If it were commercial milk?  
A. The most reasonable conclusion would be water.

Q. At what rate?  
A. About 10 per cent.

Q. Do you know commercial milk, at what rate it should stand?  
A. From 1.029 to 1.033.

Q. Your reading and preparation for your profession and for these special investigations that you have made, have they embraced the experiments and observations made in France, Switzerland and other countries?  
A. I am familiar with the literature.

Q. And will you now state what the data, the facts and opinions
to be derived from the French authorities and from what range of observation?

(Objected to as calling upon the witness to state the contents of those authorities.)

Q. From what range of observations reported in the best standard French writers upon the subject of milk and its tests has the best opinion been derived about a fixed standard of milk and the use of the lactometer?

(Objected to as calling on the witness to state opinions of others and to discriminate between them; objection overruled; exception.)

A. The tests reported are stated to be 6,000 by Quevenne and the statement is made by Dr. Christian Mueller, the director of the milk station in Thun, in Switzerland, who is considered an expert in that business.

Q. At what range of observations there? A. In Switzerland there are a number of observations ranging from twenty to forty at a time, but I do not remember exactly in what proportion, yet I remember that it is about such a proportion as ten.

Q. Is the opinion that you have expressed according to the best authorities in regard to the use of the lactometer for detecting the watering of milk? A. The lactometer is not an instrument to detect small quantities of water in the milk within that scale.

Q. I ask, is the opinion which you have already expressed as to the use of the lactometer for detecting the watering of milk consistent with the best authorities on this subject? A. Yes, sir, the lactometer is recommended by Mueller himself in consequence of experiments by himself throughout Germany and other countries.

Q. Is your opinion that you have expressed at variance with or in accordance with the best opinion of the best authorities?

(Objected to; objection overruled; exception).

A. I think it is.

Cross-examined:

Q. Now, Professor, won't you give us the names of the standard authorities to which you refer? A. Of standard authorities I might name Fleischmann, Vogel, Mueller; these are principally some of the original investigators; those who have compiled I have not taken care of.
Q. There are a great many more?  A. Yes, sir; every text book on chemistry used——

Q. Can you designate any others?  A. Proskauer; he is a chemist on the Prussian experimental station.

Q. Where can that book be found, where is it published?  A. I have not his original work; I derive this opinion from the publications in the leading journals.

Q. What leading journals?  A. The Agricultural Gazette of London, before mentioned, and the Milk Journal; every agricultural periodical in Germany might be found to contain facts on these questions, and also the publication of the milk experiment station at Thun.

Q. You say that Quevenne made 6,000 tests of milk?  A. That is stated by Christian Mueller, the Director of the experiment station at Thun.

Q. I do not understand you stating that of your own knowledge?  A. No, sir; derived from books.

Q. Of those 6,000 tests can you tell how many fell below 1.029?  A. I do not know that one is recorded.

Q. Will you be certain that not one sample below 1.029 is recorded in Quevenne?  A. I accept it on the authority of Mueller; I do not think that any is recorded; that is all I can say.

By the COURT—Q. Is that your recollection?  A. My recollection is that none is stated in connection with that statement; that is all I can say.

COUNSEL—Q. Are you acquainted with Hassall’s books on the adulteration of food?  A. I am acquainted with it; but I have not examined it on this particular question.

Q. Is that a book of good authority?  A. It is looked upon as such; it may be a good compilation; I look upon these compilations coming from chemists——

Q. Can you tell whether Hassall in that book records any milk below 1.029?  A. I have not opened the book for that purpose.

Q. Now, in case milk, coming from cows in a good normal condition, can be found in a variety of instances of the specific gravity below 1.029, will not you say that the lactometer as at present graduated at the standard of 1.029, is graduated too high?  A. As far as milk of an individual cow is concerned, I would not pro-
nounce until I knew that the cow was well fed and in a healthy condition.

Q. If you assume that the cow is healthy and well fed, that the milk is pure, if you first satisfy yourself of all this and then from a variety of cows, not a single one, find milk the specific gravity of which at 60 Fahr. falls below 1.029, will you yet say that the lactometer is graduated at too high a scale when it is placed at 1.029?  

(Objected to; objection sustained; exception.)

Q. Now, Professor Goessmann, you stated it as your opinion, did you not, that 1.029 is the lowest specific gravity at which pure milk can be found?  A. That is the statement.

Q. Do you state it as your opinion?  A. I never found it so low.

Q. Now, in case you found milk lower, your opinion as to the standard would change, would it not?  A. I would inquire, doubtless, before I would decide.

Q. In case, after inquiry into all the details of the case, you had satisfied yourself that the milk was everything it ought to be, would not your opinion then change?

(Objected to; objection overruled; exception.)

Q. Now, sir, you say that the lactometer is always used in connection with the thermometer, do you not?  A. I can conceive a case where I would add another test.

Q. I ask you, is it always necessary to use the thermometer with the lactometer?  A. Oh yes, certainly.

Q. You differ from Prof. Chandler in his testimony, yesterday, when he said it was not necessary?  A. It may be that so much experience makes it not necessary to use in every case the thermometer.

Q. Now, sir, is analysis the most correct and accurate method of testing milk?  A. I think that analysis in the present state of science does not definitely settle the question for two reasons; as long as there is not a minimum of solid matter recognized by scientific men as a standard, and as long as added water in the milk cannot be distinguished by analysis, I think that analysis cannot advance the question at the present time, at the present state of the inquiry, I mean.

Q. You differ from the authorities which hold that analysis is
a perfect test for milk?  \(A\). Certainly, conditionally of course, as I modified my answer.

\(Q\). I do not ask you now what is a perfect test for milk, but I ask you to state to the jury what is the best test for milk that is now within the reach of scientific men?  \(A\). As far as the composition of milk is concerned the relative different constituents in the milk, of course the chemical analysis might give special information; as far as water is concerned, I think the lactometer gives as safe a one as any other.

\(Q\). Well, will the lactometer show how much of any one ingredient it contains?  \(A\). No; it is an instrument not to test the constitution of milk, but a certain property of milk, the specific gravity.

\(Q\). Now, sir, will an analysis show how much of each ingredient the milk contains?  \(A\). In regard to water, if I had not taken the milk myself I would of course repeat my experiment; it would be only an individual case.

\(Q\). Will analysis show how much water, how much butter, how much caseine, and how much salt the milk contains?  \(A\). It will give the exact proportion of the constituents contained in that sample, that is, according to the best modes we have of separating them from each other.

\(Q\). Now, suppose two samples of milk to exist to one of which cream has been added, to the other of which water has been added, will the lactometer show which contains the added water and which the added cream?  \(A\). The lactometer will not alone show the exact proportion; it will make it lighter; it depends on the proportion of the substance added.

\(Q\). Well, now, adding water to milk makes it lighter by the lactometer and adding cream makes it lighter also, does it not?  \(A\). Yes, sir.

\(Q\). In case two samples of milk exist which when tested by the lactometer give each the same result, each stands at the same degree and to one of those samples water has been added and to the other cream has been added, will the lactometer show to which the water has been added and to which the cream has been added?  \(A\). If I did not look at the sample both have the same effect; the question would then be to call my other senses and my experience into account and judge from that.
Q. But from the lactometer alone that would not appear? A. No.

Q. Will you from your senses tell what is in that bottle? (Bottle shown).
A. No; I know too much.

Q. Then you regard the lactometrical test as being as sure a test as analysis? A. Yes, sir; for that particular point.

By Mr. Prentice—Q. With the two samples of milk given to you, one that has been doctored by the addition of cream and the other by water so that they present in that shape the same grade of specific gravity submitted to an expert in the testing of milk who will use his other senses and all of them necessary, will it be possible for him to distinguish between the two samples?

(Objected to objection sustained.)

By the Court—Q. I ask you in view of the question which I have permitted and which you have answered, now say you took a gallon of milk and you put two quarts in one vessel and two quarts in another and you add a spoonful of cream to one and a quart of water to the other, will the lactometer tell which the water is in? A. The quantity of water of course would affect the lactometer more than a small quantity of cream in the same proportion of specific gravity, whatever might be the quantity arranged.

Q. You put a tablespoonful of cream to two quarts and you add a quart of water to the other, the lactometer would tell the water, would it? A. Certainly.

Charles F. Chandler, recalled by Counsel for the Defendant, for cross-examination.

Q. Now, Doctor Chandler, I understand you to say that the lactometers used by the Board of Health are adjusted under your special personal direction? A. Yes, sir.

Q. You take great care, do you not, that they should all be accurate and that they should be alike? A. I take great care that they should be exact at the hundred point, which is the essential point or the lactometer, but when they get down to 44 it is immaterial whether the lactometer reads 45, 44, or 43, or when they get up to 114 it is immaterial whether they read 114, 115, or 116; the essential
point is the 100th mark, and that is determined with great accuracy on those four lactometers that I used yesterday.

Q. Then, Dr. Chandler, do I understand you correctly that the 100 mark is the only point at which this lactometer is correct? A. I would not say it is the only point at which it is absolutely correct; I can tell by referring to my notes if you will allow me to do so.

Q. Will you designate any other point except the 100 mark at which the lactometer is absolutely correct? A. 88 on that lactometer is correct; 104 on that lactometer is correct; 100 on that lactometer is correct.

Q. Any others? A. I think 68 was absolutely correct; there are five points on that lactometer which unless my memory fails me are absolutely correct; it was tested at five points.

Q. Now as to all the four lactometers we examined yesterday, is each one of those correct at all the points you designate? A. I think there are one or two points at which one of them was not correct; they were all correct at the 100th point and at 104.

Q. Then why, sir, did they all disagree at 114 and figures above? A. Because it is not necessary in constructing such fragile instruments of that kind to make the unimportant portions of the scale absolutely accurate; it would make them something like twice as expensive, and we have difficulty enough in getting money to pay for these from the City Treasurer; it is a simple question of expense in the cost of the lactometer whether every mark upon it shall be absolutely correct.

Q. How much do those cost at retail? A. I think we pay a dollar apiece.

Q. Don't you know that the lactometers used by the milkmen cost three dollars? A. If they choose to have a thermometer inserted in the lactometer they increase the expense.

Q. Do you use an inferior instrument? A. No, sir; I tested one of your instruments and it was inaccurate at the 100 mark.

Q. What do you mean by my lactometer? A. The one you handed to Dr. Waller yesterday.

Q. Now, Dr. Chandler, aside from the fact that out of 120 degrees on your instrument you can only designate five which are absolutely correct, can you state any other mechanical defect in this instrument, or are there any? A. I am not aware of any.
Q. Now, sir; is the lactometer correct at 20?  A. I am not sure that the scale on that lactometer goes down to 20.

Q. It does?  A. I do not know; I never have tested the 20 mark; that is a mark we have no occasion to use.

Q. Why do you put it there?  A. Ask the maker; 44 is as low as we find——

Q. I beg your pardon, I understood you to be the maker?  A. No, sir; I am not a maker of lactometers, I simply test them.

Q. You testified yesterday, did you not, that the four instances outside of your personal knowledge, found by your assistants at which cows yield milk, which when pure at 60 Fahr. stood below the 100 on the lactometer, were the cows in an abnormal unhealthy condition?  A. I said that they were cows that were feeding under abnormal circumstances, and that as two other cases of milk standing below 100 were known to be cows that were sick, and as these cows were feeding under very trying and abnormal conditions, and were exceptions in a very large number of cases, although there was absence of direct proof of an unhealthy condition, there was a reasonable ground to suppose that such exceptional cases, at an exceptional time and season, were due to an unhealthy condition of the animals.

Q. The milk was sent to New York during that season, was it not, Doctor?  A. I presume it was.

Q. It arrived in the hands of milkmen at least in as unhealthy condition as it left the cow, did it not?

(Objected to.)

A. It reached the milkmen, but mixed with the milk of other cows, by which an average was established.

Q. If you mix milk from healthy cows and from unhealthy cows, you make it all healthy; the disease does not spread?  A. You do not make it all healthy, but you lose the few quarts of milk below 100; the milk of these few exceptional cows is lost in the large volume of milk from healthy cows, and consequently while those four individual cows stand out as having produced milk below 100, those cows produced a very small quantity, in some cases a quart or two of this light milk; I have forgotten the amount, but the quantity was very small, and the milk is placed in forty-quart cans, which are filled, and consequently it would be impossible from any
dairy, even if all those cows were at one dairy, it would be impossible to send to New York commercial mixed milk standing below 100 on the lactometer?

Q. Will you not look at this table, out of fifteen cows, cow No. 14, and say whether it does not appear from this table that the milk of that cow stood 95, and with one exception, that cow produced as much milk as any of the 15? A. I said in some cases, not in all cases, that the quantity of milk was very small; Number 95 produced five quarts of milk.

Q. Was that not as much milk, with one exception, as any other cow produced? A. No, there is one cow that produced six, and another cow that produced eight, and several cows that produced five.

By the Court—Q. What season of the year was that? A. July, this last July, the hottest weather.

By Counsel—Q. In case the condition of the cow is unhealthy or abnormal to such an extent as to affect the composition of the milk, can this be discovered from the milk itself? A. Not with absolute certainty.

Q. Can it be discovered generally? A. I lost the first part of your question.

Q. In case the condition of the cow is unhealthy or abnormal to such an extent as to affect the composition of the milk, can this be discovered from the milk itself? A. It might in some cases be discovered, but certainly not in all.

Q. Could it generally? A. I doubt it.

Q. Now, in case you took two samples of pure milk at 60 degrees Fahr. one standing at 100, and one at 95, which would you expect to contain the most water?

(Objected to; objection overruled.)

A. The one standing at 95.

Q. Which would you expect to contain the most butter. A. The gravity would not indicate.

Q. Either might? A. Either might contain most butter.

Q. Are you confident that the one standing at 95 would contain the most water? A. Yes, sir.

Q. Now, sir, will you look at these two analyses in Doctor White's report, one being an analysis of milk at 100, and one of milk at 95,
and state whether from that the one at 100 did not contain more water than the one at 95? \textit{A}. In answering the question I presume healthy milk; you asked me whether the one that is at 100 has the most water?

\textbf{Q.} Yes, sir. \textit{A}. Yes, sir, the one which stood 100 indicates a higher percentage of water than the one that stood at 95.

\textbf{Q.} Has not the one that stood at 100 a less percentage of butter than the one that stood at 95? \textit{A}. It has.

\textbf{Q.} Doctor, please state the proportions in which the ingredients exist in milk? \textit{A}. There are no fixed proportions.

\textbf{Q.} Well, sir, then the usual proportions? \textit{A}. May I look at my notes? there are no two samples of milk that have the same proportion.

\textbf{Q.} Well, sir, look at your notes? \textit{A}. I would say that there are no two samples that have same composition, nor is there any such thing as an average composition of milk; you may make an average of 5 samples of milk, or 10 samples, or 100 or 1,000 samples of milk, but the moment you make one additional analysis and introduce the results of that into the previous average, you change the figures; I will say that as good an average as I can make of several hundred, and I do not know but thousands of published analysis which I took the trouble to elaborate and average, was fat, 3.8; caseine, 4.37; sugar, 4.54; salts, .63; water, 86.66; I have occasionally given different averages from memory as a fair exhibit of the ordinary composition of milk.

\textbf{Q.} Now, I read you the proportions found in the analysis of milk before referred to at 95; the average of water, 87; butter, 5; sugar, 4.14; caseine, 3.68; chlorine, .029; do not those proportions go to indicate that that milk was from a healthy cow? \textit{A}. They do not.

\textbf{Q.} Can you point out anything abnormal or unhealthy about them? \textit{A}. They prove neither one thing nor the other; they prove neither that the cow is healthy nor unhealthy further than the specific gravity is an abnormal one, and therefore arouse suspicion that the cow is not in a normal condition or not normally fed.

\textbf{Q.} That suspicion is not verified when you proceed further and examine the sample of milk? \textit{A}. It is not verified, nor is it re-
moved; it would be necessary to dissect the cow to settle the question completely.

Q. Can you then from the milk tell whether the cow from which it came was in an abnormal condition? A. Within certain limits; if the milk stands below 100, I consider the cow in an abnormal condition.

Q. Although the ingredients of the milk may be the same as usual? A. They cannot be the same as ordinarily if the milk stands below 100, because there is an undue proportion of fat which is often the case with sick cows.

Q. Will you state what there is about the analysis which I read to you indicating that the cow is sick? A. The fact that the gravity of milk is below 100 on the lactometer indicates an abnormal cow.

Q. Would this analysis show that the cow is unhealthy—87.08 of water, 5 per cent. of butter, 4 of sugar and 3.68 of caseine? A. The figures are a little unusual, for the ratio of fat is unusually large, and the caseine is unusually small, still one could hardly judge from those figures that the cow was a sick cow.

Q. How much butter usually proceeds from the milk of an Alderney cow in health? A. The percentage of butter is high in the milk of the Alderney cows; it runs sometimes as high as 8 per cent. But the milk is still above 1.029 in specific gravity, because the caseine also is present often in a considerable quantity. I have before me the analysis of Alderney milk in which there was 8 per cent. of fat and the specific gravity of 1.030; another one with 8.28 per cent. of fat and a specific gravity of 1.029; the milk is rich in fat, and also rich in other solids at the same time, and consequently the gravity is maintained.

Q. Now, Doctor, have you ever found milk at the specific gravity of 1.029? A. I have not in my recollection; not myself.

Q. Have you known of its being found—pure, good, healthy milk. A. Some of the inspectors have reported milk which stood at 1.029, I think, in some of those reports or samples; there was one before me to-day which you handed me. We found them this season, but last season we could not find any.

Q. Do you recollect the trial of the case of John Kneib in the Court of Special Sessions, on which trial you were examined as a witness? A. I do.
Q. Now, sir, on that trial did you not in answer to a question put by Col. Hastings, say: "We have never found any unadulterated milk which registered as low as 1.029, consequently we considered ourselves perfectly safe"?
A. We have now, as I stated yesterday—

Q. Within the past year you have found samples of milk lower than you have ever found before? A. Yes, sir; during those very hot weeks in July, when the pastures were dried up and the cows were feverish.

Q. Milk came to the city, though, the same? A. Not by itself, mixed with the milk of other cows; only a very few of those cows were of that kind.

Q. Have you made any change in the lactometrical scale? A. No, sir.

Q. Because of that discovery? A. No, sir; we did not consider four cases out of 505 where the milk is mixed with that of a much higher gravity and the average dairy is over 109 on the lactometer, we hardly think it necessary to change the standard of 100.

Q. Look at these tables and say whether you do not find twelve samples standing at 100?
Mr. Prentice—I assume so, it is in that report.

Q. At the time your lactometer was adjusted to its present standard you had never found pure milk as low as that, had you. A. Never.

Q. Then the milk last summer was in an unusual state consequent upon the heat? A. It was during the first week in July.

Q. Was it later in the season? A. Not to my knowledge.

Q. Do you know whether it was or not? A. No, I do not; I presume not.

Q. Was it the 24th or the 25th of August? A. I could tell, by reference, the exact state of the weather at that time; as long as that hot weather lasted the milk was undoubtedly in an abnormal condition.

Q. Doctor, will you state the causes that will vary the specific gravity of milk? A. Variations in the composition would undoubtedly modify the specific gravity.

Q. Proceed and enumerate all that you can think of? A. The increase of fat, other things remaining constant, would diminish the
gravity, a decrease of caseine or of the sugar or of the salts and other things remaining constant would diminish the specific gravity; in this case it is equivalent to an increase in the percentage of water.

Q. Is not the specific gravity of the milk of the same cow milked in the morning different, very often, from the specific gravity of the milk of the same cow milked in the evening? A. There are differences.

Q. Are they not frequent? A. Yes.

Q. Are they not very considerable in extent? A. No; in exceptional cases possibly.

Q. Now, Doctor, I find here Dairy Number 2, Mr. Blake White's report; a cow that in the morning gave milk which stood at 111 at 60 Fahr., and in the evening at 120 and 60 Fahr., is that unusual? A. I think not.

Q. What makes the milk heavier in the morning or evening whichever it is? A. A little difference in the composition.

Q. When the cow is milked, is not the first half of its milk heavier than the last half? A. It is.

Q. To what extent? A. I could not say without referring to my notes; the strippings are light, the last half of the milk is lighter than the first half.

Q. How much? A. I do not know.

Q. Of course it would stand higher on the lactometer? A. Certainly.

Q. You testified yesterday that the specific gravity of 1.029 was selected to favor the milkmen; do you point out how this is so? A. Because it is fixed at the lowest point at which cows under normal circumstances furnish their milk; had we fixed it at 1.033, as is done in the lactometer which has long been used by the milkmen themselves, we should have found that a great proportion of the samples of genuine milk would have stood below 100; we might still have used this lactometer however, because we could have fixed it at a point below 100 on the 1.033 lactometer; we should consider the milk to be watered and could have prosecuted in cases below that point, but it seemed more desirable that the standard of the lactometer should be placed at the lowest point at which genuine normal mixed commercial milk is delivered from the cow, and for that reason where Dinocourt, the original inventor, placed it, at 1.029.
Q. Who invented the hydrometer, Doctor?  
A. That is more than I can say.

Q. You are quite sure that Dinocourt invented the lactometer?  
A. I won't say that some one else may not have suggested it; Dinocourt's glactometer, as it is called.

Q. A milk at the specific gravity of 1.029, how does the selection of that standard favor the milkmen?  
A. Because by using the lactometer at 1.029 for the 100 mark, no mistake is ever made of arresting a milkman for selling watered milk, when he might have been selling milk from an abnormal cow.

Q. Is it not possible that a milkman arrested for selling milk at 88 or 90 might have been selling from an abnormal cow?  
A. Not mixed milk, city milk; if a milkman should bring one, two, three or six quarts of milk from a sick cow to New York, he might in that way sell abnormal milk, which would stand below 100.

Q. Now, Doctor, suppose you mix two quarts of milk at a specific gravity of 90, and two quarts at the specific gravity of 100, and two at the specific gravity of 110, what specific gravity will result from that mixture?

(Objected to; objection sustained; exception.)

Q. How do you determine an average specific gravity of mixed milks in equal quantities?  
A. By means of the lactometer.

Q. Well, do you determine the average by calculation?  
A. No, sir; we insert the lactometer into the mixture.

Q. Will you point out whether in those tables made by your subordinates they did not adopt another method, that of calculating between all the extremes?  
A. You asked me how to determine the average of mixed milk; these milks were not mixed; the report here is the average observations and not an average of mixed milks; they made say a dozen determinations of specific gravity of as many samples of milk and then represented these observations by an average, some 100, some 105, some 110, some 115, and some 120; you add them together and you get an average; not the average of the mixture of the milk, but of the observations.

Q. Milk mixed together originally of different gravities is the mean between the extremes of those gravities, the true average specific gravity?  
A. It would not be certainly, because in the first place there are different quantities.
Q. Assuming the quantities to be alike?  A. It would not be an exact mean; they do not claim to show the specific gravity of the milk after it is mixed; it is an average of the observations.

Q. You say that you can distinguish milk from cream by the exercise of your senses?  A. I can distinguish fair cream from fair average milk.

Q. You say that you can distinguish skimmed milk from pure milk?  A. I can, sir; from the lactometer and my senses; that is if it has been well skimmed.

Q. From the evidence of your senses can you distinguish pure milk from watered milk?  A. With the aid of the lactometer.

Q. Without the aid of the lactometer, can you?  A. I should hardly dare to declare that the sample was watered milk, without the aid of the lactometer.

Q. Would your general answer as to what you would distinguish by your senses be subordinate to that qualification?  A. Certainly; I made it by the aid of the lactometer, as I had it here at the time; though if I knew that three samples were placed before me, one of which was skimmed milk, another was cream, another watered milk and another genuine milk, I might distinguish them, even without the aid of the lactometer, as my thirteen-year-old daughter did last night when I took those samples home.

Q. Has your attention ever been called to any case of a healthy cow in a normal condition giving milk below 100?  A. My attention has been called to cows giving milk below 100, but as to whether they were in a healthy or normal condition, the means of proof were not at hand, consequently I cannot say that it ever has been.

Q. Do you say that it has not been?  A. Not knowing whether those cows were in a healthy or unhealthy condition by absolute proof, I have only an inference as to their condition from which I can infer that their milk exhibited an abnormal specific gravity.

Q. Had you not the same evidence that they were healthy and normal in their condition that you had that the milk stood below 100?  A. No; that milk stood below 100 was indicated by the lactometer; but that they were in a healthy normal condition I had some evidence to the contrary.

Q. Had you not the same evidence that they were in a healthy
normal condition that you had that the milk had been tested by the lactometer?  A. I had not.

Q. You were present at the trial of John Kneib which I have alluded to, throughout, were you not?  A. I believe so.

Q. You heard the testimony of Doctor Doremus?  A. I did.

Q. Was not your attention then called to several cows the milk of which was said to have been tested by the lactometer and found at various points below 100, and which milk was sworn to have been analyzed and the analyses produced?  A. My attention was called to that statement.

Q. Is not one of your arguments in favor of the lactometer that it is a test which the milkmen themselves can apply?  A. Yes, sir; in connection with their senses.

Q. You do not think it necessary to use the thermometer in testing milk?  A. Only to avoid trouble in trials; I do not consider it absolutely necessary to use the thermometer when one tests milk who has any experience in judging of temperature.

Q. There are two methods to test your lactometer, are there not?  A. Yes, sir.

Q. One is by the hydrometer?  A. That is by comparing it with another lactometer or hydrometer which is known to be correct.

Q. And the other is by the specific gravity bottle, I believe?  A. The other is by placing it in liquids of known specific gravity.

Q. Which is the best of those two methods?  A. Both are equally accurate.

Q. Did you not yesterday testify that the test by the hydrometer was the best of the two?  A. I do not remember that I did; if I did it was simply because it was the quickest and simplest.

Q. If you did so testify were you mistaken?  A. Do you refer to the test of the specific gravity of milk or the accuracy of the lactometer?

Q. The latter.  A. I do not recollect what I stated with regard to those methods; my impression is that I was not examined on testing the accuracy of the lactometer but on determining the specific gravity of liquids; in either case however to test the accuracy of the lactometer by comparing it with another lactometer which is known to be correct is the better method of the two, for the reason that it is simpler; in either case it will be necessary to float the
lactometer to be tested in a liquid of known specific gravity, and it is a question of convenience whether the known specific gravity shall be ascertained by weighing a portion of the liquid in a bottle against the equivalent quantity of water or by determining it by means of an accurate lactometer or hydrometer; the use of the bottle and the balance involves more sources of error than the use of an accurate hydrometer and thermometer because you have the uncertainties of the balance and the uncertainties of weights and a longer amount of time will be consumed; I have tested the lactometer by the balance simply because I had no lactometer sufficiently detailed in its accuracy over the entire length; that is simply to make it proper to use it as a standard for comparison, consequently I used the balance and this little bottle with the overflow which gives an absolutely accurate result; the four lactometers are absolutely accurate at the 100 mark; they are sufficiently accurate at all other points on the scale for all practical purposes.

Q. The decrease of the temperature of the milk causes an increase of the lactometrical showing, does it not? A. It does; the cooler the milk the heavier it is, the warmer the milk the lighter it is.

Q. What is the scale of that decrease? A. There is no regular scale; for instance a sample of milk which at 60 degrees Fahr. stood at 100 on the lactometer, at 66 Fahr. stood at 98, at 80 Fahr. stood at 90, at 100 Fahr. stood at 74, and 44 Fahr. stood at 106; now the ratio is different between each of those observations; for instance, between 44 and 60 the ratio is for every degree of the Fahrenheit scale, three-eighths of a degree on the lactometer; between 60 and 66, for every degree of the Fahr. scale, it was two-thirds of a degree on the lactometer; between 66 and 80 for every degree of the Fahr. scale it was .57 of a degree by the lactometer, and from 80 to 100 for every degree of the thermometer, it was .8 of a degree by the lactometer; now, no other sample of milk would probably have shown the same ratio.

Q. Now, what was the average, Doctor? A. Well, to make an average, it would not be proper to add those together because they differ; I can give you the entire stretch from 44 to 100; you cannot guess at figures with any certainty in a case like this.

Q. Will you state whether you agree with Dr. Blake White's
statement, or guess, or evidence, to the effect that for every three degrees of the thermometric temperature milk decreases two degrees in specific gravity?

(Objected to.)

A. There may have been in some sample that he tested.

Q. Is that a safe general scale or average? A. It is not, nor is any other scale safe, nor is any used by the inspectors of the Board of Health.

Q. Doctor, you demonstrated yesterday, did you not, that skimmed milk stands much higher on the lactometer than milk which is pure or comparatively pure? A. It does.

Q. Now, if your inspectors come across skimmed milk, will they not pass it by as pure? A. Not necessarily; they detect it by the fact that it stands high on the lactometer; looks blue and thin to the eye and tastes peculiarly, and they take samples if necessary and have them analyzed.

Q. In the Kneib case were you not asked the question: "In case he," meaning the inspector, "came across skimmed milk he would invariably pass that by as good milk"? and did you not answer, "Yes, sir, most undoubtedly"? A. I think, very likely; I have learned a great deal about skimmed milk and cream since the indictment in that case.

Q. Did you not make that answer? A. I did; I had not investigated at that time the question of whether it would be easy to detect skimmed milk by the means of the lactometer and the senses.

Q. But that was about a year ago? A. It was, I think, about a year ago.

Q. At that time you testified, did you not, that you had been a chemist about twenty years? A. I had.

Q. That you had made the subject of milk analysis a specialty? A. Yes, sir.

Q. Your lactometrical standard was the same as it is now? A. I never was after skimmed milk, and I never had been accustomed to experiment with skimmed milk; I testified I was not aware it was possible to detect skimmed milk; I made that reply.

Q. Then within the past year you have made the discovery that the evidence of the senses will enable the inspectors to tell the
difference between skimmed milk and pure milk? A. Within certain limits; their senses had not been trained at that time by the experience they have had since; there is great difference in the senses of persons; a shepherd knows his sheep, but a stranger would not know them individually.

Q. Will you take these bottles, or any of them, and pick out those that have skimmed milk? A. I should have to taste them.

Q. Do your inspectors report cases where the milk tested is above 100? A. I think they have in one or two instances, but they have had their hands full in prosecuting men whose milk stands down at 85 and 86.

Q. They have paid no attention to skimmed milk dealers? A. I think there have been one or two prosecuted.

Q. I ask you as a chemist is it not possible to make an article resembling milk in appearance, which when tested by the lactometer at 60 Fahr., will indicate 100 or more, which will cling to the lactometer as milk does, which will be deceptive to all the other senses, including taste, and that article contain no milk? A. I think very probable, very possible, but I never saw such a liquid.

Q. How can you say that the evidence of the senses enables you or your inspectors to tell whether the fluid tested is milk or not? A. I do not say that they could do so invariably.

Q. If an article resembling milk in appearance, tasting and smelling like milk, and which tested by the lactometer at 60 Fahr., indicated 90, would you give it as your opinion that this article was not pure milk?

(Objected to; objection overruled.)

A. If I found it for sale at a milk depot in New York City I should say it was watered milk; if I found a quart of it coming from a single cow, under abnormal circumstances, I should say it was abnormal milk, but not watered; the surroundings would influence my opinion with regard to such a sample.

Q. Without having regard to the surroundings you could not tell whether it was pure milk or not, could you? A. All the probabilities would be in favor of its being watered milk; I could not say that you had not hunted up some abnormal cow that gave milk that stood at 90, or made some combination that had all the physical properties of milk.
Q. Dr. Chandler, how long has the lactometer been used in this city?  
A. I think it must have been used in this city thirty or forty years, I don't know but 100.

Q. How long has it been used by the Board of Health, under your supervision, as a standard of milk?  
A. I think it is about two and a half or three years, since we succeeded in getting two officers detailed as milk inspectors, and began a systematic control of milk sold in this city.

Q. Now, don't you know that within that past two years and a half since the lactometer has been used as a standard test for milk, by the Board of Health, the traffic in skimmed milk has increased fivefold?  
A. I do not know it.

Q. Do you know whether it has increased or not?  
A. I do not.

Q. In case pure milk, standing at the gravity of 105, has its cream removed, that, as you have stated, increases the gravity, does it not?  
A. It does.

Q. How much water can the milkman then add to that diminished milk, without bringing it below its original standard?  
A. I presume he can add 10, 12, or 15 per cent. of water; I do not know exactly how much.

Q. Then, is it not a sure way for milkmen to escape the test by this instrument to skim the milk and add water?  
A. No, sir; because the lactometer is used in connection with the senses which distinguish watered and skimmed milk from whole milk.

Q. Now, Doctor, in the Kneib case, were you not asked the question by me, how many methods of adulteration of milk may be practiced that this instrument will not detect; and did you not make answer, it will not detect skimming or the addition of water and the simultaneous addition of something such as salt or sugar?  
A. I think, very likely.

Q. Did you make that answer?  
A. I do not know without looking at the question a moment.

Q. Have you any doubt that you did?  
A. If you say that I made those answers——

Q. I say it is in the book?  
A. Very good, I admit it.

Q. Now, you stated yesterday, I believe, that the lactometer does not detect the addition of 16 per cent. of water to good milk?  
A. That is a milk which stands 120 on the lactometer.
Q. How much water may be added to milk which stands at 102?  
A. A much smaller quantity.  
Q. How much?  A. I do not know.  
Q. Cannot you calculate?  A. No; not without considerable difficulty.  
Q. Now, suppose the milk is at a temperature of 80, does not that vitiate the test by the lactometer, unless allowance be made for that?  A. The temperature of 80 makes the milk lighter.  
Q. Does not that vitiate the test, such a high temperature as that?  A. I do not know how it vitiates the test; I test a sample of milk and find it is warm and has a certain density.  
Q. If you test the sample of milk which stands at 80 on the thermometer, and you do not make any allowance for it, is not the test vitiated?  A. If we made no allowance for temperature the test would be vitiatsed.  
Q. Do not those tables show a great deal of milk tested at temperatures above 80?  A. Certainly; because the warm milk was tested by the lactometer and the result recorded; it was then cooled to 60 and another test made and the result recorded again, if I understand the tables right, and the test at 60 is the one which is averaged and which is considered to be the test of milk.  
Q. Doctor, in the Kneib case, did you not testify in answer to Mr. Hastings, no temperature to which the milk is likely to be heated would influence the lactometer sufficiently to vitiate our test?  A. I think it very possible; the question of vitiating is a question which admits of various significations; when I speak of vitiating the test by not knowing the exact temperature or by the temperature being above 60, I use that language with reference to the object of the test; if I am endeavoring to determine with absolute accuracy the specific gravity of a sample of milk, I take that specific gravity at a temperature of 60; if I am examining a sample of milk with a view to a prosecution for the sale of adulterated milk I may take my observation of the gravity at 80 Fahr.; the result of that observation may be such as to satisfy me that there is no possibility of that milk standing below 100 when cooled to 60 and therefore I pass it; the test is not vitiatsed for that purpose, it would depend therefore on the object of the test whether the making of the test at a temperature of 80 would or not vitiate the result.
Q. Is taste a safe and reliable test to be applied to milk? A. I should not hesitate to taste any milk offered for sale in New York; I should consider it quite safe to taste it.

Q. Is it a safe and reliable test to tell whether it is milk or not? A. In all ordinary conditions it would be.

Q. Will it or will it not under any and all conditions? A. In all probabilities it would; I do not take into consideration the possibility but the probability.

Q. Will the taste indicate whether it is milk or not to a greater extent than to give a probable indication? A. Without seeing it?

Q. Well, sir, and sight if you like? A. Taste would give one a considerable amount of information with regard to the nature of the liquid purporting to be milk, but one might be deceived if he had only taste to rely upon.

Q. Now, don't you know the test so called was made by your officers in the month of August, when, without thermometers, they applied the same test to milk standing on the sidewalks and to milk standing in the ice box.

(Objected to; objection sustained.)

Q. Now, Doctor, suppose you found in several instances milk coming from healthy, well-fed cows which, at a temperature of 60 Fahr., fell below 100 on the lactometer, would not that destroy your faith in the instrument as at present adjusted if it was repeated in several instances? A. The question assumed that there is no doubt about the health of the cows; there is absolute proof that the cows have been healthy—efforts have been made to ascertain that fact?

Q. Yes, sir. A. How many cases?

Q. In case you should find milk coming from a healthy, well-fed cow, which, at a temperature of 60 Fahr., fell below 100 on the lactometer, would not that destroy your faith in the instrument if it were repeated in several instances? A. It would not.

Q. In the Kneib case, were you not asked the question, "In case you should find milk coming from a healthy, well-fed cow which, at at a temperature of 60 Fahr., fell below 100 on the lactometer, would not that destroy your faith in the instrument if it were repeated in several instances," and did you not answer, "Yes, sir?" A. I think very likely; it was a new idea to me; I answered it promptly on the
spot; I have added considerably to my information since that time; if you say that is there, I admit it.

Q. Now you base your faith on the instrument simply because you do not know that such a thing ever occurred? A. No, sir; even though I did know that it occurred, it would occur on such rare occasions, and under such unusual conditions, that it could not influence the use of the instrument in New York city.

Q. In the Kneib case, were you not asked by me the question: "You base your faith on the instrument simply because you do not know that such a thing ever occurred"? and did you not answer, "Yes, sir; in this part of the world"? A. I think very probably I did.

Q. Do you concede the correctness of that? A. I concede the correctness of your quotation.

Q. Dr. Chandler, is ice sometimes added to milk to preserve it during transportation?

(Objected to as irrelevant.)

The COURT—With reference to the second count I would rule the evidence out, but under the first count it appears to me it is proper.

COUNSEL—We offer it now simply under the first count.

The COURT—It is excluded.

COUNSEL—Note an exception.

Q. Doctor, if ice is placed in milk at a temperature above the freezing point——

(Objected to; objection sustained; exception.)

Q. Doctor, what is the specific gravity of whey?

(Objected to; objection sustained; exception.)

Q. What is the specific gravity of buttermilk?

(Objected to; objection sustained; exception.)

Q. Is buttermilk a healthy article of diet?

(Objected to; objection sustained; exception.)

Q. Doctor, the lactometers in use in Europe, are they constructed with the specific gravity of 1.029 as the lowest standard of pure milk? A. As far as I know, they are; but in Paris no milk is allowed to be sold below 1.030, I am informed, and I suppose they may range their lactometer with the standard of 1.030; I am not sure, however.
Q. Doctor, is the lactometer a reliable guide for testing milk; I would like an affirmative or negative answer to that question?  
A. It is reliable for the purpose for which it is used by the Health Department; it is not reliable for the detection of combined frauds which an instructed dealer in milk might be able to perpetrate.

Q. Is the lactometer a reliable test for milk? I ask you to answer that question categorically.  
A. It cannot be done.

Q. You cannot?  
A. No, sir.

Q. Doctor, are you the editor of the scientific journal called the American Chemist?  
A. I am one of them.

Q. Will you look at this and see whether this is a number of that periodical—page 26, July, 1871—what purports to be an article over your signature?  
A. I remember writing an article about that time.

Q. In a note to this article, it is stated, under your signature, “The lactometer is a very unreliable guide, as skimming causes the milk to appear better, while watering exerts the opposite effect.” Did you write that?  
A. I did, I am sure, and should write it again if I had occasion to write to an audience that did not entrap every word I uttered.

Q. Is the lactometer an unreliable guide for milk?  
(Objected to. Objection overruled.)

A. Not for all cases.

Q. Can you not answer that question yes or no?  
A. I answer it no, if it applies to all kinds of milk.

Q. Can you give a simple negative or affirmative answer?  
A. Not to tell the truth, the whole truth, and nothing but the truth, which I have sworn to do.

Q. You say in Paris they reject all milk below 1.030?  
A. So I am informed.

Q. Whence do you derive your information?  
A. It is stated in one of the books that I have here.

Q. Is it in Quevenne, and where?  
A. No, that is an old book published in 1830. It is a recent book. It is that little German book, or possibly that little French one, I have forgotten which.

Q. I hold in my hand a book entitled, Du Lait, by Quevenne, 1857, and I read from pages 2 and 3 a translation: “If the guilty is to be punished severely, it is important above all things that the
innocent should not be condemned with him. The following is the method which seems to us to conciliate all interests, and render possible the daily verification in the largest city. We will take the established regulations in Paris for example: First, the Commissioners of Police, or those under their orders, shall make daily visits to the different sellers of milk in wards, and will perform the following operations in less than a minute: a, Take the degree by the lacto-densimeter, and taste the milk. If the degree of the lacto-densimeter is below 29, having regard to the temperature as we describe, pages 10 to 15, or if the taste or color shows something abnormal, take care not to draw a conclusion from these preliminary trials, unless the vender signs an affidavit acknowledging the fraud, but take a sample of half a litre (a pint) at least of the suspected milk, taking care first to render it homogeneous by thorough agitation, and sending it immediately to an expert chemist appointed by the administration. This mode of procedure offers the undoubted advantage of respecting the feelings (dignity) of the merchant, and not to make a seizure, a circumstance always serious unless there exists a strong presumption that the law has been violated. Second, the expert, on receiving the milk, should immediately perform the following operations: a, verify the degree of the lacto-densimeter; b, take the degree with the lactoscope; c, prepare some whey, and take the gravity of the lacto-densimeter; determine, if necessary, the quantity of milk and sugar with the polarizing apparatus, or, with the copper test, the quantity of butter after the process of Marchand; d, if he is not perfectly satisfied, he should make a complete analysis, if the case is sufficiently important. Third, if the vender, without testing the low figures obtained, alleged the milk was just as it was furnished by the cows, the expert must demand, at the risk and peril of the merchant, an examination on the premises. By means of these precautions, easily executed, justice is fairly dealt, and the object we are seeking, that of assuring to the consumer a pure milk without adulteration, will be obtained. When one has verified, as we have shown, the degree of the lactometer, he knows only the half of that which he should understand.” Now, is not that the method used in Paris to test milk? A. I do not know that that is used in Paris at all.

Q. Were you not questioned, yesterday by Mr. Prentice as to
whether the best authorities of Europe did not uphold the lactometer as used by the Board of Health? A. I think not; I know what the question was that was asked me.

Q. Please state it? A. It was from my knowledge of the publications and authorities on the subject of the examination of milk, what was the best opinion as to the use of the lactometer for such tests, and I stated that from my knowledge of the literature of this subject that the best opinion was that the lactometer was perfectly reliable when used in connection with the other senses, and limited to such cases as it is limited to in the hands of the inspectors of the Health Department, that is to the cases of milk which stand below 100 on the lactometer.

Q. That is not responsive to my question? A. And has the other properties which distinguish it.

Q. Did you not subsequently give the names of certain books as supporting your opinion? A. No, sir; I gave the names of certain books which I had consulted; I did not say that each one of those books supported verbatim my statements, but they were the books which I had studied to arrive at this best opinion.

Q. How about Von Baumhauer as quoted in Watts' Chemical Dictionary, does he support your position? A. There is a partial quotation from Von Baumhauer in Watts' which is contained in many other quotations, a criticism on the lactometer as a general test for the character of milk of all kinds and under all circumstances. That criticism is made in the same spirit that my own remarks were made.

Q. Will you take the second supplement to Watts' Chemical Dictionary, and read the quotation from Von Baumhauer? A. "Analysis of Milk, E. H. Von Baumhauer. Discussions on the several methods hitherto adopted for the analysis of milk. He rejects as worthless all modes of testing depending on the use of hydrometers, inasmuch as the milk, which is a solution of substances specifically heavier than water, contains in suspension a much lighter body, namely the cream, and consequently exhibits a mean specific gravity, which, after a removal of part of the cream, may be again imparted to the liquid by the addition of water. A further objection to the use of hydrometers for the purpose, is that the expansive co-efficient of milk is unknown, and moreover, is uncertain
on account of the varying proportions of the dissolved constituents. To obtain comparable results, it would therefore be necessary to work always at the same temperature. Moreover, the quantity of milk which becomes attached to the unimmersed part of the instrument may give rise to an error equivalent to 5 per cent. of water."

Q. When was the latest edition of Dr. Wanklyn's book published?  
A. I was not sure whether mine was the latest edition; I cannot answer that question.

Q. I have one here for 1874; is that the latest?  
A. I think that is the latest, there may be one later.

Q. I read from the head of chapter 2, in Wanklyn's book, published 1874: "The lactometer, or lacto-densimeter, as it has been called to distinguish it from another similar instrument, the creamometer, was at one time a great favorite. In France a few years ago, if not indeed now, the police would take action at once on reading that instrument, and turn milk out into the gutter if it were condemned. And in London, the lactometer is exposed for sale in shop windows, and both the public and milk dealers trust to it. Even in some recent manuals intended for the guidance of medical officers of health, the use of the lactometer is recommended. In one of them in particular—Dr. Edward Smith's—which claims a pseudo government sanction, the lactometer is very prominently put forward, and recommended as being for milk what the hydrometer is for alcoholic fluids. But, although it is so very popular, and although it has been so implicitly trusted, the lactometer is the most untrustworthy instrument. There hardly ever was an instrument which has so utterly failed as the lactometer. It confounds together milk which is exceptionally rich with milk which has been largely watered, and many a poor French peasant, bringing the best and unadulterated produce of his dairy into a French town, has been ruthlessly stopped by the police, who have dipped their lactometer into the milk, and forthwith sent it down the gutter, as if it had been milk and water. Very curious things, too, are done in this country by reason of trust in the lactometer. There is a prison not far from London, and the prison authorities are especially particular about their supply of milk; they allow no milk to enter the prison unless it comes up to the end mark on a certain lactometer. The end mark is pitched very high, and the milk of the purveyor
reaches the end mark by skimming the milk. From a careful consideration of the whole subject, I am convinced that one of the most necessary steps to be taken in milk analysis is to abandon the use of the lactometer.” Now in the Kneib case were not the extracts I have just read from Dr. Wanklyn’s book, the extract I read from Quevenne, and some other trivial extracts read in your presence? A. I think they were.

Q. Were you not, with reference to this citation, afterwards asked by your counsel, was there anything in those citations that differed essentially from the views expressed, in relation to the lactometer as expressed upon the stand, and did you not answer there was not? A. I think I did.

Q. Is there any doubt about it? A. I should rather look at the record; the question was, was there anything in those citations that differed essentially from the views you expressed, in relation to the lactometer, as expressed upon the stand. I replied there was not.

Q. That had reference to these same citations from Wanklyn and others? A. As I recollect them at the time the question was addressed to me.

Q. In case five samples of pure milk should fall below 100 by the lactometer, out of twelve at 60, would not that destroy your faith in it? A. What sort of milk should that be?

Q. Pure healthy cow’s milk with outany question? A. No, sir.

Q. In the Kneib case, after Dr. Doremus had testified to finding five samples of pure milk out of twelve, below 100 by the lactometer at 60 Fahr., the cows being healthy and well fed, were you not asked: “Now in case what occurred to Professor Doremus occurred to you, that out of twelve samples, five should fall below 100 by your instrument, would not that destroy your faith in it?” did you not answer: “Undoubtedly, if I found cows totally different from the cows I have seen before?” A. You ask me if I made that statement?

Q. Yes, sir? A. I did.

Q. Is there a surer test for milk than that by the lactometer, accompanied by the senses? A. Not for watering.

Q. Is there a surer test for milk than the lactometer? A. Not
for watering. One test is for one object and one for another; each is sure for its own object.

Q. Is not analysis a surer test? A. Not for excessive watering.

Q. In the Kneib case were you not asked by me: "You would adopt another test; would you not?" and did you not answer; "Yes, sir?" Then were you not asked "Would not analysis be a surer test"? and did you not answer, "Yes sir?" A. I think very likely, I entertained an opinion of that kind at that time.

Q. You have changed it since? A. I have learned a great deal since. My confidence in the lactometer has been increased ten-fold since that case was tried.

Q. From your opinion as it is at present, is analysis of milk made by an expert chemist, thoroughly and fully, a surer test than the use of the lactometer accompanied by all that the inspector testified to in this case? A. Not for watering.

Q. Is analysis thus made better and surer for the purpose of ascertaining whether the fluid is milk? A. Yes, sir.

By COUNSEL FOR THE PEOPLE—Q. Doctor, you were asked some questions about the Dictionary of Chemistry by Watts, and were called upon to read some extracts; please look at that article again and tell me if the title of the article related to the analysis of milk or whether it was some other subject? A. They related to the analysis of milk—that is the subject.

Q. Does that article which you have in your hand, the part which you read and its treatment of the particular subject under the title of analysis of milk, confirm, or, as you understand it, is it at variance with your opinion of the value of the lactometer as a practical test for the adulteration of commercial milk found in cities by the addition of water? A. It is in full accord with my opinion on the subject.

Q. Doctor, you were examined upon this edition of the book Du Lait, published in Paris in 1859; I ask you to turn to pages 192 and 193, and the table therein contained, the observations of 102 cows, and also the resumé on the following pages; the resumé of those tables of observation, the density of the milk, the analysis of it, and the average, the minimum and the maximum? A. I have done so.
Q. What is the result upon your opinion, as detailed there, as to the value of the lactometer as a practical test for determining the watering of milk? A. They confirm me in that opinion.

Q. State the maximum and the minimum and the result upon that page; read the resumé as it is there? A. The lacto-densimeter the highest and lowest degrees; milk marking more than 35—that is, 1.035, five of them; milk marking less than 30, seven of them, and only two of which stand below 1.029.

Q. How many altogether? A. 103.

Q. How many exceptions? A. Two exceptions; one is 1.0288 and the other is 1.0289.

By the Court—That is by the lactometer, not by analysis? A. This is by the lactometer on the milk of cows in their natural state.

Q. The lacto-densimeter, is that the same as the lactometer? A. It is.

Q. Is that the same standard? A. It gives the specific gravity as compared to water; it does not give the figures.

By Counsel for the Defendant—Q. Were the books before you at the time that the questions were asked you at that trial?

(Objected to; objection overruled; exception.)

By Counsel for People—Read, if you please, page 36; the passages marked? A. "Having cleared away any confusion arising from those slight differences in scale, we pass on to consider the practical use to be made of the various data afforded by milk analysis; as will be remembered, 100 C. C. of milk of average quality contains 12.81 grammes of milk solids; very rich—exceptionally rich—stall-fed milk contains 14.47 grammes of milk solids; now it must be obvious to every one that very rich milk let down with a little water will simulate milk of average quality; there is a certain limit below which the milk of well fed cows is never known to fall; below 11.8 grammes of solids per 100 C. C. milk has not been known to fall; the most variable constituent of milk is fat, and if the quantity of fat be deducted from the milk solids, the milk solids not fat, which is of very constant datum, is obtained; taking the milk solids in common milk, and deducting the fat from it, there remains 9.65, which is a milk solids not fat; similarly, milk solids not fat in stall-fed milk amount to 10.35 grammes per 100 C. C.; the best way
of dealing with the question of watering is to assume a perfectly rigid standard of normal milk, and to treat all departures from it as sophistications."

Q. I ask you to look again at page 41, the passage marked in chapter 9, and read that? A. In dealing with milk supply on a large scale, we are little concerned with the possibility of single animals giving abnormal milk, and need only concern ourselves with milk of normal quality, all departures from the standard being looked upon as sophistications.

Q. I ask you to look again at page 41, the passage marked in chapter 9, and read that?

A. In dealing with milk supply on a large scale, we are little concerned with the possibility of single animals giving abnormal milk, and need only concern ourselves with milk of normal quality, all departures from the standard being looked upon as sophistications.

Q. I ask you from an examination of the tables and the statements, and the arguments made in the book of Wanklyn, have you found anything at variance or that refutes the opinion which you have expressed as to the reliability of the lactometer as a practical test of commercial milk in cities, the adulteration of milk by water?

(Objected to as incompetent; objection overruled; exception.)

A. Not to its use as employed in connection with the other senses by the inspectors of the Health Department.

Q. Has Mr. Wanklyn a peculiar method which he advocates in this book? A. He has a peculiar method of analysis.

Q. You were asked yesterday to give the authorities which directly supported your opinion; are you prepared now to give them? A. I am prepared; I have the works here and can read passages from them.


Q. The gentleman in the examination of lactometers in the practical experiment yesterday made use of the term which I desire should be explained in accounting for different readings; please explain the term meniscus? A. When a liquid is in contact with
the surface it generally either attracts or is attracted by that surface; as a consequence when the lactometer is dropped into the milk, the milk does not rise against the lactometer on a perfect level; but, on the contrary, climbs up the side of the lactometer a certain distance, and covers a portion of the lactometer; the consequence is that when you look at the lactometer you are in doubt as to exactly where the surface of the liquid cuts the scale on the lactometer; in some liquids the contrary takes place; in the case of mercury the liquid does not climb up the glass, but on the contrary, there is a light depression, so that it would have the appearance of my diagram when inverted; that is called meniscus, and it makes a difference in the case of milk of two or three degrees, whether one reads what is actually visible; it is all the same if they read it always in the same way.

Q. Have investigators in natural science a personal rule of reading scales of this kind?  
A. It depends altogether on circumstances; if the instrument is graduated so as to be read above the meniscus, that is the proper way to read it; if the instrument is graduated to be read on a line with the surface of the liquid independent of the meniscus, then that is a proper way to read it; the lactometer is graduated to be read at the top of the meniscus; I read at the top of the meniscus; Dr. Barker differed from me by reading it below the meniscus.

Q. How do you know?  
A. He said so.

Q. Now, Dr. Chandler, in examining a sample of commercial milk yesterday before the Court and the jury, or cream perhaps it was, or both, there were used four lactometers and the experiment of the fluid in one instance was found far below 100 and in another instance it was from 14 to 16 or 17 above; I ask you have you tested those four lactometers upon the scale and mark of Board of Health 100, so that in these several experiments of variation of from two to three degrees at those very high and very low degrees upon the scale were shown?

(Objected to; objection overruled; exception.)

A. I have tested them; they were tested under my direction, originally, and agreed exactly at the 100 point and approximately at other points, sufficiently for all practical purposes as a test for watered milk; desirous to know how great a deviation there might
be at other points, as I had not retained a record of the original tests of these lactometers, I very carefully verified four points on each of those lactometers last night; in addition to 100 which had previously been verified. At the 104 mark, they agreed exactly; three of them were correct at 88, the fourth marked 87; at 78 two of them were correct exactly, one marked 77 and one marked 76; at 68 two were correct, one marked 67 and one marked 66; the greatest deviation being two degrees, and that at points which are unimportant, as being far away from the standard of 100.

By COUNSEL FOR DEFENDANT—Q. We would like to ask the witness to produce those four lactometers? A. I have only one of them here.

Q. Are the others here, Doctor? A. I can ascertain by examination.

Q. You have explained, I believe, Dr. Chandler, what you have intended by the term commercial milk, that it is a milk received here in the city of New York and offered for sale in forty-quart cans? A. I have.

Q. It is mixed milk, is it? A. It is.

Q. You have testified that when you testified in the Court of Special Sessions in the Kneib case, Mr. Wanklyn's book and the other books containing the extract were not before you; were they not in court at that time? A. I presume they were in the hands of the experts on the other side of the case and were read by them.

Q. Did you make any attempt to get them into your hands? A. I have no recollection of trying to do so.

Q. Did you or did you not? A. I cannot say whether I did or not; I presume not.

Q. Were you at that time satisfied that they were correctly read? A. I had no reason to doubt it.

Q. Were you satisfied that they were or do you now remember that they were then correctly read? A. I have no reason to doubt it.

Q. What is analysis, is it not a system of testing? A. Analysis is taking things to pieces.

Q. Is it not one means of testing milk? A. Yes, it is one method.

Q. Take this table of Quevenne and look through pages 194, etc.,
and state whether it does not contain three instead of two instances of milk below 1.029?  

A. I find one 27 and one 28.9; yes, I see there are three, but I read the résumé on the opposite page where only two are given; it is very likely a misprint in a table as it is not in the résumé.

Q. Do you mean to say that there is nothing contained in the extracts which I read from this book, the milk analysis of Dr. Wanklyn, which refutes or is at variance with your opinion as to the lactometer as a test for showing the adulteration of milk by water?  

A. I do; the author speaks of the lactometer without the use of the other senses.

Q. Do you cause the milk arriving in this city to be tested and examined at the railroad stations and seized if impure?  

(Objected to; objection sustained; exception.)

GEORGE C. CALDWELL, sworn and examined by Mr. Prentice, testified as follows:

Q. Dr. Caldwell, you are a chemist by profession?  

A. I am, sir.

Q. Please state your study and experience in that profession?  

A. I began the study of chemistry about 20 years ago, at Harvard University, took the degree there, went to Germany, and spent a year and a half at Goettingen in the study of chemistry, and took the degree of doctor of philosophy there; went to Heidelberg in Germany, and spent another year in the study of chemistry, and since my return to this country have been engaged in teaching chemistry part of the time; a short time at Columbia College, and a short time at Antioch College in Ohio, as Professor of Chemistry, and at the Agricultural College of Pennsylvania, and at Cornell University, where I now am.

Q. What is your chair there?  

A. Professor of Agricultural and Analytical Chemistry.

Q. Have you made a special study of dairy products and of milk?  

A. I have made some special study of that subject.

Q. The lactometer is of the kind of instruments called hydrometer?  

A. It is.

Q. And there are similar instruments used for like purposes in other substances than milk?  

A. There are.
Q. The lactometer is for determining the specific gravity of milk?  A. It is.

Q. Is there any more accurate method of determining the specific gravity of liquids than by the use of such instruments?  A. Not when they are properly constructed and proper precautions are used.

Q. In your opinion is the standard 1.029, that adopted by the Board of Health, a correct and safe one?  A. It is.

Q. In connection with the lactometer it is proper to use the thermometer?  A. It is.

Q. And what degree of heat should the milk be for the practical test with the lactometer?  A. Any degree that is agreed upon; 60 Fahr. is the usual temperature and is the one most usually reached.

Q. If we have a sample of what is called commercial milk, milk found in the city offered for sale at a temperature of 60 Fahr., which shall show upon the lactometer a degree of say 90, what will that determine if anything?  A. It will determine that some liquid lighter than normal milk had been added to it.

Q. I ask your experience what would be the adulteration?  A. Water.

Q. You are acquainted with the literature on this subject generally, are you not?  A. I am acquainted with some of it.

Q. What is the best opinion according to the best authorities with regard to the use of the lactometer for detecting the watering of milk?

(Objected to; objection overruled; exception.)

A. My opinion is that there is good authority for the use of the lactometer for detecting excessive watering of milk.

Q. You yourself have published papers on dairy products and on milk, have you not?  A. I have, sir.

Q. And have you recommended the lactometer for use by dairy-men?

(Objected to; objection sustained.)

Cross-examined.

Q. Doctor, you say you have made some special study of milk from dairy products; what do you mean by that?  A. I have analyzed milk, studied its composition in that way; I have read some works on milk.
Q. How many hundreds of samples of milk have you analyzed?  
A. I have not analyzed any hundred, I have analyzed about a dozen samples, I do not remember how many.

Q. How recently?  
A. Some of them have been made within the last two years; the last was made last spring, made partly by myself and partly by an assistant under my direction.

Q. Over how many years does the making of this dozen of analyses of milk extend?  
A. It extends perhaps over two years.

Q. Then although you have studied chemistry for twenty years, Professor, you have only taken up the subject of milk within the past two?  
A. The subject of the analysis of milk I have not taken up except in the last two years; analysis by myself I mean.

Q. In all your experience in making all these analyses of milk what is the average quantity of butter that you find them to contain?  
A. I have not my figures with me and therefore I cannot tell.

Q. Can you estimate it?  
A. I should say the proportion of butter was about three and a half per cent., but I cannot tell any nearer than that, I have made no special effort to remember the results.

Q. Have you ever made tests with the lactometer?  
A. I have.

Q. When?  
A. I made some tests shortly before coming here.

Q. To-day do you mean?  
A. Shortly before coming to the city, within about four or five days ago.

Q. With reference to this trial?  
A. I made some comparative tests with this lactometer.

Q. With reference to this trial?  
A. I did.

Q. Then I do understand that you have especially qualified yourself to testify on this trial?

(Objected to.)

Q. Where did you make these tests with the lactometer?  
A. In my laboratory in Ithaca, Cornell University.

Q. What lactometer did you use?  
A. I used the lactometer furnished me by the Board of Health.

Q. Did you try that lactometer to test its accuracy?  
A. I did not.

Q. Then you do not know it to be accurate, do you?  
A. I do not, except that it was furnished me by the Board of Health.

Q. How did it come to you?  
A. It was given to me last winter by the President of the Board of Health.
Q. Did you use the thermometer?  A. I did.

Q. At what degree of Fahrenheit?  A. The temperature was very low; I used a Centigrade thermometer, and I did not at the time convert it into Fahrenheit—7 degrees Centigrade.

Q. Did you notice any variations of the thermometer in the milk you tested?  A. There were no variations during the time of the experiment.

Q. Had you tested milk with lactometers before or after that?  A. I had not.

Q. Did you ever note any variations of temperature in milk when tested by lactometers?  A. As that is the only time I have tested, I noticed no variations then; I have noticed no variations.

Q. In all, how many tests did you make with the lactometer?  A. I made one test which included the addition of five successive portions of water.

Q. Did you note the result of your investigations?  A. I did.

Q. What was it?  A. The milk stood at 110.

Q. That was at a temperature of 7 degrees Centigrade; what would that have been Fahrenheit; at what lactometrical degree would that milk have stood at 60 Fahrenheit?  A. I do not remember.

Q. That is not a question touching your memory?  A. I do not understand your question; it would not have stood at 60 degrees Fahrenheit.

Q. If that same milk had been at 60 Fahrenheit, at what degree would it have stood on the lactometer?  A. That I cannot tell.

Q. Cannot you convert Centigrade degrees into Fahrenheit?  A. I do not remember; I cannot tell.

Q. By using the lactometer of the Board of Health you are not able to tell what the temperature of a fluid would be if you inserted the Centigrade thermometer?  A. No, sir; I do not remember the formal fact of conversion, always having a table at hand.

Q. Did you test pure milk?  A. I tested pure milk.

Q. How do you know it was pure milk?  A. Milk that is brought to my house by the parties who always supplied it.

Q. Did you see the cow milked from which the milk proceeded?  A. I did not.
Q. How do you know it was pure milk?  A. I do not know as I can say from positive knowledge.

Q. You said so a moment ago?  A. I must qualify my answer; I had every reason to suppose it was pure milk.

Q. Will you swear, from the inspection you made, that that fluid was milk at all? will you look at this, and state whether it is milk or some other composition?

(Objected to.)

Q. You could tell the fluid you tested was milk?  A. I knew that the fluid that I tested was milk.

Q. How did you know it?  A. Because it was furnished me by a family that has always supplied it; it was taken from a portion of milk used by my family that day.

Q. Is that the only reason you knew it was milk?  A. That is the only reason I knew it was milk.

Q. Aside from that, you did not know it was milk?  A. That is all the reason I have for supposing it was milk.

Q. And yet you, as a distinguished and scientific gentleman, from that assumption, testify that you had knowledge that it was pure milk; is that it?  A. I testify it was pure milk.

Q. Suppose I assure you that this bottle contains pure milk and nothing else, and you examine it with the lactometer and thermometer, and, in short, make just the same examination as you made at Ithaca, will you then state whether this is milk or not?

(Objected to; objection sustained; exception.)

Q. If a fluid should be presented to you looking, tasting, smelling, and to the touch, like milk, clinging to the lactometer, and at 60 Fahr. showing 90 on the lactometer, would you give it as your opinion that the article was milk?

(Objected to; objection overruled.)

A. I should not be able to say positively.

Q. In your opinion, could any other scientific expert say positively?

(Objected to.)

Q. We submit this question to the witness, whether or not analysis is not the only method of determining whether an article is milk?

(Objected to; objection overruled.)
A. It is not.

Q. What other methods are there? A. I mean that something more than analysis is necessary.

Q. State what that is? A. We must have the taste and the observation of the senses in addition to analysis, because those ingredients may possibly be mixed together in proper proportions to constitute milk, and not be milk.

Q. Is not the use of the senses included in analysis of milk? A. It is not; not all the senses.

Q. What are included? A. The sense of sight, all the senses that are involved in the handling of the apparatus; the sense of taste is not necessarily included in an analysis of milk.

By Mr. PRENTICE—Q. Then I understand that analysis is only one mode, with the use of the senses, and in your direct examination you stated that the lactometer with the use of the senses determined the same result accurately of water in milk? A. It determines the excessive water in milk.

Q. Is the use of analysis any more accurate a method of determining the adulteration by water than the lactometer, with the use of the senses in both cases?

(Objected to on the ground that it goes into matters which are excluded, and also upon the ground that this witness has not shown himself to be an expert in the use of the lactometer; objection overruled; exception.)

A. It is not any more accurate in the case of excessive watering.

By Mr. LAWRENCE—Q. Dr. Caldwell, how do you analyze milk?

(Objected to; objection sustained; exception.)

Q. Dr. Caldwell, can you determine without analysis whether a fluid is milk?

(Objected to; objection overruled.)

A. It can be.

Q. How? A. By careful observation of the sources from whence it is taken.

Q. Is there any other way besides seeing the cow milked? A. I do not think there is.

Q. Are you not sure about it, that to know a fluid to be milk a man must either see a cow milked or analyze the fluid? A. I won't be positive; I think he must.
Thomas H. Doughty, sworn and examined by Mr. Prentice, testifies as follows:

Q. What is your business, Mr. Doughty? A. I am Manager of the Essex County Farmers Milk Association.

Q. Where is your place of business? A. In New York, 297 Seventh avenue.

Q. How long have you been connected with this company? A. About two years and a half.

Q. How does your milk come to the city? A. It comes in forty-quart cans.

Q. How much do you deal in? A. We use from forty and sometimes as high as fifty and sixty cans.

By the COURT—Q. In a day? A. Yes, sir.

By Mr. Prentice—Have you tested the milk of cows with the lactometer? A. Yes, sir.

Q. The Board of Health lactometer? A. It has been compared with the Board of Health lactometer, and it has been found to agree with theirs: I have compared it with officer Jepson's instrument at my office and it agreed; I will correct that—with the Board of Health lactometer.

Q. What was the standard of that? A. 1.029.

Q. And at what degree of Fahrenheit? A. At 60.

Q. How many tests have you made? A. I suppose I have made between two and three thousand tests.

Q. Have you ever found by the lactometer genuine milk standing below 100 at 60 Fahr.? (Objected to on the ground that it is incompetent and irrelevant; objection overruled; exception.)

A. No, sir.

Q. At what did you find it? A. I found it to vary from 100 to as high as 112.

Q. How did you make your tests? did you use your senses? A. To a certain extent; I smell of it to see if it is milk or not. I visit all the farmers myself and I know very thoroughly that it could not be anything else but milk, because the parties are too ignorant to make any chemical preparations.
TESTIMONY OF THOMAS H. DOUGHTY. 95

By the Court—Q. The milk you get comes from different farmers? A. Yes; it comes from different members of our organization.

By Mr. Prentice—Q. Tell me what commercial milk is, how it comes, how it is mixed, and in what quantities?
(Objected to as irrelevant and immaterial.)
A. As I understand, commercial milk, the farmers milk in the morning and at night; these two milks are added together after they are cooled properly in a spring, and are sent to New York, in cans.

Q. And the milk of a number of cows in the same can? A. Yes, sir.

Cross-examined:

Q. Mr. Doughty, do you know Daniel Schrumpf, the defendant? A. No, sir; I never saw him that I know of.
Q. Can you tell whether the milk in his shop on the 25th of August last, was mixed milk or milk from a single cow? A. I have never seen it.
Q. How was this lactometer that you used, tested? A. The Board of Health officer called at our place to test our milk, and as he made his test, I have a test in the office of every can of milk disposed of by us every day, and I asked him to give me his test; he gave me the reading of his instrument, and I put my instrument immediately after in the milk, and it read the same.
Q. At what degree was that? A. That milk that he tested stood 110.
Q. How many degrees higher on your instrument that you used? A. I read to 110 and down to 80; those are the only ones that I pretend are correct; I have tried 3 or 4 instruments and I never found them to agree.
Q. How many degrees are printed in the graduation of your instrument? A. It is graduated to 120.
Q. From what? A. Graduated from zero, graduated to 120.
Q. Can you swear that your lactometer was correct as compared with the lactometer which you know to be one of the Board of Health's at any other point than 120, than the one you referred to? A. Yes, sir.
Q. How many at 120? A. I can swear to it at 120, 110 and 100.

Q. Did you test it at 100? A. Yes, sir; because we made an experiment at my office at that time.

Q. How often have you found pure milk at 100? A. I found it running 100 in the month of September, quite frequently.

Q. I would like to know about how many times? A. If I had my book I could tell you exactly; I have seen it 10 nights in succession on milk; I suppose I have seen it in a thousand different cans of milk standing at 100.

Q. Pure milk? A. Yes, sir; milk supposed to be pure.

By the Court—Q. Did all these run at 100? A. The tests vary in different months.

Q. Do farmers have these lactometers? A. Yes, sir; every one of our members have got them, and some of our customers.

By Counsel—Q. Have you found any milk less than 100? A. I have seen milk taken from cows which were feverish—farmers very frequently send such milk down here.

Q. I ask you whether you have seen pure milk at less than 100, and how often you have seen it? A. I have seen it so in diseased cows.

Q. Only in diseased cows? A. Never in any case where I knew the milk to be pure, have I seen it below 100.

Q. Are you a judge of cattle as to whether they are diseased or not? A. I am a fair judge of cattle; I can tell I think when a cow has got fever; about calving time I know generally cows have got fever.

Q. About calving time how does milk run, does it run below 100 or over? A. I have seen milk run down below 100 at calving time.

Q. How often? A. I know of ten instances where I have noticed it myself.

Q. Are those the only instances you know of? A. Those instances I have noticed.

By the Court—Q. Just before calving? A. Yes, sir; there will be blood particles through the milk.

By Mr. Prentice—Q. Milk at that time has a scientific name; do you know it? A. I do not.
Thursday, December 21, 1876.

Henry Morton, sworn and examined by Mr. Prentice, testified as follows:

Q. Dr. Morton, you are a chemist by profession, are you? A. I am a physicist.

Q. You are President of the Stevens Institute? A. The Stevens Institute of Technology in New Jersey.

Q. State how long you have been in this profession and the places you have occupied and your experience? A. I have been engaged in the study and investigation of subjects involved in the science of chemistry and physics since my boyhood; I have occupied the position of Professor of Chemistry in the University of Pennsylvania in Philadelphia, and Professor of Chemistry in the Philadelphia Dental College; I have for the last seven years been the President of the Stevens Institute and in connection with my duties there have given instruction in physics more especially and in the use of various physical instruments, and during the same time have carried on various investigations in the subjects of chemistry and physics; that is, investigations which involve questions of chemistry and physics.

Q. You are familiar with the processes and manipulations involved in the use of scientific instruments and the prosecution of experiments and scientific researches on the subject? A. I believe that I am.

Q. Have you published the results of original investigations on scientific subjects? A. I have in a number of instances.

Q. And have these been republished in foreign journals? A. They have in England, in France, and in Germany.

Q. Do you know the class of instruments called hydrometers? A. I do.

Q. And the lactometer, you are acquainted with its use? A. I am.

Q. And have you used such frequently in your investigations? A. I have.

Q. How general is the use of these hydrometers in manufactories and stores for the purpose of showing in what proportion various
substances are mingled with water? A. Very generally in chemical manufactories where acids for example are manufactured in large quantity, hydrometers are used to determine the percentage of acid to water or in other words the strength of acids; in distilleries and vinegar manufactories, in breweries, in sugar houses and among those dealing in similar products; similar instruments are also used where water is not concerned in the buying and selling of petroleum products, naphtha, kerosene, etc.

Q. You would say it is in general use, readily to be used by any person of ordinary intelligence? A. Yes, it requires no special skill.

Q. What is your opinion of the accuracy of such instruments for determining specific gravity of liquids as compared with such other methods as are commonly in use? A. I think they are quite as accurate; the accuracy in any sort of method depends upon the care and the precaution and the arrangement; this being the same in both cases as accurate results may be obtained with these as with the other ordinary methods, such as the specific gravity bottle.

Q. Then, is the use of the lactometer, for instance, in determining the question of the watering of milk as accurate as that other method you named? A. Unquestionably, for such a purpose as this there can be no doubt, for in this extreme accuracy is not in any way necessary; the question of a tenth of a degree, more or less, of course is outside of the limits that are involved in such an inquiry as this.

Q. Are the indications upon the hydrometers of this class of instruments under the circumstances related relied upon even where large sums of money are involved by those who use them?

(Objected to; objection overruled; exception.)

Q. Does any difficulty present itself in the use of the lactometer beyond that which is found in the use of these other similar instruments? A. That for instance with alcohol we have a perfectly fixed body, alcohol; in the case of milk we have a body which varies within certain limits; therefore, in the case of alcohol we can have a precise determination, because we start with a certain known basis perfectly defined; in the case of milk we have not that fixed known basis, and hence we cannot so precisely and definitely say just how much water may be mixed with the milk, as this will
depend upon whether the original milk was a little heavier or a little lighter to begin with; this is a difficulty, however, simply limiting the degree of precision in application and not the general principle, and the proper margin being allowed, the indications are just as reliable and just as good a foundation for a judgment or conclusion.

Q. You have stated that there is not a fixed standard for milk as for alcohol; is there not a fixed standard of gravity for milk accepted, or is it not fixed within certain limits? A. It is accepted within certain limits.

Q. So far as the best knowledge and opinion goes among scientific men, is there not a fixed standard of the specific gravity of milk?

(Objected to on the ground that the witness cannot state the best opinions of scientific men, as it devolves on him to discriminate between those who are good and bad; objection overruled; exception.)

A. I consider that the opinion of those scientific men who have studied this subject, and written upon it, and who are free from personal bias in relation to it, is to the effect that the normal density of milk is above 1.029 at 60 Fahr.

Q. Is the lactometer alone to be used as a means of distinguishing milk from any other fluid of the same density? A. It is not, any more than an alcoholometer, or similar instrument for determining the percentage of alcohol and water, is useful or is available for discriminating between alcohol and any other liquid of like density such as naphtha or the like.

Q. You are acquainted with the general literature on the subject of milk? A. I am.

Q. What is the best opinion according to the best authorities with regard to the use of the lactometer for detecting the watering of milk?

(Objected to on the ground that it calls upon this witness to discriminate between the authorities; objection overruled; exception.)

A. It is that the lactometer is a reliable means for detecting the adulteration of milk by the excessive addition of water; no one, I think, has ever claimed that the lactometer will detect the addition of small quantities of water to milk; but when these quantities become considerable, 20 per cent. and more, then I believe that it
is an available means, in conjunction of course with such other evidence as the senses and observation supplies, for this discrimination under ordinary conditions, such conditions as are met with in the circumstances now under consideration.

Q. If you have a sample of commercial milk, milk offered for sale in the city of New York, which at 60 Fahrenheit, will rate at 90 on the lactometer of the standard of 1.029, what in your opinion will that determine? A. That it was milk adulterated with water.

Q. You have personally tested samples of milk with the lactometer? A. I have.

Q. How did you determine that the milk was milk? A. By a consideration of all the conditions under which I found it or received it. I may illustrate what I mean perhaps by another example; if I went into a grocery store and asked for some eggs, and articles were given to me which looked like eggs, and I bought them and paid for them, I should feel myself justified in swearing that they were eggs, that I knew them to be eggs; if I went into Heller's establishment up Broadway, the gentleman who sells material for legerdemain, and saw an article which looked exactly like an egg so that I could not tell them apart, I should not feel myself justified in swearing, nor would I feel sure that that was an egg. I consider that my knowledge of anything is not derived from one, two or three circumstances involved, but from all of them, and it is only upon the basis of all the circumstances involved that that knowledge can be weighed and established.

Q. In the testing of commercial milk, is the question of the amount of butter or fat in it important? A. Not in my estimation in comparison with the question of the amount of its other constituents, such as caseine, sugar and salts; butter is not, strictly speaking, a nutritious substance; the caseine containing nitrogen is far more important, going to build up tissue; the butter resembles in its effects rather the sugar than the caseine; they might be regarded as of similar importance in my estimation.

Q. Did you make any test of milk that had been frozen? A. Yes, I did.

By the Court—Professor, I assume from what you have stated, there is a mode other than by the hydrometer of ascertaining the specific gravity of fluid? A. Certainly, a great many more.
By Counsel for People—Q. Is there any other instrument, so far as you are informed, which is used for ascertaining the specific gravity of fluid by insertion in the fluid, other than the hydrometer, that kind of a hydrometer called a lactometer—do you understand me? A. Not, perhaps, properly speaking, an instrument, but by weighing a heavy substance—for example, platinum—in distilled water, and then weighing the same lump in another fluid, we can compare the densities of the two fluids.

Q. It becomes my duty to ascertain, under some police regulations, the quality of milk which may be kept for sale in New York: Is there any instrument, except the hydrometer called the lactometer, by which the specific gravity of milk thus found can be practically determined at the place where you find it, by any other instrument than the lactometer? A. None to my knowledge.

Q. You regard the lactometer as the best practical test of watering? A. Undoubtedly.

Cross-examined:

Q. Professor Morton, I understand you to testify that you regard it as important that the lactometer should be accurately constructed and accurately used. Am I correct? A. The term accurate of course admits of a very wide range of interpretation. When I use the term accurate, I mean sufficiently accurate for the purpose involved.

Q. As you are going into metaphysics, will you state the difference between accurate and sufficiently accurate for the purpose involved? A. Certainly. When I buy a pound of sugar, I expect the scales of the grocer to be so far accurate that he shall not cheat me. If I wish to determine the specific gravity of a new element, I should only be satisfied when my balance was so accurate that I knew no way of making it more so.

Q. If you made a test of a substance or fluid by a scientific instrument, and upon that test you propose to base a criminal prosecution which might have the effect of ruining the person prosecuted or subjecting him to fine or imprisonment, would you not use the most accurate test that you could possibly get hold of? A. Not if the question involved was entirely independent of the extreme accuracy of the test.
Q. In making a test upon the result of which such a prosecution was intended to be based, how far would you regard yourself as being justified in departing from the standard of extreme accuracy?  A. I would require such accuracy that, the extreme limit of error being admitted, my conclusion would be irrefutable.

Q. Then you would not regard it as necessary to use the best and most accurate method that science could devise?  A. I would not.

Q. You say if the lactometer differs the tenth part of a degree, or is not accurate to that extent, that will not endanger the accuracy of the test, do you not?  A. I said substantially what you mentioned, but did not intend to limit myself to the tenth part of a degree of the lactometer.

Q. Suppose it differed the hundredth part of a degree?  A. That would not injure the test.

Q. Suppose it differed a tenth?  A. That would not injure the test.

Q. Suppose it differed a degree?  A. That would not affect the test.

Q. Suppose it differed two degrees?  A. I do not think then it would be impossible.

Q. Suppose it differed three degrees?  A. The question would presently resolve itself into whether at that point or soon after there would be one involved on which the main question hung; if in the specific case the adulterated material showed 50 per cent. of water I should consider that an error in the lactometer, of three or five degrees was of no importance.

Q. Suppose the adulterated fluid appeared to be adulterated to the extent of 15 per cent., would you regard an error in the lactometer of three degrees as being important?  A. I should regard it of small importance.

Q. Take the case put by Prof. Chandler, assuming the cow's milk to be 120 and therefore that the lactometer will not detect adulteration to an extent of 15 per cent., in that case would a variation or inaccuracy in the lactometer of one degree be important?  A. Your question involves a statement which I do not understand Dr. Chandler to have made.

Q. Understand the statement as coming from me as a hypothetical question if you choose?  A. I must in that case, in the first
instance, correct what I conceive to be an error; that is the statement that the lactometer will not detect the addition of twenty per cent.

Q. I said 15 per cent.; A. I beg your pardon.

Q. When a cow's milk stands at 120, how much water may be added without being detected by the lactometer? A. If a cow's milk stood at that degree in the first instance and we added any water to it, more than perhaps one or two per cent., the lactometer would detect it.

Q. Did you not hear Dr. Chandler testify upon the stand that good milk standing at 120 will bear the addition of 16 or 17 per cent. of water without going below 100?

(Objected to on the ground that in the testimony there were a number of lactometers; objection overruled.)

A. I cannot from memory assert one or the other.

Q. Is your memory bad, Professor? A. It does not enable me to retain every answer in a long examination.

Q. Is it true, as the learned counsel for the prosecution has just stated, that the lactometer is graduated to take effect only at the specific gravity of 1.029? A. I do not understand the learned counsel for the prosecution to have stated what I understand your question might imply; will you allow me to explain? I find this lactometer to have a number of marks upon it; one of these has the figure 100, and that I understand to represent the gravity of 1.029; then there are other marks adjusted to a scale which if continued would give us a zero mark corresponding to the gravity 1.000, or that of distilled water at 60; between these extremes the scale is divided into theoretical hundredth parts; consequently if we assume that when plunged in it, we shall have a standard of milk, milk at the gravity of 1.029 the instrument would indicate 100 or float at the 100 mark; this would show us that this was 100 per cent. of normal milk, in other words nothing but the assumed normal milk; if to this any percentage of water were added the instrument would sink deeper and the level would come to another mark on the scale, say 80, which would then indicate that there was only 80 per cent. of this normal milk and that the other 20 per cent. was made up by water; these same degrees are continued below the 100 mark, and in this instrument reach
the number 120; they would then indicate something denser than normal milk and I think it is clear enough already what this would mean that the normal milk stood 100, being an extremely light kind of milk; that milk would be often found for sale heavier than this, and the degree in which it was heavier would be indicated on this scale, but no longer as a percentage of milk and water of course as before; this I understand to be what the instrument is, and I presume must be what the learned counsel alluded to.

Counsel—I move to strike the answer out; it is not responsive to the question.

Court—I think it is responsive, or if you think it is too much responsive, I will leave it in.

Counsel—I will except.

Witness—Would you like me to add a word?

Counsel—No, sir.

Q. Now, Prof. Morton, if milk which when pure would have stood, by the lactometer, at 120, have 15 per cent. of water added to it, what will the lactometer show? A. I never tried that experiment.

Q. Can you state from the vast knowledge which you have acquired from other sources than by experiment? A. I think no man of scientific knowledge will ever venture to predict the results of an experiment.

Q. Then, do you not think that it is only safe for a scientific man to testify to things within his own personal experience? A. When he testifies to them as matters of his knowledge, certainly.

Q. When he testifies to them as matters of fact in a court of law, is it safe for him to testify to matters outside of his own personal experience?

(Objected to; objection sustained; exception.)

Q. Suppose pure milk stands at 100 degrees on the lactometer when properly tested, how much water may be added without bringing the lactometer down lower than 99? A. This would depend on the accuracy of the lactometer, but, within the reasonable limits, I should suppose one or two per cent.

Q. How much would be required to be added to bring the lactometer down two degrees? A. Two or three per cent.

Q. How much to bring it down ten degrees? A. From ten to twelve per cent.
Q. How much to bring it down to fifteen? A. Fourteen to sixteen.

Q. Then it is an irregular scale, is it not? A. Not as I understand it.

Q. What per cent. of water added influences the lactometer to the extent of lowering it one degree; do you estimate one per cent. of water to a degree, or two per cent., or what; is it irregular? A. I will answer to the best of my ability; I think I know what you want; the scale is a regular one, with a constant limit of error; that is to say, each per cent. of water added adds a degree, with an error of a degree or two in the possible adjustment of the instrument and reading.

Q. Then the regularity of that scale is principally notable, is it not, for its irregularity? A. I think not; just such things are constantly used in various scientific investigations.

Q. Professor, will you state what is the lowest standard of specific gravity of pure milk recognized among scientific men? A. In reference to milk of individual cows?

Q. I do not ask you that; I ask you as to cows in general? A. You did not mention cows at all.

Q. Nor is it proved that this is cow's milk in this case. A. There is no recognized limit, as to milk in general, other than the average which I have already stated.

Q. Do not the authors whom you have referred to in Europe and in this country recommend the use of the lactometer at 1.029 as the lowest standard of specific gravity? A. Most of them, I think; my impression is that 1.030 has been recommended.

Q. Will you name a few of the fluids besides milk which are ordinarily examined with the hydrometer or its modifications. A. Nitric acid, sulphuric acid, in its various forms, hydrochloric acid, alcohol.

Q. Now, take alcohol; in alcohol are not all the ingredients either lighter or heavier than the alcohol itself? A. I do not want to be captious, but really if you will allow me to explain it and go on——

Q. No, I will perhaps shorten it by asking another question? A. Alcohol is one thing, therefore it cannot have ingredients if I understand what you mean.
Q. As to alcohol are not all its ingredients heavier than the alcohol itself?  A. I must still explain; the word alcohol is used in two senses, to mean (1) a chemical substance—alcohol is a compound of carbon, hydrogen and oxygen, and (2) a mixture of alcohol and water in various proportions; if I understand you to mean that a chemically pure alcohol is lighter than the mixture of alcohol and water, that is so.

Q. Is not alcohol lighter than any and all of its adulterants?

(Objection.)

COUNSEL—I propose to show that all modifications of the hydrometer have a certain peculiarity, which is lacking in the lactometer.

WITNESS—I have already explained that in my testimony in chief; I may mention personally that I anticipate what you are now about to ask me.

Q. Perhaps you can explain?  A. Chemically pure alcohol is lighter than its ordinary adulterants; in the case of sulphuric acid, it is heavier than the water with which it is mingled; in the case however of milk we have a substance as I explained before containing materials both lighter and heavier and therefore varying; if there were no relation existing in these variations we could determine nothing about it in connection with its gravity; these relations, however, existing, by finding out the widest range or limit correctly in practice and using this as our starting point we can approximate and obtain a sufficiently accurate determination.

Q. Then as I understand you the hydrometer and its modifications are strictly accurate as a means of detecting adulterants when applied only to fluids the adulterants of which are either lighter or heavier than the fluids themselves; is that it?  A. That is it.

Q. Now milk may have an adulteration by water or an adulteration by cream, may it not?  A. Certainly.

Q. Or an excess of cream?  A. It may.

Q. Now an adulteration by water is an adulteration by something that is lighter than milk itself, is it not?  A. Yes, sir.

Q. And the adulteration by cream or the presence of excessive cream, that tends to make the milk lighter, does it not?  A. It does to a degree, but cream itself being heavier than water, a great deal of cream must be added to produce a small effect.
Q. You concede, do you not, that as a test of the purity of milk the hydrometer is not as strictly accurate as it is when used as a test of other fluids to which it is ordinarily applied? A. As a test of some of the ordinary fluids to which it is applied; it would not be so in reference to mixtures of petroleum distillate, naphthas, and the like, where the mixture of bodies of different densities takes place.

Q. Professor Morton, if two samples of milk which when pure, each of which stood at 100 by the lactometer properly used, were presented to you, one sample having been adulterated by the addition of water, and the other having been adulterated by the addition of cream, each adulteration being to such an extent as to bring the fluid down to 90 on the lactometer, and you applied to those two fluids the test by the lactometer, the thermometer and the exercise of the senses, could you tell which milk had received the water and which the cream? A. I think I could.

Q. Are you positive about it? A. I cannot be positive about a future event.

Q. Have you ever tried such a thing? A. I have not.

Q. What experiments have you made in the analysis of milk? A. I have examined various specimens of milk with the lactometer and hydrometer.

Q. How many? A. About a dozen.

Q. Within how long? A. Some of them last week.

Q. How many? A. Some 7 or 8.

Q. With reference to this trial? A. No, with no special reference to this.

Q. You knew at that time that you were to be a witness on this trial, did you not? A. I did.

Q. Prior to last week, how many analyses of milk have you made? A. In using the term analyses, which has a good many meanings, I must explain that I have examined milk, but have not made strictly an analysis, that is, I have not separated it.

Q. I am not using the word analysis in what I understand to be its chemical meaning; I am now using it in its separation of constituents? A. I have not made an analysis of milk in that sense, I have analyzed many other substances.

Q. Can you swear that analysis is not a surer test for milk than
tasting milk and using the lactometer and hydrometer or the senses? A. As a test for butter, caseine and sugar, it is of course infinitely better.

Q. Analysis is infinitely better? A. As a test for butter, sugar and caseine.

Q. What else? A. Salts.

Q. Is it not as a test for water? A. For the water in milk?

Q. Yes; for the water in milk, or to see whether it has added water? A. That is a different question.

Q. For the water in milk is it not a better test? A. Certainly; the lactometer does not show the water in milk at all.

Q. Is it not a better test for the adulteration of milk by added water? A. It is not.

Q. How can you swear that if you have never analyzed milk? A. Because my opinion is not founded on the matter of analysis, but upon the principles involved in the analysis.

Q. You give it as your opinion, not as a matter of knowledge? A. Not as a matter of knowledge in that sense.

Q. Professor, you see two cows milked, and each yields a milk of as low a gravity as is ordinarily found—can you tell which milk owes its low gravity to the presence of water, and which owes its low gravity to the presence of cream in it? A. I never tried it.

Q. Can you tell? A. I cannot tell whether I could or not.

Q. Will you take these two bottles and try? A. But those are not cows; I have not seen them milked; I do not know that either of those are milk.

Q. Cannot you distinguish by looking at them? A. No; not by that alone.

Q. Cannot you tell by testing them with your senses? A. Not under all circumstances.

Q. Stick the lactometer in it and use the thermometer? A. Those are not means of knowing whether the fluid is milk or not—I should add to my answer, under all circumstances.

Q. I understand you on the subject of telling whether eggs are eggs, to say that if you procure an egg at a grocery store, you assume it to be an egg, but if you get it at Heller's establishment, the illusionist, you doubt it; is that correct? A. That was not my statement.
Q. Well, sir, what was it? A. I said that if I found an egg, got an egg, at a grocery store, and it seemed to me to be an egg, I would feel justified in swearing that it was one, while, if I found it under other conditions, though it should seem to me to be an egg, I should not feel justified in swearing that it was one.

Q. Suppose I present an egg to you in Court, and ask you what it is, will you feel justified in swearing that it is an egg? A. I should not?

Q. Do you apply your observations respecting eggs to milk? A. Certainly, it is my intention.

A. Can you tell from the egg what kind of an egg it is, good or bad? A. It depends upon how bad.

Q. By looking at milk and testing it with the senses as fully as possible and the lactometer and thermometer, can you tell by what animal it was produced? A. I think not.

Q. What is the composition of milk, Professor? A. It varies within certain limits.

Q. What are the limits, what are the ingredients, the proportions in cow's milk? A. The ingredients are water, fat, caseine, sugar and some salts, some soluble and some insoluble; the proportions are about, if I give them from memory, 85 or 87 per cent. water, 3½ of fat, about 4 of caseine, about 4 and over of sugar, and less than 1 per cent. of salt.

Q. Is albumen a constituent of milk? A. That is a question.

Q. Is it or is it not? A. In some form it is included in the caseine.

Q. Can you regard it as identical with the caseine? A. The term caseine is generally used to include, what is otherwise called albumen.

Q. What does caseine mean? A. It means the cheesy substance.

Q. What does albumen mean? A. It means the substance of which we have the type in the white of the egg.

Q. There is as much difference between caseine and albumen as between cheese and the white of an egg? A. Not under all conditions.

Q. Generally? A. No, I should not say so.
Q. What kind of salts are found in milk?  
A. Salts of lime, soda; I do not recollect the list of them.

Q. Are there many?  
A. No, those are the principal ones.

Q. Can you give the specific gravity of the milk of any animal other than the cow?  
A. There is no specific gravity of milk of any animal, each lot of milk will differ a little.

Q. The milk of the lower animals, say the mare, the sheep and the dog, is that on an average lighter in specific gravity or heavier, than cow's milk?  
A. My impression is that on an average there is very little difference.

Q. Do you recollect whether it is heavier or lighter?  
A. No, I never attempt to remember such details; they are easily accessible in books; I look there if I want them.

Q. Can you state in these various animals or any two of them how the ingredients vary in the milk?  
A. Not from memory.

Q. You are not a resident of New York, I believe, Professor?  
A. I am a resident of Hoboken, New Jersey.

Q. Have you ever tested New York milk or what you knew to be New York commercial milk with the lactometer?  
A. I have not.

Q. Then how can you testify as you did on your direct examination, that if the commercial milk for sale in New York City is at 90, at 60 Fahr., it is adulterated with water, if you have no acquaintance with New York milk?  
A. Simply because commercial milk, whether in New York or in Philadelphia or anywhere else, I fully believe is essentially the same thing.

By the COURT—Q. By commercial milk you do not mean milk of cocoanuts or the milk of mares, but milk of cows?  
A. Yes, sir.

By COUNSEL—Q. I understand you to say that butter is not strictly a nutritious portion of milk, is that correct?  
A. That is my belief.

Q. Why is it there—is it placed there for ornament?  
(Objected to; objection sustained; exception.)

Q. Are you not aware that the introduction of milk into New York city from which the butter has been removed is forbidden by an ordinance of the Board of Health?  
(Objected to; objection sustained; exception.)

Q. You mentioned frozen milk—in your direct testimony; have you ever tested that?  
A. I have.
Q. How?  A. With the lactometer.
Q. At what degree?  A. At 60.
Q. Frozen milk at a temperature of 60 Fahr.—at what degree does milk freeze?  A. Excuse me; I answered hastily; I desire to explain; I of course melted the milk before testing it, my object being to find what effect freezing had upon the density of the milk; I did not pay sufficient attention to your question; the question was asked, but I did not answer it.
Q. You said something about frozen milk?  A. The question was asked me, but I did not answer it.
Q. By what lactometer did you test milk?  A. Chiefly by two.
Q. Where did you get those?  A. One I obtained from the Board of Health and the other was purchased by myself from Mr. Tagliabue in Pearl street.
Q. Did you compare the two?  A. Only at one or two degrees.
Q. Was there any variance between them?  A. There was a little variance.
Q. How much?  A. I think a degree or two.
Q. Is there not a more accurate method of determining the purity of milk by its specific gravity in regard to adulteration by water than that adopted by the Board of Health?  A. I think not, for this reason; allow me to explain my reason; by rendering an instrument more delicate or accurate nothing would be gained in practice since we must allow a large margin on account of the variations in the density of ordinary milk.
Q. I refer to the use of an ordinary instrument as shown on this trial to be used by the officers of the Board of Health, and I repeat the question with that addition?  A. I think not.
Q. Will you swear to that positively?  A. I will swear to my belief.
Q. Will you swear to more than a belief in the truth or correctness of that answer?  A. I will swear that it is true.
Q. Then you know of no other method which is better?  A. Which is more accurate for this purpose?
Q. Yes, sir?  A. No.
Q. Do you know of any other that is better for any purpose?  A. Analysis is better for the determining of caseine.
Q. For the determination of adulteration of milk by water, to determine its specific gravity with the lactometer, do you know of any better method than that employed by the Board of Health as shown on this trial? A. None.

Q. Suppose brackish water be added to milk, will that vary its gravity? A. It will.

Q. How? A. Increase it.

Q. Will all brackish water do that? A. No.

Q. How is that, Doctor? A. If the brackish water contains very little salt it will make the milk lighter; in other words if the brackish water is lighter than the milk itself it will make the milk lighter; if the brackish water is heavier it will make the milk heavier.

Q. Is there not a great deal of brackish water, which when added to milk will make it heavier and make it stand higher by the lactometer? A. I think not, unless it was so brackish as to impart a very strong taste to the milk.

Q. Is there not a great deal of brackish water up the Hudson river where the tide water ends and fresh water begins; where a great deal of milk sent to New York comes from? A. About Newburgh?

Q. Somewhere about there? A. The river is full of brackish water.

Q. Is not brackish water there which will not lower the gravity of milk? A. I cannot say.

Q. Assuming that brackish water be added to the milk with the effect of making it heavier, will the lactometer tell that adulteration? A. It will not.

Q. Then there is an adulteration by brackish water which the lactometer will not detect? A. Not the lactometer alone.

Q. The lactometer and all the usual tests? A. The taste will detect it.

Q. Will analysis detect that addition?

(Objected to as irrelevant; objection sustained.)

Q. Will analysis determine the condition of brackish water? A. It will.

By Mr. Prentice—Doctor, when you speak of the hydrometer used for the purpose of milk as being less accurate, or when you
refer to the accuracy of the hydrometer as used in various liquids, do you use the term accurate as referring to a degree of accuracy, or as to the determination of the fact itself of density—in other words, if the question is whether or not a fact exists, will the word accurate give your opinion correctly?

(Objected to; objection sustained.)

Q. You say you tested the lactometer used by the Board of Health? A. I used it, not tested it.

Benjamin Silliman, sworn and examined by Mr. Prentice, testified as follows:

Q. You are a chemist by profession? A. I am.
Q. You have also taken a degree of doctor? A. I hold the degree of doctor, but I am not a practising physician.
Q. How long have you been in the profession of chemistry, and what has been your experience? A. I have been in the profession of chemistry since 1837, at which time I became an assistant in the department of chemistry under my father at Yale College, where I remained until 1847, when I became professor of chemistry applied to the arts in the scientific school at Yale College; I then held that chair until 1849, when I added to it the appointment of professor of medical chemistry and toxicology in the university of Louisville, Kentucky; I held the two chairs parallel until 1855, when I resigned the Kentucky appointment, returning permanently to New Haven, where I have since, until the present time, resided as professor of chemistry in Yale College, and at present specially connected with the medical department of that institution.
Q. You are one of the editors of the scientific journal known as Silliman's Journal? A. I am.
Q. And you are acquainted with the milk question, so called; the literature upon it and the general subject? A. I am.
Q. You are acquainted with this class of instruments called hydrometers and the lactometer? A. Yes, sir.
Q. Which is used in testing specific gravity in milk? A. Yes, sir.
Q. Is milk a defined chemical compound? A. It is not; milk
is an emulsion; it is substantially water to the amount of 85 to 87 per cent., more or less, and the remainder is made up in part of substances soluble in water, and in part of substances insoluble in water; all those substances insoluble in water are embraced chiefly under the name of fat, and are held in suspension in the fluid.

Q. Is chemical analysis alone capable, with entire certainty, of determining if a given sample of milk has been treated with water? A. Science has not taught us to distinguish with certainty between the water that is natural to milk, and within certain degrees the amount of water which may have been accidentally or fraudulently added to it; we have no precise means of determining which is natural and which is added water within limits.

Q. Tell me what do you understand by commercial milk? A. I understand by commercial milk that average product that is sold in commerce, and which represents not the milk of one cow but the milk of many cows.

Q. Is there such a thing as normal or standard milk? A. In the scientific sense, no; you might as well ask if there were normal wine; there is normal alcohol, but because wine contains alcohol we cannot speak of normal wine nor normal roast beef; there is good milk and bad milk, good wine and bad wine, strong wine and weak wine, good beef and bad beef, but there is not a normal standard in these things; normal alcohol we have.

Q. Is there a minimum and maximum standard of specific gravity of milk? A. I conceive there is—that a minimum and maximum must be established as the result of a pretty large range of observation.

Q. What is the average between those two? A. According to the best of my memory I should say a fair statement of the general average, throwing out extremes as exceptional, would be from 27 to 28 thousandths as the minimum, to 33 or 34 thousandths as the maximum, that is to say 1.027 or 1.028 for the minimum, and 1.033 or 1.034 for the maximum; I can give you the corresponding degrees of the scale upon the New York Board of Health hydrometer or lactometer if you desire it, I believe.

Q. What will you say of the standard of 1.029 as a safe and reliable standard for commercial milk? A. I should say that, as far as my reading and knowledge go, it was a standard in favor of the
milkmen; that it is lower than the accepted standard of France, which is 1.030, and that in some sense, and perhaps in a general and best sense, it may be considered a safe standard.

Q. Is the hydrometer an accurate instrument for determining the specific gravity of liquids?  A. It is, if properly made and used.

Q. Is there any more accurate method of determining the specific gravity of liquids than by the use of such an instrument?  A. No, it is a preferred method for liquids lighter than water, and for many that are denser than water, both for the rapidity and the accuracy with which it may be used. It is an instrument of incomparable practical importance, alike in the arts and in the sciences.

Q. What is the best opinion, according to the best authorities, with regard to the use of the lactometer for detecting the watering of milk?

(Objected to; objection overruled; exception.)

A. As I understand the best knowledge on that subject, it is that, within certain limits, the lactometer is very generally if not universally accepted as a means of determining the watering of milk. This, I believe, will be found to be true by examining the writings of Bouchardat, Quevenne, Von Baumhauer, and all the other authorities that are considered, both abroad and at home, as the best representatives. I would qualify that answer, if you please, by one remark. It is not intended to apply to extreme cases, nor even to an individual case. You may have the milk of a cow that in an exceptional condition may contain an enormous and unusual quantity of cream, and the hydrometer would fail utterly. With that qualification, I think the answer is correct.

Q. I will limit it to the use of the lactometer for detecting the watering of commercial milk?  A. I consider it a suitable and an accurate instrument for that purpose. My answer is affirmative.

Q. I will ask you, if you should find a sample of commercial milk which, at a temperature of 60 Fahrenheit, should show a degree of 90 on the lactometer, what would that determine?  A. It would at once excite the suspicion that the milk had been falsified with water, if I understand your question, that it should read at 90 on the lactometer?
Q. Yes sir. A. It would at once excite suspicion that it had been falsified with water, but it would not be, without observation, sufficient evidence that it had been watered.

Q. You do not mean to say it would be no evidence? A. Oh, no; it would not be conclusive evidence.

Q. Suppose a sample of milk, commercial milk, which to the eye as it appears in the glass and upon the lactometer is tested, and and also by the taste, and on the lactometer shows at 60 Fahrenheit a degree of 90, these observations occurring, what would it determine? A. Almost absolutely convincing the mind of the observer that it had been tampered with by the addition of water.

Q. Is there any more accurate method of determining? A. Well, practically no.

Cross-examined by Mr. Lawrence:

Q. Professor Silliman, have you personally tested milk with the hydrometer? A. Do you ask that question of the hydrometer in general, or the Board of Health instrument?

Q. The modification of the hydrometer which is called the lactometer. A. I have.

Q. Very often? A. Very often.

Q. How many times? A. I cannot say how many times; every year during the last forty years.

Q. Have you ever used the lactometer of the Board of Health of New York? A. I have not.

Q. Do you know whether its mechanical construction is correct? A. I conceive from the examination that I have made of the instrument that it is very skilfully constructed for its purpose, inasmuch as the stem is very small in proportion to the bulb.

Q. Did you not assist the other day in court at the reading by four lactometers which were alike in bulb and stem? A. I did.

Q. They differed I believe? A. Slightly.

Q. Can you point out any mechanical defects about the Board of Health’s lactometer? A. I do not know that I exactly understand the purport of your question.

Q. Will you take that instrument and see whether you can discover any mechanical defects in its construction? A. Judging merely from the external form, the appearance of the instrument
and the proportion of its parts, without any knowledge of the special value of this particular sample of it, I should say it was a very well devised form of hydrometer as applied to the measurement of milk—lactometer—and for the reason that I specify, that the stem is very slender and the bulb very large.

Q. Will you give the reason as plainly as you can to the jury, why the hydrometer is not as perfect and accurate a test for milk as it is for other fluids?

(A. If I understand the question of the learned counsel, it is a question as to whether the instrument is capable, in dense fluids, of rendering as exact answers as in thin fluids?)

Q. No, sir; it is a question of whether the hydrometer for instance is as exact an instrument to test milk with as it is to test alcohol?

Q. Is cream lighter than milk? A. It is.

Q. Is water also lighter than milk? A. It is.

Q. Does alcohol contain any impurity lighter than itself? A. It ought not to.

Q. Pure alcohol I refer to; is there not therefore a distinction between the results of tests made of milk by the hydrometer and tests of alcohol? A. By the specific gravity test you may determine density?

Q. Yes, sir? A. I conceive in no other sense than this, that if the milk be carefully averaged so that the cream and the skimmed milk be perfectly homogeneous, so to speak, in the mass, that there is no serious error in the hydrometer as applied to the testing of the density of milk more than applies to the use of the same instrument in the testing of the density of oil or of any other substance that is more or less viscous or tenacious, which is to be understood, if I may be allowed to make the explanation, as involved in the care which is used by those who have experience in the use of this instrument in plunging it into the fluid that it be not wetted on any portion of the stem above the point at which it is expected to sink, inasmuch as in that case if it be so smeared or moistened by a dense liquid the whole instrument becomes denser by that quantity and will sink
deeper in the fluid and consequently involve an error; if you will have the kindness to refer to the book which is already in evidence before the court of yesterday, Bouchardat, you will find in it specific instructions given in the prefatory portion of that volume that the most careful consideration and precaution should be used in introducing the instrument into the milk to avoid the moistening of the stem above the portion of the stem where it is expected to sink, and with that explanation I say I see no difference between the use of the hydrometer applied to milk or the hydrometer as applied to oily materials or any other fluid.

Q. Is any difficulty presented in examining milk by the hydrometer more than in the examination of other bodies? A. I think not.

Q. In case a sample of milk stands when properly tested by an accurate lactometer at 95 degrees, may not that be caused either by the presence of too much water or too much cream? A. It may.

Q. How can you tell the change by the lactometer? A. By the consistency of the milk that is caused by water; the milk will not fail to distinguish itself at once by the familiar character of diluted or skimmed milk; it will be changed in color; it will be changed in consistency; if the milk is so exceptionally rich in cream that it will stand at 90 or 95 degrees of the hydrometer the least skilled observer will not fail to distinguish at once the fact that the milk is very greatly richer than average commercial milk.

Q. Do you assert that by looking at the milk and exercising the evidence of your senses towards it you can tell whether its low gravity is caused by the presence of cream or by the presence of water? A. I think so.

Q. Are you certain of that? A. Reasonably certain.

Q. Are you quite certain; I do not know what reasonably certain means? A. I should be willing to hazard my opinion upon it that it was so.

Q. Would you be willing to hazard anything more than an opinion on that? A. I would; I would hazard my money on it.

Q. I suppose your opinion is worth more than your money? A. No doubt, I should prefer to buy some milk of that sort for my coffee.
Q. Now, sir, in case you saw two cows milked and the milk of each stood at as low a degree of gravity as it is generally found at, could you say, by applying the evidence of your senses to that milk, and testing it properly with the lactometer, whether the low gravity of either of the two milks was caused by the presence of cream or the presence of water? A. I did not understand the degree of density which you affixed to it.

(Question repeated.)

A. I do not see the point of that question; if you will be kind enough to state a density for either or both the supposititious cases, I, perhaps, can better understand it.

Q. Suppose you saw two cows milked, and the milk from each cow when properly tested with the lactometer, stood at the degree of 98, might not that degree as to one milk be caused by the presence of water, and might not the same low degree as to the other milk be caused by the presence of cream, would you, by the aid of the lactometer and thermometer and your senses be unable to state as to which milk the low gravity was caused by cream, and as to which by water? A. I do not think, within the limits set by the learned counsel of this supposititious case, namely, two degrees of the lactometer of the Board of Health, if I understand it, that I could draw any certain inference whatever; allow me to say that each of those degrees upon the Board of Health lactometer is the equivalent upon a scale of thousands of only a small fraction; the whole scale of 1.029 is divided into 100, and consequently 3.47 degrees of the Board of Health lactometer is equivalent of one division on the scale of thousands, and the reading of the lacto-densimeter is not graduated to read a less quantity than 1.00; we are speaking of the measurement of the density by the thermometer in conjunction with other things; I should be very happy to hear any further explanation.

Q. Now, sir, in case two samples known to you to be pure, seen by you taken from the cow, each sample coming from a different cow, and when tested at a low lactometrical degree, take any degree you like within 90 and 100, say each milk standing at the same degree, can you tell as to one sample whether that gravity is caused by the presence of cream or of water, and can you tell the same as to the other? A. When we consider the case of individual cows, we
are upon a very different ground of argument, understand, from what we are when speaking of average commercial milk; I can point you to scores of samples of the milk of individual cows, which will fall low in density, but the average milk of cows does not vary if they are in health; if you take twenty cows, twelve cows, forty cows, it does not vary substantially from 1.030; that science has perfectly determined, unless you select a dozen of cows of very exceptional quality, but if you do the average of any herd under exceptional conditions of temperature or health there may be variations.

Q. Ought the gravity of the milk of cows to vary much at intervals of 10 days? A. It would depend on their food and the condition of their health; it may vary very much within that limit of time.

Q. Now, you say that among the herd of a dozen of cows the gravity of their milk ought to be nearly the same, and ought not to vary much? A. The average gravity, yes, sir; I mean that it ought not to vary much from 1.030.

Q. I now read you the figures from the report signed by Doctor O'Connor, made to the Board of Health, the figures showing the gravity of milks from a herd of thirteen cows, and I ask you whether that is an unusual variance; the figures are as follows— A. The temperature is presumed to be at 60?

Q. I suppose so; the figures are 101, 108, 116, 118, 113, 103, 102, 122, 106, 112, 105, 102, and 114; now, sir, assuming those to have been properly made at a standard temperature Fahrenheit, is that an unusual variation in a herd of thirteen cows; I ask you to assume that the test was properly made at the proper temperature. A. I should say that all those cows that were reported there were under abnormal conditions of health or food.

Q. I am forced to come back to my previous question, Professor Silliman; I want to make it plain if I can; I am not talking about commercial milk, but to the kind of milk I referred to, pure milk from two cows; if you see two cows milked, see their milk properly tested with the lactometer, and at the proper temperature, the milk from each cow stands at 95, may not the low gravity of one milk be caused by the presence of water, and may not the gravity of the other milk be caused by the presence of cream in it? A. I have no knowledge of any samples——
Q. I am putting a supposititious case to you? A. I must answer from my knowledge; I have no recollection of any sample among all the thousands of the densities of milk that I have examined of the case of a cow in normal condition of health which gave a milk of a less density than 100 degrees where that density was due to anything else than the presence of excessive cream; I have no knowledge of samples where milk is of low density from excessive cream.

Q. How many cows have you seen milked? A. I have kept cows all my life and milked them; I don't know how many.

Q. How many cows have you seen milked, and tested the milk? A. I cannot answer that question; I am not a milkman or a dairyman; it is not my business to inspect herds.

Q. Have you seen one cow milked and tested the milk? A. I have.

Q. Have you seen 100? A. I have not.

Q. Have you seen 20? A. I have examined my own cows repeatedly, but not further than that.

Q. What breed are your cows? A. Alderneys, Ayrshires and other breeds at different times.

Q. Well, do they render milk of a lower or a higher specific gravity than ordinary cattle? A. They are all stall-fed and give milk above the average gravity.

Q. Then they are not pasture-fed cattle? A. During summer they are.

Q. When you tested their milk which you saw milked were they pasture-fed or stall-fed? A. I should think both at different seasons of the year.

Q. When were they high or when low? A. Always higher when stall-fed in the winter.

Q. To what extent have you known the presence of cream in milk to diminish its gravity below the highest specific gravity that you found? A. Does your question refer to my knowledge of the general subject, or of experimental?

Q. Experimental matters made by yourself?

(Question repeated.)

A. It is not in my power to answer that question with accuracy.

Q. Have you known the presence of cream to largely decrease the
gravity of milk? A. I have in my memory instances recorded of that fact.

Q. In your own knowledge? A. No, not of my own experimental knowledge.

Q. How much of your testimony on your direct examination was based upon your personal knowledge; was it all? A. The testimony upon my direct examination was based upon my general knowledge.

Q. Was there more than a small portion of your testimony upon your direct examination based upon your personal knowledge?

The COURT—I will exclude the question.

COUNSEL—I except to its exclusion.

Q. Was there one-half of your direct evidence based upon your personal knowledge?

The COURT—that I will exclude.

Q. You mentioned certain authorities, Quevenne, Bouchardat, and Von Baumhauer, will you state or point out which one of those recommends the use of the lactometer as the best test for milk? A. I made no statement of that kind.

Q. What did you say about them? A. The stenographer's record of my answer will state.

Q. Professor Silliman, I hand you a copy of a book, Du Lait, by Quevenne and ask you to point out the portions to which you refer. Have you consulted Quevenne's book? A. I have consulted it.

Q. Will you point out the passages you referred to in your direct examination; you stated that book to be by Bouchardat? A. I said that the book was by Bouchardat and Quevenne, which statement is true in general; the introductory part was originally by Quevenne alone; they jointly edited the book; it is dated Paris, 1857. May it please the Court, the introductory portion of this book which describes the lacto-densimeter occupies thirty-two pages altogether; I will therefore briefly state the points and read but one or two extracts, translating from the French. After giving the general instructions upon page 2 for the guidance of those who would make observations upon milk, the author says: "The different instruments therefore employed for the weighing of milk only sufficiently fulfil their end." Quevenne has attempted to establish the lacto-densimeter with the table of corrections with which he accompanies it; he states that the commission with whom he was associ-
ated in this matter was Soubeiran, Rayer, Gueneau De Mussy, Bouchardat, and Orfila, who was the reporter; the employment of the creamometer or graduated etrouvette, which was an instrument necessary for the lacto-densimeter in order to determine the cream; he then goes on to give more minute observations with regard to the methods of examination, and adds as follows: "We only occupy ourselves here by considering things practically essential alike for the security of the vender, and also in efforts which shall be sufficiently expeditious; we do not speak of those methods the manipulations of which are more or less complicated, which belong necessarily to the domain of the laboratory, the shortest of which demands generally from fifteen to thirty minutes." He then goes on to describe particularly the method of construction of the lactometer or lacto-densimeter upon pages 4 and 5, and there is the original figure which has been copied into so many books; if you so desire it I will translate more of this description, but it would occupy some time; there are points which I have not yet spoken of.

Q. I desire you to translate such portions as you deem necessary to show that Quevenne advocates the use of the lactometer as it is used by the Board of Health, I mean in the same manner; the quotations which show that that book supports the lactometer alone, and not the lactometer and the hydrometer. A. He goes on to show how to apply a table for the corrections of temperature where the instrument is used at another than a standard of temperature fifteen degrees centigrade. Upon page 11 the author says the degree which the lacto-densimeter should mark in the milk, Quevenne has found that upon thirty-two specimens of milk collected under very varying conditions, the mean degree by the lacto-densimeter was 30.8, that two milks which were found to weigh 27.5, and another the higher figure of 36, the minimum was 29 and the maximum 34.5. Since this time we have had occasion to continue the examination of other milks taken under circumstances equally varied for place, for season, for food, for the kind of life, whether in the open air or in the stable, for the age of the animal and that milk, etc.; by way of explaining that last statement it would be proper to add, that on the previous page the author calls attention to the fact that there is a variation in the density of milk from the moment when it is drawn or just after it is drawn, and after it has stood six hours; it is not
necessary to go into that detail unless the counsel desires it. Says Quevenne, "We place under our eyes a table covering a period of eleven years, 1843 to 1854, upon which are recorded the degrees by the lacto-densimeter and the lactoscope of 103 milks of the purity of which I am sure, they having been drawn from the cow before my own eyes," or words to that effect; see the results; minimum, 28.8; maximum, 36.4; mean, 32.2. Now, sir, without occupying more of the time of the Court, I will simply add that in the close of this very valuable memoir, which, I think, upon the whole is by far the most valuable contribution we have received to the literature on the subject of milk, there is a resumé of 103 analyses. It will be observed that the columns here relate to the date at which the milk was produced, the place of their production, the kind of cow, the age of the cow, the quantity that is furnished by each cow per day, whether milked in the middle of the day or in the evening, and then the degree of density by the lacto-densimeter, and they give the numbers, running from 1 to 103 consecutively; it is not necessary to read them, but I will give you the resumé; the pages are 192 to 196 inclusive, the resumé being upon the last; my inference from this is that the statement which I made in my testimony before recess is abundantly supported in the fact that these very competent witnesses appear to rely exclusively upon the lacto-densimeter for determining the density of milk.

Q. Can you refer to any other passages in this book which sustain the method or a method similar to that used by the Board of Health in this city? A. I regard the whole book as responsive to your question. Will you allow me to add one word of explanation, lest I should be conceived by the honorable counsel or jury to not fully state the matter; I do not wish to conceal the fact that there are expressions in Quevenne upon the lacto-densimeter in which he states that the instrument as a scientific instrument is not as perfect as might be desired to meet all the questions of caseine and sugar, etc., and he criticises the instrument; doubtless the witnesses on the other side will call attention to that; I will take the time of the Court to do it now if it is desired; I will read the whole of it to you if you like.

Q. Will you refer to the bottom paragraph on the first page and translate that? A. I translate it as follows: "If the guilty ought to
be severely punished it follows that the innocent should not be confounded with him; behold the progress or march which to us appears to reconcile all the interests involved, and to render possible the daily verification of milk in the largest city; we take Paris for example;” do you wish me to go further?

Q. Yes sir, the next paragraph, if you will? A. “Messrs. the Commissioners of Police, the subordinates in their order should practice each day, at the houses of many of the venders of milk in their circumscription, the following operations, which ought to be executed at least in one minute: a, first, to take the degree with the lacto-densimeter; b, to taste the milk, if the degree by the lacto-densimeter is inferior or below twenty-nine degrees in having regard to the temperature as mentioned upon pages 10 and 15, if the taste or the color presents anything which is abnormal. After these preliminary trials the merchant or vender is presented by affidavit, and to take at least half a litre of suspected milk, taking care previously to have rendered the whole mass homogeneous by stirring, and then to transmit it immediately to an expert chemist, who shall be designated by the administration. This method of procedure presents the incontestible advantage of respecting the dignity of the merchant, and it does not involve a seizure, a circumstance which is always grave and which always carries with it a powerful presumption of the violation of law.” It is rather a free translation.

Q. Now, sir, if you will read that short sentence? A. “When he has verified, as we have before said, the degree by the lacto-densimeter he knows only the half of that which ought to be understood.”

Q. These gentlemen referred to in the beginning of this work, Soubeiran, Rayer, Bouchardat and Orfila, are they distinguished men in France? A. Orfila is the reporter in that case and he is a great toxicologist, an eminent man.

Q. Does not Quevenne speak of commercial milk? A. I do not distinctly remember that he makes use of that expression. I do not doubt that he may; if you say that he does I accept your statement.

Q. Does not his book show that he intends the methods prescribed by him to refer to milk sold in the city of Paris, that is commercial milk as you understand that term? A. Clearly.
Q. It is also necessary to use a table in connection with this lactometer?  
A. That is a matter of difference of opinion among scientific men; he appears to regard it so; I do not.

Q. What is a creamometer?  
A. An instrument for measuring the amount of cream which is thrown up to the surface of the milk.

Q. Are you familiar with the book by Von Baumhauer, to which you refer?  
A. Yes, sir, with that article in it.

Q. Will you see whether this book, at page 811, does not call your attention to that memoir? (Watts' Dictionary shown to the witness).  
A. This citation by Watts in his second supplement, makes reference to the Zeitsch Anal. Chem., I will refer to the book. That is the chemical journal which is referred to. Methods of Milk Analysis. Von Baumhauer describes in an elaborate communication the methods previously in use for determining the commercial value of milk. He came to the conclusion, long recognized in Germany, that one will not by determining the specific gravity of milk or by determining cream by the aid of the creamometer or glactroscope, be in a position to establish the degree of its adulteration, either by skimming or by the addition of water. It can only serve to prove the addition of 10, 20, 30 or 40 per cent. of water and the excessive skimming. I believe that is the correct rendering.

Q. Will you proceed and read a little further, finishing the extract?  
A. I think that is all that is pertinent to the point of inquiry.

Q. Now, sir, please state Quevenne's method for determining the adulteration of milk by water; what is it?  
(Objected to; objection sustained; exception.)

Q. Is there not a more accurate method of determining the purity of milk by its specific gravity in regard to its adulteration by water than that adopted the Board of Health?  
A. Practically, I think not.

Q. Are you certain?  
A. The hydrometer, as this particular hydrometer is called, if accurately constructed gives us precise information, if properly used at the proper temperature, and the balance does no more; each of them weighs a certain quantity of milk; the one in a specific gravity bottle, on the pan of the balance, and the
other by displacement of the known volume, namely, the instrument floating in the liquid; neither distinguishes between the water which is normal to the milk and the water which is added to the milk except in excessive degree.

Q. And that is the definite test which is common to all methods, is it? A. I think so, to all methods.

Q. Will not analysis show more surely the quantity of water contained in milk than the lactometrical test? A. You mean chemical analysis?

Q. Yes, I mean taking the milk apart? A. Doubtless a careful chemical analysis is a more accurate means of determining the constitution of milk, of which water is one of the factors, than any sight or any other application of the unaided senses.

Q. Now, in your opinion, when a tradesman is charged with selling an adulterated article, and the fact is sought to be proved by means of a scientific test so called, should the best possible test be employed?

(Objected to; objection sustained; exception.)

Q. By the COURT—How long, probably, would it take to analyze carefully a quart of milk? A. According to scientific methods?

Q. Yes, sir. A. The complete analysis given of a sample of milk would occupy, unless there were a large number of samples done at the same time, it would occupy two days of working time in the laboratory; understand me, if you please, I should, perhaps in that case propose to establish all the points, to analyze the milk thoroughly.

Q. You would have to analyze milk if you undertook to find out the per centum of water? A. No; we could make a water determination by evaporation in a shorter time.

Q. By heat? A. By heat I should say in three hours.

Q. By COUNSEL—In three hours you can demonstrate how much water the milk contains? A. I should think so.

Q. It would show the quantity of water which the milk contained, which the lactometer does not? A. It would show the exact quantity of water contained in milk.

Q. Will the lactometer show exactly the quantity of water which the milk contains, or is not the same effect produced or a similar effect to a less degree produced upon milk by cream as upon
water, as to its gravity? A. Cream is so near the density of milk, that in order to reduce the density of milk say from 100 to 95 on the lactometer, the volume of cream added must be very large, while the volume of water added would not much if at all exceed the 5 per centum considered.

Q. Do I understand you to mean that the specific gravity of cream is nearly the same as that of milk? A. No, but I say there is so little difference.

Q. What is the specific gravity of cream? A. The specific gravity of cream will depend in a measure upon the specific gravity of the milk from which it is derived, for cream is nothing but milk with an excess of fat.

Q. Between what figures does the specific gravity of cream range? A. I cannot certainly tell from memory without reference to some authorities upon the subject?

Q. Were you present in Court the other day when Professor Chandler demonstrated its specific gravity to be 44?

(Objected to as assuming a fact which does not appear.)

A. The answer which I was searching for in my own mind was the actual density, which I thought would not be far from 1.015; by reference to my table of comparative density I see it is 1.014.

Q. Water being at the density of 1.000, is that it? A. Yes, sir. Q. Cream would be at a density of 1.014? A. Yes, sir. Q. And milk would be at a density of about what? A. 1.030.

By Mr. PRENTICE—Q. If you have a large quantity of cream in the milk on one side, and have a quantity of water in the cream on the other side, is there a difference in color? A. Yes, sir, there is.

Q. Is there a difference in consistency? A. There is.

By Mr. LAWRENCE—Q. You say that as to milk containing added cream and milk containing added water, the color would vary, do you not? A. Not in small quantities.

Q. Suppose there to be 4 quarts of each, would there be a variance in color; 4 quarts of the fluid of each kind? A. You do not understand me; allow me to make plain my meaning; I mean that if to a given sample of milk there is added 5 parts by weight, if you please; if to a given sample of milk there is added a sufficient volume of cream to reduce the specific gravity of the mixture to 95
degrees by the lactometer, the volume of cream so added will be necessarily very large, and that the effect upon the milk will consequently be very apparent, whereas 5 per cent. of water might be added which would reduce the density of milk to 95 in round numbers, and its effect might not be very apparent; it would be a little thinner, but would not be very apparent.

Q. Professor, as you have just stated that the specific gravities of cream and milk were nearly alike, how can you now state that a large quantity of cream would only bring the milk down 5 per cent.? A. I think I have sufficiently explained that.

Q. How large a quantity would have to be added? A. In a particular case which occurs to my memory, milk which had the density of 1.018 by specific gravity determined by the balances was found to have 55 per cent. by volume of cream floating upon it after standing until the cream was raised; I therefore infer that in order to reduce the density of milk to 1.018 that at least one-half its volume must be cream.

Q. If you see a cow milked and its milk stands at a low gravity, at as low a gravity as you ever find pure healthy milk, can you tell whether that low gravity is caused by the presence of much cream or much water in the milk? A. I think so.

Q. How can you tell that? A. By the sensible properties of the fluid.

Q. Can you tell it from the exercise of the senses? A. In connection with the lactometer; you assume it is of a like density?

Q. Yes, of course I do? A. The reason for my answer is this: a cow in health never gives milk of a low density, which usually means an excess of cream, unless she has been fed upon highly oleaginous food; if she is a stall-fed cow, fed upon cotton seed meal or upon linseed meal or very nutritious food, her cream may be very greatly exaggerated.

Q. Then I understand you at last definitely that if you see a sample of milk which you know to be pure milk at a low gravity and apply the lactometrical test properly and exercise the senses you can thus determine whether the low gravity is due to the water or to cream? A. I think so and for the reason that the analysis of that very milk which I cite showed only 80 per cent. of water.
ELWYN WALLER, sworn and examined by Mr. PRENTICE:

Q. Dr. Waller, you are a chemist by profession?  
A. I am.

Q. And you are consulting chemist of the Board of Health, I believe?  
A. My title in the Board of Health is Assistant Sanitary Inspector; I have the work of analysis of the Board.

Q. And you are one of the officers of the School of Mines, are you?  
A. I am, sir.

Q. The Laboratory?  
A. Yes, sir.

Q. You have charge of the Laboratory?  
A. I have charge of one of the Laboratories.

Q. How many students have you there?  
A. At present, some 70.

Q. How long have you been there?  
A. I have been there as a student since 1868. I was there as a student for two years, and, since 1870, I have been there in one capacity or another; in my present position, I have been there since 1871.

Q. You have had a number of samples of milk brought to you by inspectors of the Board of Health, for analysis, have you not?  
A. I have.

Q. And with the rate on the lactometer?  
A. Yes, sir.

Q. And have you made the analyses?  
A. I have made the analyses.

Q. To test the lactometrical rate?  
A. Yes, sir.

Q. In how many cases?  
A. In 73 cases, I think.

Q. And what did you find?  
A. I found that the analysis showed that the lactometer was correct.

Q. In all these cases?  
A. In all these cases.

Q. Have you tested the lactometers of the Board of Health?  
A. I have tested them.

Q. At what point, and how?  
A. I have tested them at three or four different points; at some point near the 100, at a point about 10 or 12 to 15 degrees below that—that is from 85 to 88; at about 75 to 78, to 65 to 68 for different ones.

Q. When the lactometer has shown an excess of water, what has the analysis shown?  
A. The analysis shows a little more usually than is shown by the lactometer.

Q. The four lactometers that were in use here, perhaps the first
day of the trial, in the practical tests that were made, you took, I believe? A. I did.

Q. And did you test them? A. I did, that evening.

Q. And did you find that at the 100 point they agreed? A. I found that they did agree at that point.

Q. Did you find that they agreed at any other point? A. I found that they agreed, I think it was at the 88 point, at the 78 point and at the 68 point, essentially agreed. I have a note here on the subject.

Q. Look at your notes, and refresh your memory if it is necessary, and tell me at what points they agree? A. At the 104 point they all agree, at the 88 point three were 88 and one was 87; at the 78 point two were 78, one was 77 and one was 76; at the 68 point two were 68, one was 67, and one was 66.

Q. You have, in addition to the prosecution of studies in milk, been into the country and tested the milk from cows when milked? A. I have tested it with the lactometer.

Q. Will you state the result, and the number of experiments you made? A. I made 86 tests upon the milk which I saw taken from the cows myself, and the highest of those was 122, I think; it was either 120 or 122; the lowest was 102, the average I do not recollect now absolutely, but it was a little below 110.

Q. The lactometer which you used, was what? A. It was the lactometer constructed for the Board of Health, with the 100 mark at 1.029.

Q. And the temperature was what? A. The temperature when I tested them was 60 Fahr.

By the COURT—Q. All the milk you tested had a greater specific gravity than 100? A. Yes, sir.

By Mr. PRENTICE—Q. Now, you have had practical experience in these several tests; have used the lactometer and have used the analysis; in your opinion is it necessary when milk at 60 Fahr. falls below the 100th point on the lactometer of a standard of 1.029 to use analysis to detect the adulteration by water alone. A. In case it were very near 100, 98 or 99, I should prefer to make an analysis before deciding whether the milk had been watered or not, but in ordinary cases if it fell much below 100 I should not consider analysis necessary.
Q. In case it stood at 95? A. In case it stood at 95 if it were commercial milk I should not consider it necessary.

Cross-examined:

Q. How long have you taught chemistry, Doctor? A. Four or five years.

Q. Did you test the other evening a lactometer handed you by Professor Doremus and myself? A. I did.

Q. Did you find that to substantially agree with the Board of Health lactometer? A. Yes, it agreed essentially with the Board of Health lactometer.

Q. Did you test it at more than one point? A. I tested it at the same points at which I tested the other ones.

Q. Did you test it so that you have no doubt as to its general accuracy? A. Yes, sir; I did.

Q. These samples of milk 86 of which you analyzed, did you know them all to be pure? A. Those that I tested in the country you refer to?

Q. I think you said you analyzed 86? A. I analyzed 73 samples of milk; I also tested 86 in the country.

Q. The 73 that you analyzed, did you know them to be pure milk? A. I did not; I knew that they were not.

Q. How did you analyze those? A. According to the ordinary method; I will describe the method if you wish; the milk was first dried to a constant weight; then the butter fat was extracted by means of ether, the loss of milk residue determined by the balance, and as a check upon that the amount of butter was placed in a dish and the ether evaporated off and that was also weighed; what remained consisted of caseine, sugar and salts; the sugar was then extracted by means of water and the loss noted and also the weight of the sugar separated was determined; the remainder consisted of caseine together with some salts; the sugar was burned and the salts in the sugar thus determined; the caseine was also burned and the salts with the caseine was determined.

Q. You are familiar with the general method pursued by the Board of Health to detect the adulteration of milk in this city, are you not? A. I am.
Q. Does the Board of Health cause the milk to be tested at the depot?  
(Objected to; objection sustained; exception.)

Q. Now, what is the most accurate method of determining the adulteration of milk by water?  
A. The lactometer.

Q. Then that is more accurate than analysis, is it?  
A. I think it is.

Q. But you stated just now that by analysis you always found more water in milk than the lactometer indicated, did you not?  
A. I did.

Q. Then if you consider the lactometrical test the best why was it that you subsequently verified that by analysis?  
A. Because I desired to find out by two different and independent methods the amount of adulteration.

Q. Then you found the most adulteration by what you deemed the least accurate method of analysis did you not?  
(Objected to; objection overruled.)

Q. Will the lactometer show you the percentage of water milk contains to a certainty?  
A. Do you mean the per cent. of that which it naturally contains?

Q. Naturally and properly together; if you take a sample of milk pure or adulterated does the lactometer show you accurately how much water it contains?  
A. It will not under those circumstances.

Q. Will it show you accurately how much water is contained in the specimen of pure milk?  
A. It will not.

Q. Will not analysis?  
A. Analysis will.

By Mr. Prentice—Q. Will you read the test of the lactometer handed you by the learned counsel the other evening for a test at the point at which it agreed and disagreed with the other lactometer?  
A. Where it should have stood at 104 it stood at 105; one degree higher; at 88 it was one degree too low; it was 87; at 78 it was correct; at 68 it was one degree too high; it was 69.

Q. How did you make the determination?  
A. By taking a salt solution, the gravity of which was determined by means of the specific gravity bottle, and then by calculating from the specific gravity, thus determined, what the degree of the lactometer should have been, and then testing the lactometer in the solution.
Henry A. Mott, Jr., sworn, and examined by Mr. Prentice.

Q. Dr. Mott, will you state your profession? A. I am an analytical chemist.

Q. And what has been your study and experience? A. With respect to the subject of milk, I have devoted what I may say undivided attention to it for the last two years and a half, with a view of publishing a very extensive work on the subject.

Q. Have you already published some papers? A. I have.

Q. You are acquainted with the lactometer, I suppose? A. I am.

Q. Have you made tests and experiments with it? A. I have.

Q. Is it an accurate instrument for determining the specific gravity of milk? A. Yes, sir; when it is properly used.

Q. Other similar instruments are used in the arts for like purposes, are they? A. Yes, sir.

Q. Is there any more accurate method of determining the specific gravity of liquids than by the use of such an instrument? A. I have compared the result I have obtained from the lactometer with the results I have obtained by actual weighing in the scales, and they have agreed in every instance.

Q. How many times have you done that, do you remember? A. I did that at least six times last winter.

Q. This was in a case of milk? A. Yes, sir; in the case of cows' milk.

Q. You have examined the question of milk, generally? A. I have examined milk, generally.

Q. And you have made comparative tests to determine the accuracy of the lactometer you have already stated? A. Yes, sir.

Q. What do you understand by the specific gravity of milk? A. I understand by the specific gravity of milk, first, the result obtained by comparing the volume with the known quantity of milk, the weight of a known volume of milk with the weight of a known volume of water, at the conventional temperature of 60 Fahr.; and secondly, I should have said when I speak of the specific gravity of milk, I mean the specific gravity of all the milk that can be obtained from a cow, in perfect health, thoroughly mixed together
at the temperature of 60 degrees, and not the specific gravity of the first, second, or third portion of milk.

Q. What would you say of the standard of 1.029 as a standard of milk from a sound healthy cow? A. I say, that the standard 1.029 is the lowest that pure normal milk can ever reach: it never falls below that standard. In cases where it falls below the milk is not normal but is abnormal.

Q. Are you familiar with the literature of milk and its examination? A. I am, sir.

Q. What is the best opinion according to the best authorities, with regard to the use of the lactometer, for detecting the watering of milk?

(Objected to; objection overruled; exception.)

A. According to my opinion and the researches that I have made from the best authorities, the lactometer is recommended as a test; not of the purity of milk but of the excessive adulteration of milk.

Counsel—I move to strike that out as not responsive.

The Court—I think it is responsive; leave it in.

By Mr. Prentice—Q. You understand it approves the use of the lactometer? A. Yes, sir, I understand it.

Q. Do you consider that the thermometer is absolutely necessary to discover the fact, whether milk has been adulterated with water or not? A. "The fact," I should like in italics—to discover the fact. No sir, for this reason, that combined with the lactometer we use the senses. If there is any doubt as to the temperature of milk, it can be easily cooled, so that the senses will detect that its temperature is below 60, and when it is below 60, it is in favor of the milkmen.

Cross-examined:

Q. How do you determine the temperature without the thermometer? A. I can easily determine by my senses that the temperature of milk is or is not below 60.

Q. Can you tell it with water? A. Through the glass, no.

Q. Well, if you taste it or touch it—apply your senses to it? A. Do you say that is water?

Q. I say it came from this decanter? A. I should cool the milk a
little further down before I made the experiment. I should imagine the temperature of that was below 60.

Q. Then to determine the temperature of milk you would use your imagination, would you—would you determine the temperature of milk by your suppositions—what do you think the temperature there is? A. I said that I would cool the milk lower than that. I should judge that that was below 60; it was 48 and a half.

Q. In order to get it to a temperature which would favor milkmen you would cool that first still further, would you, if it was milk? A. Not a great deal.

Q. If you would put it at 16 degrees from the 48 you would have it at the freezing point? A. Yes, sir; when you have reached a certain standard one or two degrees makes considerable difference.

Q. At what standard does one or two degrees of temperature make considerable difference; why does it make a considerable difference there? A. Because my senses are acute enough to tell the distinction.

Q. Now why would you cool this article at 48 further in order to test it properly? A. I would like to explain.

Q. We have seen that you cannot tell the temperature of a fluid by guessing at it; are your other senses, referring only to those you would use in testing milk, more accurate than the sense which enables you to tell the temperature? A. I have never found any defect in my senses.

Q. Won't you apply another of your senses, that of sight, to the contents of this bottle?

(Showing bottle.)

A. To a chemist's preparation? no, sir.

Q. Have you any ground for assuming this to be a chemical preparation? A. The ground that you will not positively swear that it is milk.

Q. Have I been a witness in this case—this is a fresh bottle? A. What is the question?

Q. Won't you apply another of your senses, that of sight, to the contents of this bottle?

(Objected to; objection sustained; exception.)

Q. Is the sense of smell of use to you in determining whether a fluid is milk or not? A. Yes, sir, when I heat the milk.
Q. Have you made large researches concerning the milk of woman?  

A. I have.

The Court—You need not answer that; I exclude that.

Counsel—I except.

Q. Now, Doctor Mott, how many times have you analyzed milk which you knew to be pure?  

A. I have analyzed milk that I have known to be pure—you mean cow's milk?

Q. I refer now only to cow's milk, not to negro women?  

A. I have made six analyses of milk that I knew to be pure.

Q. How did you know it to be pure?  

A. My assistant stood by and saw the cows milked and brought me the milk.

Q. Did you see it milked?  

A. My assistant, whom I place perfect confidence in, saw it milked.

Q. Did you see it milked?  

A. I only saw it through the confidence I place in my assistant.

Q. Were you present when the cow was milked?  

A. No, sir.

Q. That is what you call knowledge of the purity of milk given you by your assistant?  

A. Sufficient to any sensible person, I think.

Q. Have you analyzed any milk concerning the purity of which you had any greater or further knowledge than the information given you by your assistant?  

A. I have never analyzed any milk that I have stood by and seen taken from the animal.

Q. Could you tell from the statement of your assistant that the cows from which this milk had come were healthy?  

A. My results would speak for themselves.

Q. How do they speak for themselves?  

A. If I had found one specimen of the specific gravity less than 1.029, I would safely conclude that the milk was abnormal.

Q. How often have you tested cow's milk, which you knew to be pure cow's milk, with the lactometer?  

A. Five times which I knew to be pure and at least 20 to 25 milk which I had not sufficient evidence to be pure.

Q. How did you know those five specimens to be pure?  

A. My assistant obtained them for me and stood by and saw the cows milked.

Q. That is the only knowledge you have on the subject?  

A. Yes, sir; that is all I required.
By Mr. Lawrence—Q. Did you make the test by the lactometer? A. I made the test by the lactometer which I had procured and which I had verified by first obtaining the specific gravity by an instrument, and then by weighing the milk on the scales.

Q. Did you use the thermometer in making those five tests with the lactometer? A. I did; I wished to have my results scientifically accurate.

Q. At what degree? A. At 60 degrees Fahr.

Q. Did you make any memorandum of it at the time, showing the results of that examination? A. Yes, I think I did.

Q. Have you it with you? A. I have not.

Q. When did you make those five tests, Doctor? A. I made them between December and February of last year: I made other tests since then.

Q. December of last year, and February of this year? A. Yes, sir.

Q. Among the articles that you have published on this subject did one appear in the New York Herald on the 14th February, 1876? A. It did, sir.

Q. State whether I read correctly from that article: "I have frequently met with samples of fresh cow's milk having a specific gravity between 1.029 and 1.030, but only once have I ever found the specific gravity below 1.029. The sample I refer to was milked from an Alderney cow owned by a gentleman at Nyack, which gave a specific gravity of 1.028.64 at 60 Fahr.; on analyzing this sample the milk proved richer in milk solids than any milk I have been able to find recorded," is that correct? A. That is correct, but I wish to explain; I had at that time a gentleman in my laboratory whom I requested to obtain a sample from an Alderney cow at Nyack; he obtained the sample, I tested it, believing it to be a fair average sample of that particular cow thoroughly mixed together, and I believed the cow to be in a perfectly healthy state; I afterwards found that he was not present when the sample was obtained, and could not give me any evidence that the sample was a fair average of all the milk; not knowing that the results were correct for that particular sample, but not for milk in general.

Q. The assistant who did all this, was he the same assistant who gave you the information of the purity of 5 samples? A. I did not say he was an assistant, he was a gentleman in my laboratory.
Q. Was he your assistant? A. No, sir.

Q. You did not allow me to finish my reading, shall I proceed?—

"I therefore do not hesitate to say that any milk which tests below a hundred on the instrument adopted by the Board of Health has been tampered with?" A. That is correct.

Q. What do you regard as the best test for milk? A. I regard the best test for the purity of milk chemical analysis.

Q. Is that better than the use of the lactometer? A. For the purity it has never been claimed that the lactometer would decide; the lactometer will detect the adulteration of milk by water and that is all that is claimed by the lactometer.

Q. Now, Dr. Mott, will the lactometer show the quantity of added water which milk that has been adulterated by water contains? A. It will show that the milk has added to it water.

Q. Will it show how much water has been added? A. It will show how much water has been added more accurately than by any other process; for this reason, we have amongst scientific men a standard for the specific gravity of milk, but we have not the percentage of water contained in milk.

Q. Cannot you tell more definitely by analysis how much water, added and natural, a sample of milk contains than you can by the lactometer? A. No, sir; added and contained did you say?

Q. Added and natural? A. Well the lactometer does not pretend to tell the amount of water normal to healthy milk.

Q. Will you give simply an affirmative or negative answer? A. Chemical analysis will give the amount of water in milk.

Q. Will chemical analysis show how much water has been added to milk adulterated by water? A. No, sir; because we have no standard for the percentage of water in milk.

Q. Has not a paper of Professor Chandler's giving a standard been published in several papers? A. I am not familiar with the fact that according to my researches that that standard has been accepted.

Q. Why don't you answer that, Professor Chandler has published such a standard? A. I might publish such a standard myself; I have seen such a standard published by Professor Chandler.

Q. Now, don't you think that analysis ought to be added to the
thermometrical tests, to the tests generally used by the Board of Health? A. I consider that the addition of analysis would elaborate the results, but whether analysis would benefit the determination of adulteration by water I think is unnecessary.

Q. Then you think it unnecessary to add analysis to determine adulteration by water, is that it? A. That is my opinion.

Q. I ask you if this is a correct extract from your article I have before alluded to: "But the Board of Health does not rely simply upon the lactometer; when any sample of milk has a specific gravity less than the mark 100 on their instrument, or when a sample of milk presents any appearance of being tampered with, the milk is submitted to chemical analysis"? A. That is a fact, and shows how thorough they are in proving the adulteration of milk.

Q. That is a correct extract from your article? A. That is very correct.

By Mr. Prentice—Q. Are you connected with the Board of Health? A. In no way.

Q. Have you ever been? A. Never.

HERMAN ENDEMMANN, sworn and examined by Mr. Prentice, testified as follows:

Q. You are a chemist by profession? A. Yes, sir.

Q. And have been how many years? A. I commenced, I think in 1857.

Q. You took your degree where? A. In Marburg, in Germany.

Q. And what has been your course and experience since? A. I have been for three years as instructor at the Polytechnic School in Stuttgart; I was for two years private assistant to Professor Chandler at the School of Mines, and after that I was appointed in the Health Department in 1869.

Q. You have paid attention to this milk question and made experiments and tests? A. Yes, sir.

Q. The lactometer is a kind of hydrometer? A. Yes, it is a hydrometer.

Q. And is the hydrometer an accurate instrument for determining the specific gravity of liquids? A. Yes, sir.

Q. Is there any more accurate method of determining the
specific gravity of liquids than by the use of such an instrument?  
A. No, sir, not for any practical purposes.

Q. Is the standard of 1.029 a correct standard for pure, sound milk?  
A. Yes, sir; I consider it a good one—a very good one.

Q. You are familiar with the literature on this subject, are you?  
A. I paid a little attention to it—not much.

Q. If a sample of milk offered for sale in this city at a temperature of 60 Fahr., tested by the lactometer standard of the Board of Health at 1.029 should rate at 90 on the lactometer, what would that determine in your opinion?

(Objected to; question withdrawn.)

Q. I will ask, in your opinion, is the lactometer as accurate a method as any for testing the adulteration by water of milk offered for sale in this city, when used with the thermometer at a degree of 60 Fahr., and with the observation and the use of the senses of the inspector?

(Objected to, on the ground that it calls for the expression of an opinion on the part of the witness as to the qualifications of the inspector, and as to his sense of smell, etc.; objection overruled.)

A. As far as the senses are concerned, I cannot say what the inspector is able to do, but as far as the lactometer is concerned, if the lactometer is down at 90 at a temperature of 60 Fahr., it is evident that the milk has been watered, provided it is not the milk of an individual cow, but commercial milk.

Cross-examined:

Q. Have you made an analysis of milk?  
A. Yes, sir.

Q. How many?  
A. Between two and three hundred.

Q. How long ago?  
A. About four or five years ago.

Q. Have you made any since?  
A. Yes, sir; occasionally.

Q. When did you make the last?  
A. I could not say.

Q. Have you made tests, with the lactometer, of milk?  
A. Yes, sir.

Q. Have you verified the lactometers which you used on these occasions?  
A. In every case I always made an analysis.

Q. In every test you made by the lactometer, I understand you to say, you verified by analysis?  
A. Yes, sir.
Q. Those tests which you made by the lactometer of fluid, did you know that to be milk? A. I assumed it to be milk, because of the parties from which it was bought—

Q. You had no other knowledge except assumption on your part that the article which you tested with the lactometer was milk, have you? A. It was sold as milk.

Q. Answer my question; you had no other knowledge, except assumption on your part, that the article which you tested with the lactometer was milk; yes or no? A. It was sold as milk; that is all I know about it.

Q. Was that your only knowledge on that subject? A. The analysis proved that it was milk; the reactions, and so on.

Q. Then analysis, I suppose, according to your testimony, is a better method of ascertaining whether an article is milk than by testing with the lactometer and with the senses, is it not? A. It shows better whether there is milk; but, as the vital question—

Q. Can you tell whether an article which looks like milk, tastes like milk, and to all the senses appears to be milk, which tested by the lactometer stands at 100 and the thermometer at 60, is milk? A. Not under all circumstances.

Q. Could you tell if such an article were presented to you in court whether it was milk? A. No, sir.

Q. Could you tell if an article were labeled milk whether it was milk? A. Just the same answer.

Q. Now suppose that you should find an article which looked like milk and to all the senses appeared to be milk and which answered to the lactometrical and thermometrical tests which I have described, in a grocery shop, would you assume it to be milk? A. If it was sold to me as milk, I would assume it.

Q. You would swear it was milk—would you give it as your scientific opinion that it was milk? A. Not without an examination.

By Mr. Prentice—Q. You have stated that you made two or three hundred tests with the lactometer? A. Yes, sir.

Q. Was there any instance in which the analysis did not confirm the test by the lactometer as regards the adulteration by water? (Objected to; objection overruled.) A. In all those cases where I was sure that the lactometer had
been read correctly, in all those cases where I read it myself and was sure, the analysis proved the correctness of the reading of the lactometer.

Q. They agreed, did they? A. They agreed.

By Counsel for Defendant—Q. You used analysis for the purpose of verifying what you tested with the lactometer? A. I have used analysis because I was directed to do so.

Q. That is the only reason you did it, is it? A. Yes, that is the only reason.

James C. Jepson, sworn and examined by Mr. Prentice, testified as follows:

Q. You are a member of the police force of this city and have been for a number of years? A. Yes, I am.

Q. You were for several years connected with the Sanitary Squad of Police, were you? A. Yes, sir.

Q. You were detailed for milk inspections? A. Yes, sir.

Q. And you used the lactometer given you by the Board of Health? A. Yes, sir, I did.

Q. How long? A. A little over seventeen months, nearly eighteen months.

Q. You made tests in the country as well as in the city? A. Yes, sir.

Q. How many tests did you make?
(Objected to on the ground that witness is not an expert; objection overruled; exception.)

A. Do you mean in the country or in the city.

Q. In the city first and then in the country? A. I suppose I sampled about 10,000 cans of milk in the city of New York.

Q. With what? A. The lactometer.

Q. And did you take the warmth, the degree of heat of the milk? A. Not in all cases, in a great number of cases I did.

Q. And at what degree of heat? A. At 60 as a general thing.

Q. Before you went on this duty did you have any training in the use of these instruments, and if so where? A. Nothing more than that Dr. Chandler explained the instrument to me, how to use it, how to read it.
Q. Did you make experiments with him?  A. Yes, sir.
Q. Where; at the laboratory of the School of Mines?  A. At his house.
Q. How many tests did you make in the country?  A. 109 cows.
Q. Did you see the milk taken from them?  A. In most cases I saw the cows milked myself.
Q. In any of these cows that you saw milked of the 109 did the milk fall below 100 on the lactometer?  A. The lowest milk I found by the lactometer was 102.
Q. Were those on farms that sent milk to the city?  A. They were on milk dairy farms.
Q. Have you known the defendant Daniel Schrumpf?  A. I saw the gentleman once at his place of business.
Q. You inspected his milk?  A. I did once.
Q. When was that?  A. I think it was in October, 1875.
Q. With the lactometer?  A. Yes, sir.
Q. And the thermometer?  A. No, sir; I won’t be positive about that.
Q. What did you find?
(Objected to on the ground that the defendant is on trial for a specific offence.)

Mr. Prentice—I want to show that before this time the same inspection was made at his place in the same way.

The Court—And the milk found to be watered?

Counsel—Yes, sir; if the method was shown and if he followed it and was able to——

The Court—I admit that the question may present some difficulty; you probably have not had experience enough in criminal law to see how nice a one it is; I will rule out the evidence.

Cross-examined:
Q. What is your trade?  A. Before I was on the Police?
Q. Yes, sir?  A. I am a currier by trade.
Q. You never have received a chemical education, have you?  A. No, sir.
Q. When you visited Schrumpf’s place in October, in 1875, did you have a thermometer with you?  A. I did not.
Q. You say you have sampled 10,000 cans of milk with the lactometer; to about how many of those did you apply the thermometer? A. I should judge four or five thousand.

Q. I suppose that is the last four or five thousand? A. Yes, sir.

Q. Within how long a period did you sample all this milk? A. Nearly eighteen months.

Q. Was it all pure milk? A. I should judge not.

Q. I suppose you do not know whether it was pure milk or not? A. Nothing further than what the lactometer explained.

Q. You didn’t see it milked? A. No, sir.

Q. When were you first instructed in the use of the thermometer in connection with the lactometer? A. I think it was in July, 1875.

Q. Mr. Jepson, can you state at what specific gravity the 100 mark of the lactometer you used stood? A. 1.029 by the hydrometer.

Q. Did you verify the lactometer that you used? A. I did not.

Q. Do you know this lactometer that you used to have been correct in specific gravity at any one point? A. So far as I was taught, no further.

Q. Do you know it to have been? A. Not of my own knowledge.

Q. Who did you get the lactometer from? A. Dr. Chandler.

Q. He gave it you? A. Yes, sir.

By Mr. PRENTICE—Q. The President of the Board of Health? A. Yes, sir.

COUNSEL—I move to strike out so much of this gentleman’s testimony as relates to making tests of milk by means of the lactometer; that he sampled 10,000 cans of milk by the lactometer, on the ground that he is not an expert.

The COURT—I will decline to strike that out.

COUNSEL—I except to that; I move to strike out so much of his evidence as relates to the tests of milk made by him with the lactometer that covers the country milk.

The COURT—I won’t strike that out.

COUNSEL—I except to that.
JOSEPH A. GARDNER, sworn and examined by Mr. Prentice, testified as follows:

Q. Officer Gardner, you are a member of the Police Force of this city, are you?  A. I am, sir.

Q. And you were for several years in the Sanitary Squad of Police?  A. I was.

Q. And were detailed for milk inspections?  A. Yes, sir.

Q. And were provided with the lactometer by the Board of Health?  A. I was.

Q. And you had a thermometer from the Board of Health?  A. I had, sir.

How many milk inspections did you make?
(Objected to on the ground that he is not an expert; question withdrawn.)

Q. Did you have any instruction or training in the use of the lactometer in the inspection of milk before you began that duty?  A. I did, sir.

Q. Where?  A. At Dr. Chandler's house and also at the Columbia College laboratory.

Q. Are you familiar with the inspection of milk in this city?  
(Objected to; objection overruled; exception.)

A. I am.

Q. Did you make any tests of cow's milk on dairy farms that send milk to the city?

(Same objection and exception.)

A. I did, sir.

Q. How many?  A. About 110 different cows' milk.

Q. And did you take the temperature and try them with the Board of Health lactometer?  A. I did, sir.

Q. What temperature?  A. At 60 Fahr.

Q. And did you find any cow's milk that fell below 100 on the lactometer?  A. Never.

Q. Not one?  A. Not one.

Q. Were you with the last witness?  A. He and I were together and seen the cows milked, and cooled, etc.

Q. Do you know the defendant, Daniel Schrumpf?  A. I know his place; I am familiar with his countenance.
Q. Have you inspected milk there?
(Objected to as irrelevant.)
A. I have.

Mr. Prentice—I offer to show that on two occasions this officer in his tour of duty of milk inspection—

Counsel—We submit that any statements of this kind are highly improper in a jury trial.

By Mr. Prentice—Q. Have you visited the place of the defendant and inspected his milk, and found it adulterated with water, on January 20, 1875, and again on January 25, 1876?
(Objected to; objection sustained.)

Mr. Lawrence—I ask your Honor to say to the jury that that ought not to have the slightest effect upon their minds.

The Court—I will say so.

Cross-examined:

Q. Mr. Gardner, you say you have several years' acquaintance with the business of inspecting milk; when did you begin that?
A. I began that in December, 1874.

Q. When did you finish? A. About the latter part of May, 1876.

Q. Then you have had several years' experience? A. I did not say several years.

Q. What did you say? A. The gentleman asked me if I had been several years in the police department, but not inspecting milk.

Q. These 110 cows whose milk you tested with the lactometer; did you see all those cows milked? A. I did, sir.

Q. You know it was pure milk? A. I do.

Q. Were these cows in a normal or abnormal condition? A. They were in a normal condition.

Q. What disease were they suffering from?
(Objected to.)
A. I beg pardon, I will put my answer; they were in a healthy condition.

Q. How do you know that they were? A. By the appearance of them.

Q. Did you make any examination to discover? A. I did, sir.
Q. What examination? A. I saw them all eating healthy, while they were getting milked.

Q. When did you first begin the use of the thermometer? A. I could not say positively, but I should think it was at the same time that my associate commenced.

Q. Do you recollect the case of John Kneib, whose milk you tested in the month of August, 1875, and who was tried at the Court of Special Sessions, and convicted of keeping for sale adulterated milk, whose conviction was reversed; were you present at that trial? A. I was.

Q. At that time were you familiar with the principles on which the lactometer worked? A. I was.

Q. Do you recollect that at that trial I asked you the question: "Do you know the principles upon which this lactometer operated?" and did you answer, "No, sir; nothing more than I have heard"? A. Well, I could not use it without I knew how it operated.

Q. Do you recollect that question and answer? A. I do not.

Q. Were you asked that question and did you make that answer? A. I do not know, sir.

Q. Do you recollect that in the case of Kneib, in the month of August, 1875, you made the same test to the milk standing on the sidewalk that you did to the milk standing in the ice-box, and that you used the thermometer in another case?

(Objection to as immaterial; objection sustained; exception.)

Q. In August, 1875, did you test milk without a thermometer? A. I could not say positively without I referred to my book.

FRIDAY, December 22, 1876.

JOHN R. YALE, sworn and examined by Mr. PRENTICE, testified:

Q. You are a resident of this city, Mr. Yale? A. Yes, sir.

Q. You have the sample of milk taken by you from a cow to-day, a fair average sample of the milk of that cow? A. Yes, I have.

Q. State where you got it and how you got it? A. I got it in
Bayard street, I think the second door east of Baxter on the south side, where there was one cow kept; I milked it myself.

Q. Did you milk her yourself dry? A. Very near dry; I suppose I milked her dry.

Q. Did you get out all you could? A. Yes, sir.

Q. And then did you take this sample from the milk you got? A. I did.

Q. So that it is a sample of the whole? A. Yes, sir.

Q. There were several quarts were there? A. About two and a half quarts.

Q. You took this from that? A. Yes, sir.

By the Court—Q. From the whole quantity that you milked? A. Yes, sir.

By Mr. Prentice—Q. Do you know what the cow was fed on? A. She was eating hay and meal in the tub where there had been meal.

Q. Had you been there before and told the people you were coming? A. No, sir.

Counsel—I object to this.

Mr. Prentice—My sole object is to identify the sample of milk taken from a cow in the City of New York this morning, so that we may have one instance of genuine milk actually in court to-day. I desire to make this quart of milk an exhibit.

Counsel—For what purpose?

Mr. Prentice—For such a purpose as we may offer it—simply to identify this exhibit; I desire to make a test of it.

Counsel—If they will admit that the milk which was taken at the defendant's store as they claim was city cow's milk, we have no objection to this statement.

The Court—If you propose to follow this up by other evidence as to the test of the milk I will receive it.

By Counsel—Q. All the milk you got from this cow at this milking was two quarts and a half? A. I should judge it was as much as two quarts and a half.

Q. When did you milk her do you say? A. This morning.

Q. What was the condition of the cow? A. The cow was in fair condition.
TESTIMONY OF JOSEPH T. O’CONNOR.

By the Court—Q. Did the cow appear to be healthy? A. Yes, sir.

By Mr. Lawrence—Q. How do you know she was healthy? A. She appeared to be.

JOSEPH T. O’CONNOR, sworn and examined, testified as follows:

Q. Dr. O’Connor, you are one of the Inspectors of the Board of Health, are you? A. Yes, sir.

Q. And have been for some time engaged in the inspection of milk in the city, and have also made some other tests? A. Yes, sir.

Q. There was reference upon the examination of Dr. Chandler to an instance of a cow reported among those which he had considered whose milk stood at 88 on the lactometer, and there were two cows reported at 96 and 98; did you know the condition of those cows? A. I did, sir.

Q. Healthy or unhealthy? A. They were unhealthy.

Q. Did you make this inspection of the sick cows of your own motion, or state how you made it? A. I was told that such a cow was sick. I refused to take the milk of a certain cow on the ground that it was sick, and the next day, when I was making a morning inspection to oblige the superintendent of the farm, as a matter of curiosity for him, I did take the specific gravity of that milk, and that was reported as a curiosity also, a mere matter of interest to the Board outside the regular tabulated statement of the cows.

(Objected to; objection overruled; exception.)

Q. Do you know the condition of the cow, and what was it? A. That cow I see noted to be an unhealthy cow.

Q. The one at 96? A. The one at 96; I saw but yesterday, when my attention was drawn off to something else; I could not say at this time; I cannot recollect, as it were, the picture of that cow in my memory, so that I cannot say now that I remember, but my memory is that I saw it and understood sufficiently well that it was an unhealthy cow.

Q. Did you report it as sick or healthy? A. I reported that also as a sick cow outside the tabulated statement that I made.

Q. How many samples of milk did you examine on the farms
and different dairies at different times and when? \(A\). I examined in June and July, 114 cows, duplicating the observations on some of them, so that in that time, if my impression serves me rightly, I made 133 observations; in the month of September following, I examined also 31 cows, and in addition these other cows which I have spoken of.

\(Q\). You mean the milk of the cows? \(A\). Yes, sir.

By the Court—\(Q\). When? \(A\). This present year.

\(Q\). This last year? \(A\). Yes, sir.

By Mr. Prentice—\(Q\). How were your examinations made? \(A\). They were made with the lactometer furnished me by the Board of Health, and the thermometer also furnished me by the Board of Health.

\(Q\). Did you know the lactometer to have been adjusted? \(A\). Yes, sir.

\(Q\). At what standard? \(A\). It was adjusted to the standard of 1.029 of specific gravity, equalling the 100 mark on the lactometer.

\(Q\). At what temperature was the milk? \(A\). I examined the milk in all cases at a temperature of 60 degrees, with the exception of the last place which I have stated; this statement of 31 cows where the milk, in consequence of the difficulty of not being able to get water sufficiently cold to cool it down rapidly to 60 was taken at about 62.

\(Q\). What scale, what degree did it reach in these thirty-one cows? \(A\). In these thirty-one cows it was all above 100 excepting these two cases.

\(Q\). How were the other cases? \(A\). The previous cases amounting to 133 out of the whole number I had three cases below 100 on this lactometer.

\(Q\). What month was that? \(A\). Those three cows were all in July.

\(Q\). What time in July? \(A\). The first specimen was taken, I think, upon July, the 1st or 2d, I have forgotten; I could refer to the book, if necessary.

\(Q\). What was the weather, and the pasture then? \(A\). The weather was intensely hot, and pasture was dried up or nearly so. The other two cases were taken about, if my memory serves me right, ten days later. The heat had been increasing I may say, and the pasture was of course in a much worse condition.
Q. What was the reading of these three exceptional cases?  
A. One was 96, one was 95, and one was 93.

By the Court—Q. Were these cows in pasture?  
A. They were with the regular herd; of course they were milked under my observation.

Q. Was there running water in the field?  
A. The springs had dried up, and they had to go a distance for water; but whether the water was in their own field or whether they were allowed to go out at certain times to get water, I of course could not say.

By Mr. Prentice—Q. Have you ever known the milk of a sound healthy cow, in a normal state, under normal circumstances, to fall below that rate?  
A. No, sir, I have not.

Q. Below 100 on the lactometer at this degree?  
A. Yes, sir, not below 100.

Q. Have you tabulated the tests made by all the inspectors of the Board of Health at the dairy farms of single cows?  
A. I have tabulated all the observations as published, and in addition I have tabulated a report of mine, which has not yet been published, but have not tabulated all, for the reason that four or five cows taken by Dr. White, were not in my possession at the time I made up the table.

Q. Were they city cows or country cows?  
A. I believe they were city cows; I am not in a position to know; the country cows I examined all. The average result of the observations, excluding the four cows that were found altogether, was 109.8. I beg pardon; I should say including those four cows, the average result was 109.8; excluding those four cows, the result established, the average observation, was 109.9.

Q. How many cows?  
A. Aggregate number, including the four sick cows, was 401.

Q. On all these tests of cows at the dairy farms, including the four sick cows, with the thermometer marking a temperature of 60 Fahr., the average degree upon the lactometer was 109.8?  
A. If you will allow me to make one correction which has partly been shown by what I have already said. It is substantially correct, that is to say, there were thirty-one cows in which almost all were taken at a temperature of 62, I mean the milk of cows, some a trifle over, but when the lactometer showed me a sufficient amount I certainly did
not want to bother myself. It was early in the morning, dark and all that sort of thing, I just hurried through it. In the other statements published there were some cows taken by some observers wherein the thermometer was a little lower than 60, perhaps a dozen. With that correction the statement is as you have it.

Q. Doctor, will you be good enough to take your thermometer and lactometer and tube and this exhibit of genuine cow's milk taken this morning and test this sample of milk; what is the temperature? A. It stands 108 in a temperature at 65.

Q. Is the high temperature for or against the test? A. If the milk were cooled to 60 it would stand somewhat higher, how much it is impossible to say without going through a series of experiments.

Q. Will you be good enough to pour out a part of that milk into the pail, again fill it up with water and pour out about a quart of it?

A JUROR—I want to have determined for the jury the effect of immersing the lactometer to show the number of degrees of difference, if any, that that would make; also the other question is with regard to the handling of the lactometer or hydrometer by a person who does not understand anything about the principle of the instrument.

Mr. PRENTICE—Perhaps it would be a better answer if we should take one of these gentlemen who never made an observation before. Will you be good enough to test it? (Speaking to the interpreter of the Court.)

INTERPRETER—The thermometer is 65; it went down to about 95 and now stands at 107.

Q. Now wait till it settles; read it again without wiping off? A. It now stands at 105; I never in my life made use of the lactometer before.

Q. Haven't you studied chemistry? A. I have been somewhat conversant with it about 30 years ago.

By Mr. PRENTICE—Q. Now, Dr. O'Connor, if you will take out those instruments so that it will be about one part water and three parts milk.

(Objected to.)

Mr. PRENTICE—The question was asked by a juror upon which I understand we substantially agree, namely, whether any person of
ordinary intelligence may be instructed to use the lactometer and observe its results correctly without understanding the scientific principle upon which it is made.

Mr. Lawrence—We agree that that can be done, but we suppose that if the instrument was constructed inaccurately or badly the results would mislead the person instructed.

Witness—The temperature is here, as I take it, sixty-three and a half; the temperature has gone down because some cold water has been added; we now let it come to rest; I shall read it as standing at 85.

A juror—What per cent. of added water?

Mr. Prentice—33 per cent. of added water.

Witness—It has gone down since I read it to 83; in an examination of this kind where we are looking around for so many things at once we do not have our minds directed to the business entirely.

By Mr. Lawrence—Q. Do I understand 25 or 33 per cent. was added? A. 33 per cent. of water was added, but in the mixture there is only 25 per cent. of course.

Mr. Prentice—Pour the milk back into the broad cylinder; now I wish you would take these two lactometers and put one in each vessel? This is the pure milk, that is to say it ought to be if it came from the cow; I desire you to withdraw the lactometer from each of those vessels and let the jury see whether or not there is a difference in the appearance of the milk as it runs off the lower bulb in the color and the appearance; hold it up, please, both together? (The witness did so.)

Q. Is that one of the observations that you make in examining the milk, to see the manner in which it runs off, to see the bulb? A. It is always.

Cross-examined:

Q. Dr. O'Connor, if that milk had contained an addition of but 15 per cent. of water would you still have been able to notice the difference in the color of the two fluids, the pure milk and the one containing 15 per cent. of water? A. If any one specimen of milk be adulterated with 15 per cent. of water I certainly think I could tell the difference.
Q. What would the difference in appearance be between pure milk and the sample containing the adulteration of 15 per cent. of water; how would you detect it? A. I would detect it by the difference in color; I could not tell how much, it is impossible to grade it.

Q. Would it be clearly perceptible? A. I think it would.

Q. If you can tell anything about the contents of these bottles by any examination you choose to make, I would like you to do so, and state the difference in the ingredients? A. Is one of them milk and the other watered milk 15 per cent.?

Q. That is what I want you to find out?

(Objected to unless the bottles offered by the counsel are milk.)

Mr. Lawrence—I have stated that I propose to prove what the fluid is.

Mr. Prentice—We are entirely willing that any bottles of samples of pure genuine milk should be submitted to the test.

By Mr. Lawrence—Q. In case a person of ordinary intelligence who had been sufficiently instructed in the use of the lactometer to enable him to use it properly used a lactometer which was improperly constructed or which contained mechanical defects, would not that mislead him? A. It would mislead anybody using the lactometer who did not know the defects, and only so far as those defects would mislead any one.

Q. Can a person of ordinary understanding detect whether a lactometer contains mechanical defects? A. For instance mechanical defects may be in gradation, and a small degree of difference, could not be told by a person who had not at least some acquaintance with the instrument and its uses; there are other mechanical defects, for instance the vessel in which the liquid is to be put to be tried with the lactometer should give sufficient play between its walls to allow free motion up and down; things of that kind I think could be told by a person having a certain amount of ordinary general knowledge.

Q. Does not the verification or test of the correctness of the lactometer involve a scientific process? A. It does.

Q. One of some difficulty, does it not? A. It is simply a question of the acuteness of the senses; it requires some little delicacy to calculate; that is all that I can see.

Q. Is that test one that can be applied by anybody? A. It is
applied by any one who can do those things, who happens to possess the apparatus necessary for the purpose.

Q. What apparatus does it require? A. It would require a moderately accurate balance and a good specific gravity bottle—indeed we can have any bottle, but it should be accurate in its fittings, that is all.

Q. Will you state as to the cows which you examined in the country last summer, and the examinations which were tabulated in the report published in the City Record on the 17th of August—whether those are not to a large extent the same cows that were examined by Dr. J. Blake White? A. No, sir; and to no extent; there is not a duplication there of any one of Dr. White's cows as far as I know and believe.

Q. Are you quite certain? A. I am quite certain.

Q. Did not Dr. White accompany you? A. He did, sir.

Q. But he made no report of the cows examined by you? A. No, sir.

Q. Nor you of his? A. That is it exactly.

Q. I read from your report of Dairy B, Orange county, "Alexander Thompson, Turner's Station, June 30, afternoon, July 1st, morning, 13 cows were examined;" was that correct? A. Yes, sir.

Q. I read from Dr. White's report No. 2, Farm of Alexander Thompson, Turner's Station, June 30, p. m., and July 1st, a.m., 1876, 13 cows examined? A. Yes, sir.

Q. Are not those 13 cows the same as you examined? A. No, sir; that is to say, I have of course, not being able to recognize the animals as I would men, I have to go by the designations given to the animals by the proprietor or superintendent of the farm, the grotesque and odd names that are given sometimes by the owners or by the milkers; the cows seem to have certain milkers; this enables us to separate them, and those that are duplicated in that report I recognize by the names which are given in my record book.

A. Are there any which are duplicated in those two? A. No, sir; not any; you will find some of my own duplicates in the Alexander Thompson dairy.

Q. Do I understand you correctly that 13 cows were examined by him at Alexander Thompson's dairy, and 13 by you? A. Yes,
sir; we were there together; I would pick out certain cows, and he would be off in another direction.

Q. How largely does the milk of a cow ordinarily differ in specific gravity between morning and evening? A. That I am unable to say; I have made some observations, but I am unable to adduce results; I have made some readings and from these readings I am unable to deduce results.

Q. There is a very considerable difference often, is there not? A. So it is stated.

Q. Is it not so from your own knowledge? A. I tell you that I have seen such discordant results on that point, such a difference between morning milk and night milk on the one hand, and vice versa, that I am unable to say that there is any specific general difference.

Q. In making a test of milk in this city, do you inquire first of dealers when using the lactometer whether it is morning's or evening's milk? A. I do not.

Q. Is there not a considerable difference in gravity between the first half of the milk that comes from the cow, and the last half? A. Yes, sir; so it is stated.

Q. Is it not a fact? A. It is a fact.

Q. Can you state about what difference that generally is or state within what limits it consists? A. I would not like to limit upon any such thing as that, the first and the second portion of milk; it would be impossible for me to give an answer to that question.

Q. Would you say a difference of ten degrees? A. I would not mention any number of degrees.

Q. In these examinations made by you of cattle in the country did you determine that they were healthy cattle? A. I did not determine that they were healthy cattle.

Q. What did you determine about that? A. Simply that they were healthy from external appearances—to a man who is not a veterinary surgeon apparently healthy, good-looking animals, as animals go.

Q. I suppose that is as far as they need be examined? A. I have nothing to say about that.

Q. Did you hear the testimony of Professor Silliman yesterday? A. I am not sure that I heard all of it; I know I heard part of it.

Q. Did you hear his testimony to the effect that the gravities of
milk as I read them from this report of the thirteen cows of Dairy B, Alexander Thompson, showed an abnormal condition of the cattle? A. I heard him say that.

Q. Did you not say that the three cows which yielded milk below 100 were unhealthy? A. I do not say those cows as such were in the ordinary sense of the term unhealthy or diseased cows.

Q. What was their condition? A. Their condition as I stated in my report, in a period of intense heat, and to my mind improper food, that there were unhealthy cows there, and that I held these to be unhealthy from the fact shown in my report.

Q. If these three cows had yielded milk that stood above 100 by the lactometer would you not have regarded them as healthy? A. I would not have said anything about it; my attention would not have been called to it.

Q. Was there anything about these three cows except the low specific gravity of their milk from which you could infer that they were unhealthy? A. I saw these cows only cursorily; I made no examination to detect that fact, only from my knowledge of the general influence of temperature did I make up that report in conjunction with what I had previously learned, studied, and observed as regards the milk of healthy cows.

Q. Then you won't positively swear that those three cows were unhealthy? A. I am not stating that they were in a diseased state.

Q. Did you bestow any greater examination upon the other cows than you did upon these three? A. I did, sir.

Q. Why did you except those three from the examination you gave the others? A. Which others do you mean?

Q. The other cows that you examined at this same farm? A. I saw all the cows, they were simply seen in general.

Q. You stated a moment ago you examined the other cows with more particularity? A. I alluded to other cows; I misunderstood you.

Q. Did you bestow any greater examination upon the other cows which you supposed to be healthy at this dairy than you did upon those three cows you have stigmatized as being unhealthy? A. No, sir.

Q. The cows you examined referred to in this report were of various breeds, were they not? A. Yes, sir.
Q. What breed of cattle ordinarily gives the heaviest specific gravity of milk?  
A. I can hardly say breed; I believe what are called common cows give heavier milk.

Q. From what kind of cow did the lightest milk you examined come?  
A. That I am unable to answer; simply, I have forgotten; the report will show and with that to refresh me, I will answer it.

Q. Did you examine any cows of the pure Durham breed?  
A. I examined cows that were told to me by the superintendent to be of pure Durham breed.

Q. I find in your report that one cow referred to in the dairy of Thompson, Dairy C—I am now referring to Isaac Thompson—as having been a pure Durham; is that correct?  
A. If it is in the report it is just as given to me, but whether she was pure Durham or not, I do not know.

Q. I find the specific gravity of the milk of that cow stood on July 10 at 93; is that correct?  
A. That statement is correct.

Q. You visited this place on July 1st, and again on July 10th, did you not?  
A. Yes, sir.

Q. State the difference in the condition of the cattle on the two occasions?  
A. I did not look for any differences and of course did not perceive any.

Q. Do you think from what knowledge you have on the subject of the condition of these cows that they were more likely to be unhealthy on July 10th, than on July 1st?  
A. That is a question that could not be answered by yes or no.

Q. Can you state any reason for supposing the condition of these cows on July 10th to have been different from what it was on July 1st?  
A. There might have been reasons.

Q. Can you state any?  
A. I might state reasons in both directions why they might have been worse or why they might have been better.

Q. Give us one or two?  
A. The increase of the temperature might have had its effect; some animals have gotten used to it on the one hand and on the other hand animals which on the first onset of the hot weather were not affected might have become seriously affected in the space of 10 days.

Q. At Dairy C, Isaac Thompson, I find that on July 1st the milk of cow No. 3 stood at 96?  
A. Yes, sir.
Q. On July 10th it had risen to 102? A. Yes, sir.
Q. Referring to cow No. 16 of the same dairy, I find that on July 1st it stood 100, and on July 10th it had fallen to 95? A. Yes, sir.
Q. Can you give any explanation of those two variations? A. I think my answer to the previous question covers the ground entirely.
Q. In case you should find, say half a dozen of samples of milk that you knew to be pure, which came from healthy well fed cows, and a specific gravity which was below 100 by your lactometer when properly used, would you not think that the lactometer as at present used is graduated at too high a standard? A. May I ask how large a number of cows will you suggest to be selected for this?
Q. Suppose you examined the cows at two or three dairies and found them all to be healthy and well fed as far as you could tell, and found that one-third of those cows yielded milk which, when properly tested at a proper temperature, was below 100, would not you think that the standard was lower? A. I hold it to be an impossibility.
Q. Suppose that occurred? A. I should look for evidence of disorder, of some abnormality within the cow—some condition of food or otherwise so affecting the cow as to make this change.
Q. Suppose you entirely failed to find it and found that the cow was giving this unusually low gravity of milk, what would you say? A. I would be sorry that my efforts had not been more successful to find out the cause.
Q. Do not you think that the lactometer is a very poor test to apply practically to milk in a large city for the purposes for which you applied the test? A. No, sir, I do not.
Q. Do you regard the test as you use it as being the best test for the purpose? A. The best test for the purpose.
Q. Is it the most accurate test? A. In regard to determining a quantity less than say 5 per cent. of water it is not as accurate as would be an analysis, but in determining a quantity, say more than that—I am merely giving approximate figures—it is to me just as accurate, provided that in each case we have a standard from which we start.
Q. Suppose the lactometer inserted properly at the right temperature in pure milk stands at 120, may not some 15 per cent. of
water be added to that milk without the lactometer falling below 100? A. Is the case supposed of milk standing at 120 gravity?

Q. Is it not a very common thing for milk to stand at 120? A. It is not common for me with the use of the lactometer to find milk standing at 120.

Q. Do you not very often find skimmed milk stands at 120? A. I do; not very often; I find considerable quantities of skimmed milk, but the question asked me was as I use it.

Q. Where have you made tests with the lactometer; at what place have you made tests of milk aside from tests in the country and at milk shops in the city? A. I have tested it at the laboratory of the School of Mines.

Q. Anywhere else? A. Not that I remember; I hardly get the drift of your question.

Q. How many milk inspectors are there in the Board of Health? A. Two.

Q. Are you one? A. Yes, sir.

Q. Have you never tested milk with the lactometer at the railroad depots in this city? A. Not in this city.

Q. Do you know whether your associate has?

(Objected to.)

Q. I understand you when milk stands at a high gravity, say 120, that a considerable quantity of water may be added to it without bringing it below 100, may it not? A. A certain amount of water.

Q. About how much? A. That would depend entirely upon some other conditions, on some other considerations.

Q. Do not you think the application of the lactometrical test furnishes an incentive to milkmen to add water so as not to bring it below 100?

(Objected to.)

A. I have no opinion about it.

Q. Cannot 15 per cent. of water be added to milk which, when pure, is 120 without bringing it below 100? A. It might, sir.

Q. Will analysis detect the addition of that water? A. If you would adopt a standard from which you start in your analysis.

Q. Will analysis detect the addition of that water? A. Not
without the adoption of a standard by which you can compare your analysis.

Q. Is there not in existence a standard published by Professor Chandler?  A. It is not intended for any such purpose; I do not know that Professor Chandler has set it out for that purpose.

Q. Do not you know, sir, that in pure milk the quantity of water varies between 84 and 89 per cent.?  A. I know that, and I know more than that, that it varies to the best of my knowledge within less limits than that.

Q. Are you not near enough with that knowledge to having a standard to state whether analysis would not detect the addition of 15 per cent. of water in the milk?  A. No, sir; I do not think analysis would absolutely, within those limits.

Q. That is the foundation of your views as to the lactometer being the best test, is it not?  A. That I do not think analysis would necessarily show when we have such wide limits.

Q. I understand you to say, because the quantity of water in normal milk may vary some one or three degrees, the addition of fifteen per cent. of water to the normal milk will not therefore be detected by analysis?  A. If you will allow me to make a little calculation in my head; fifteen per cent. of water would not be detected by analysis.

Q. What is the variation of water in pure milk?  A. I can give you the result of my observation and studies; I should call milk having more than eighty-eight and one-half per cent. pure water in it to a hundred parts by weight, I should say that that milk had had added water.

Q. Have you ever analyzed milk?  A. I have, several times.


Q. Within how long a time?  A. Within six months.

Q. Why did you analyze it?  A. As a matter of curiosity, and partly as a matter of duty.

Q. Had you previously tested that milk with the lactometer?  A. Some of it I had.

Q. As to that milk, did not analysis afford you a more accurate result than the lactometrical test?  A. It did; because I had a standard for analysis to go by.

Q. What standard did you go by?  A. I followed the limits as published by the British Society of Analysts.
Q. Did you not say a few moments ago that the reason why analysis would not detect the addition of fifteen per cent. of water to milk was because you had no standard to go by?  A. I followed of my own notion.

Q. Did you not state that?  A. I have no standard to go by as a legal or authenticated standard; this is a rigid arbitrary standard fixed by a board just as the Board of Health may do the same thing, and just as it is done, as it has done it in the case of the lactometer.

Redirect-examination:

Q. Doctor, how many times is milk sent from the farms to the city?  A. That is a question I am hardly competent to answer; my impression is that it is sent morning and evening; in some cases I know it to be sent once a day, and some farms I have been to send twice; farms that are near the city send twice a day, Westchester.

Q. I am talking about the general supply of the city?  A. It comes at night in the milk trains.

Q. Is the morning and evening milk mixed together?  A. Of course I do not know.

Q. What is your observation on that point?  A. My observation is not in that direction.

The case for the prosecution was closed.

The case for the defense:

Mr. Waehner: I desire first to ask your Honor to direct the jury in this case to acquit the defendant upon the ground that the indictment is defective in not charging or alleging in proper form the advertising and publishing of the Sanitary Code and its conformity by the Board of Health to the act of 1873; it also appears upon the face of the indictment that there are substantially two offences alleged without a proper separation of counts, and the further finding in the case of the second paragraph of the indictment by the Grand Jury of a distinct and separate offence that the Court cannot take judicial cognizance of the Sanitary Code of the
Board of Health; and also that the prosecution in this case has not made out a proper case to warrant a conviction; those are my grounds.

The Court—The motion is denied.

Counsel—Note an exception.

Mr. Waehner proceeded to open the case for the defendant.

Thomas C. Doremus, Jr., sworn and examined by Mr. Lawrence, testified as follows:

Q. Are you a son of Professor R. Ogden Doremus?  A. I am, sir.

Mr. Lawrence—Dr. Chandler, will you look at this bottle which you sealed on the first day of its production, and see if the seal has been tampered with?

Dr. Chandler—No, sir; it has not.

Mr. Lawrence—Is it now in the same condition that it was when you first sealed it on Tuesday?

Dr. Chandler—It is.

To Mr. Doremus—Q. Have you had practical experience in the use of the lactometer?  A. I have, sir.

Q. Can you state the contents of that bottle?  A. It is pure milk.

Q. Where did that come from?  A. It came from one of the cows on the farm of Mr. Mulford.

Q. Did you see the cow milked from which that came?  A. I did, sir.

Q. Who has had the custody of that bottle ever since the cow was milked?  A. I have.

Q. Of your own knowledge that is pure milk?  A. Yes, sir.

Q. Has that bottle been out of your possession for any length of time since it was milked?  A. Except for a few moments, when I left it in charge of Mr. Kaspir at the farm, who is in Court.

Q. When that milk was milked pure, did you test it with the lactometer?  A. I did, sir.

Q. At what degree did that pure milk stand, and at what
temperature, that is bottle No. 3?  A. It stood at 78 on the lactometer and thermometer 56 Fahr.

Q. Did you see several cows milked?  A. Yes, sir.

Q. Did you test their milk when pure with the lactometer and thermometer?  A. I did, sir.

Q. With what results; state the numbers of the cows and the results?  A. In one case the lactometer stood at 92 and the thermometer at 60 Fahr. From another cow the lactometer stood 93 and the thermometer at 59 Fahr.

Q. When did this take place?  A. Last Monday, I believe it was the 18th of this month.

Q. Look at these bottles and state whether they contain the samples of pure milk direct, and milk from the cows?  A. They do contain pure milk.

Q. State which of the bottles, if any, of those contain samples of pure milk of the cows to which you have referred?  A. They all do.

Q. You refer to only three, give us the fourth; each cow's milk is separate, I believe?  A. These are the three bottles.

Q. Bottle No. 2; what does that contain?  A. That contains pure milk.

Q. From which cow?  A. The name of the cow is Star; the lactometer stood at 92, and the thermometer at 60 Fahr.

Q. Now, bottle No. 4?  A. No. 4 is milk from a cow named Mooley; the lactometer was 93, and the thermometer 59 Fahr.

Q. I believe cow No. 1 stood considerably higher?  A. Yes, sir.

Q. Give the facts as to that?  A. The lactometer stood at 115 and the thermometer at 60 Fahr.

Q. From the time that milk came from the udder of the cow down to the present moment, has it been in your custody continually?  A. Yes, with the exception of a few minutes it was in the hands of Mr. Kaspir.

Q. Except that few minutes you have kept it day and night?  A. Yes, sir, at night under lock and seal.

Q. Has that milk been tampered with or adulterated in any way?  A. It has not, except during the few minutes it was with Mr. Kaspir.
Q. What few minutes did Mr. Kaspir have it?  
A. At the farm, after seeing some cows milked we took the samples of milk and thoroughly mixed them, and took our samples from them, and then when I went to the stable again to see the other cows milked, I left them in charge of Mr. Kaspir.

Q. Did you examine the cows from which that milk came?  
A. Yes, sir.

Q. Did they appear to be healthy animals?  
A. They appeared to be perfectly healthy.

Cross-examined:

Q. Mr. Doremus, how old are you?  
A. I am 22.

Q. Are you an assistant of Dr. Doremus in his laboratory?  
A. Not as a regular thing; sometimes in some cases.

Q. What lactometer did you use?  
A. I used the lactometer that was brought here into Court by my brother the other day; I believe that is the one behind you.

Q. It is the one you had from your brother?  
A. Yes, sir, the one that was given to me by my brother.

Q. Did you ever test that lactometer?  
A. I did not.

Q. That is the lactometer I understand? (lactometer shown).  
A. I believe that is the one—to the best of my knowledge that is the one.

Q. Who is this Mr. Mulford, whose farm you visited?  
A. He has a farm there—I never met him before.

Q. Where?  
A. A place five miles from Guymard; it is Orange County.

Q. Near what town?  
A. Guymard.

Q. Is it near any station or any railroad?  
A. It is about ten miles from Middletown—that is the station you get out at; you can go both ways—between Middletown and Port Jervis.

Q. Who accompanied you to this place?  
A. Mr. Kaspir.

Q. Who is Mr. Kaspir?  
A. I believe he is a maltster by profession.

Q. Is he a member of the Milk Dealers' Association?  
A. Not to my knowledge.

Q. Do you know whether he sold brewers' grains or food for cows to this Mr. Mulford?  
A. I do not; I think it was the first time he met him as well as myself.
Q. How came you to go to Mr. Mulford's?  A. My father requested me to go to get samples of milk.

Q. How came Kaspir to go with you?  A. To assist me.

Q. Who sent him?  A. I do not remember the name now; he is a gentleman interested in this case.

Q. One of the members of the Milk Association who sent Kaspir with you?  A. Yes, sir.

Q. And did he direct you where to go?  A. He did not; Kaspir was to go along with me to assist me and do whatever I wished.

Q. What time in the day did you go in this farm?  A. Sunday afternoon.

Q. When did you see these cows milked?  A. Monday morning about half-past eight or eight o'clock I should say.

Q. Did you know whether this cow Star, for instance, had been milked before that morning?  A. I do not.

Q. You cannot swear to that?  A. I cannot.

Q. How much milk did she give, do you know that—how much did you see taken from her?  A. I did not measure the quantity.

Q. You got that bottle full?  A. Yes, sir; that is a sample from the whole milk well mixed before taking a sample.

Q. About how much?  A. I could not tell exactly.

Q. How long were you at this farm?  A. I left there Monday morning about 10 o'clock.

Q. Had you seen this cow before?  A. Never had seen her before that morning.

Q. Do you know what feed the cow had?  A. It had been fed on hay, I saw them eating it.

Q. Do you know how she had been fed before?  A. I do not.

Q. You do not know what her food had been a week before, do you?  A. I do not.

Q. Did you see her fed on Sunday night?  A. I did not.

Q. Do you know whether this cow had ever been examined before by any one?  A. That is samples of milk taken and tested?

Q. Yes, sir?  A. Yes, sir; I believe so.

Q. By whom?  A. By my brother.

Q. When?  A. I do not remember; a month or so ago or several months ago.

By the Court—Q. Which cow was that, Star?  A. I would not
say about Star; some of these cows’ samples of milk were examined by him.

By Mr. Prentice—How many cows did you take samples from?  
A. Four.  
Q. Any more?   A. No, sir.  
Q. Did you ever take samples from cows before?   A. In this way?  
Q. Yes, sir?   A. No, sir.  
Q. Did you never test them?   A. Yes, sir.  
Q. When?   A. Probably a year ago, less than a year ago. 
Q. Is there any question about the correctness of your observation—are you sure you read it correctly?   A. Yes, sir; I am sure.  
Q. And did you take the temperature correctly?   A. Yes, sir.  
Q. You are sure that those observations were correct?   A. Provided the instrument was correct.  
Q. But your observation was correct?   A. Yes, sir.  
Q. There was no difficulty about the observation, was there?  
A. No, sir.  
Q. Who pointed out the cow Star to you to take the milk from?  
A. I saw all the cows milked and selected the samples which I wished.  
Q. You selected four cows from which you wanted the samples?  
A. Yes, sir.  
Q. How many cows were there?   Q. There were more than twelve cows there; there were only twelve cows milked that morning. 
Q. How many cows were there there?   A. I believe twenty-two.  
Q. Do you know when those were milked?   A. They had not been milked for some time, so I was told.  
Q. You do not know that I suppose about the other cows?  
A. No, sir.  
Q. What induced you to take these four particular cows?  
A. I wished to get samples of milk that stood below 100.  
Q. Then you took these four cows because you wished to get samples of milk that stood below 100?   A. Yes, sir.  
Q. You were successful in that, according to your observation?  
A. Yes, sir.  
Q. Will you be good enough, with your instrument here, to test one of those samples of milk—take that one from the cow Star, or
take this one that stood on the lactometer at 78? A. No. 3, I believe; the bottle is sealed.

Q. What cow did it come from? A. They call it the black cow; this is a milk from a cow that stood at 78 at that time.

(The witness proceeded to test the milk with the lactometer and thermometer.)

WITNESS—Stands at 82.

Q. What is the temperature? A. 56.

Q. Let me ask, are you in the habit of reading the thermometer out of the milk? A. I only lifted it up then.

Q. Is that the way you make your experiments, reading thermometer with the bulb of the lactometer out of the milk? A. I did not do so before in these cases.

Q. Take these two instruments and test the temperature and the gravity? A. It stands at 57, the temperature by Dr. Chandler's instrument.

Q. Take that lactometer? (another lactometer handed to the witness.) A. This is a little short of 82; 81 and three quarters.

Q. Did you see the cow Hetty Ann there? A. I do not remember it by that name.

Q. Won't you look at your memorandum? A. I believe not; that is I could not state positively; I only took the names of those cows from which I took the samples of milk.

Q. Did you hear anything about the cow Hetty Ann? A. I did not.

Q. Is Greenville near this place? A. I do not know.

Q. Did you see them begin to milk this cow? A. I did, sir.

Q. Did you see the pail into which the milk went? A. I did, sir.

Q. Was there any water in the pail before it was put in? A. There was not.

Q. You are sure of that? A. Yes, sir.

Q. Did you see that there was any water about the person of the milkman so that it could go in? A. No, sir.

Q. Did you see whether or not he had anything in his sleeves? A. I saw nothing in his sleeves.

Q. Did you milk the cow yourself? A. I did not.

Q. You never saw this cow milked but once? A. That is all.
Q. Was the milk of the other cows taken in this same pail?  
A. No, sir; all the samples were taken in the two pails that were taken out, and after each sample was taken, they were cleaned.

By Mr. Lawrence—Q. The lactometer with which you made these tests, did you deliver that to me in Court two or three days ago?  
A. Yes, sir; on Monday.

Q. Did you see me hand it to Dr. Waller?  
A. I did, sir.

TUESDAY, December 26, 1876.

Thomas C. Doremus, Jr., recalled by Mr. Prentice:

Q. Mr. Doremus, you testified in this case on Friday afternoon; I believe that you were the last witness before the Court adjourned?  
A. Yes, sir.

Q. You were cross-examined upon your visit to the farm of Mr. Mulford, and on certain samples of milk which you then produced; were you asked the question whether you knew the quantity of milk given by the black cow on that occasion when you took the sample?

(Objected to; objection overruled.)
A. I believe so.

Q. Did you answer that you did not know?  
A. I answered that I did not measure it.

Q. Did you answer that you did not know?  
A. I do not remember making such an answer.

Q. Did you swear on that examination that you took a fair average sample of that milk?  
A. I did; excuse me one moment; I stated, if I remember rightly, that that was a sample from the whole milk.

Q. Of that cow?  
A. Yes, sir; if I remember correctly, that was my word.

Q. Did you say any words to the effect that you did not know how much milk she gave, and that you did not measure it?  
A. I stated that I did not measure it; I remember making that statement.

Q. Did you say any words to the effect that you did not know...
how much milk that cow gave that morning? A. I think I have answered that in my last answer.

Q. I ask you yes or no if you do not remember saying that? A. I think you asked the question if I knew the quantity of milk that she gave.

Q. Very well, take it in that way; what do you say to that? A. If I remember correctly, I answered I did not measure it.

Q. Did you not say you did not know how much she gave? A. I do not remember making that answer; I think my answer was I didn't measure it.

Q. Do you know now how much she gave at that time? A. I make the same answer; I did not measure it.

Q. I ask you do you know how much milk she gave at the time you took the sample? A. I have just answered that; I did not measure the sample.

Q. How long have you been in the laboratory? A. I assisted my father for probably the last ten years in cases where life and death have been involved—poison cases.

Q. You are accustomed to nice measurements? A. I do not profess to be a chemist.

Q. Have you assisted in making experiments in measuring liquids for the last ten years? A. I have assisted him in poison cases for the last ten years.

Q. Have you assisted in mixing and measuring liquids for the purpose of experiment for the last ten years? A. When you speak of measuring, do you mean for very exact analysis?

Q. If you do not understand the question you will say so; what do you say, have you? A. It depends upon what you call measurement; some measurements are very exact; not for the last ten years in a very exact manner.

Q. Have you been assisting your father in investigations in the laboratory in making analyses and assays, and in measuring liquids in important investigations? A. I have assisted him, as I stated, for the last ten years in his poison cases where life and death has been involved.

Q. Have you any idea what a pint bottle is? A. Yes, I have.

Q. Do you know the difference between that and the quart? A. I do, sir.
Q. How long have you been acquainted with the apparent size of a pint bottle; ten years? A. I should judge so.

Q. Did you have a pint bottle with you on that occasion to take the milk of that cow as a sample? A. I had bottles of about a pint, I suppose.

Q. Was there any of that milk left when you took that milk, that you saw, of the black cow? A. I believe my brother has got the book that I refer to, with my notes in it; if you will allow me to have that.

Q. Did you take all the milk in the bottle, of that cow, which you had at that time? A. I did.

Q. It all went into that bottle? A. It did.

Q. Would that bottle hold more than a pint? A. I think if anything probably a little more.

Q. Would it hold a pint and a half? A. I think not.

Q. Did not you know how much that bottle held when you were here on Friday? A. I did, sir.

Q. Do you know the difference between the milk of cows and strippers so called?

(Objected to; objection overruled.)

A. I do not know as I could give a definition.

Q. Do you know there is a difference? A. I naturally suppose there would be, there must be.

Q. Did you know that on Friday? A. I knew as much about it then as I do now.

Q. Did you state here that that was a healthy cow, the black cow? A. As far as I could judge.

Q. In a normal condition, did you state that? A. I believe you asked me the question whether the cow was a healthy cow and I said she looked like a healthy cow, if I remember rightly; I do not profess to be a veterinary surgeon or anything of that kind.

Q. Was she a healthy cow as far as you could judge? A. She was.

Q. Was her milk the milk of a healthy cow? A. It seemed to me so.

Q. Were you able to strain it without breaking up the curds in it? A. The milk poured into the strainer and it ran through.

Q. Did it all run through? A. All except the dirt that would naturally collect in the ordinary milk.
Q. Was there any white scum or curd in it?  A. Not that I noticed.

Q. Did you see this straining done?  A. I did, sir.

Q. Did anybody put their hand in and move it around before it was strained?  A. They did not.

Q. You think now she is a healthy cow?

A. You are referring now to my visit there a week ago yesterday?

Q. I ask you now if you think she was a week ago a healthy cow?  A. The last questions you asked me were referring to my visit of a week ago Monday, I believe; you asked me the question in reference to straining which I wish to know refers to my visit of a week ago last Monday; she appeared to be a perfectly healthy cow.

Q. You think now she was a week ago a perfectly healthy cow?  A. I do as far as I could judge.

Q. Was she among the milkers or the strippers in that herd of Mr. Mulford’s?  A. I do not know if I could say what is termed a stripper or a milker.

Q. You do know at that time, that morning she gave a little over a pint, do you know that her whole milk that morning was that which you took in your sample bottle containing a little more than a pint?  A. That was all that I saw milked.

Q. Do you know how many times a day she is milked?  A. I believe twice; morning and evening.

Q. Has not Mr. Mulford told you or said in your presence that she was only milked once?  A. He stated that some of his cows—

Q. I am talking about the black cow now?  A. He has not to my knowledge stated that she was milked once; I do not remember his specifying any particular one.

Q. Did he not say that the strippers were only milked once?  A. Not to my recollection.

Q. Will you say how much milk the Mooley cow gave that morning?  A. That I do not remember now.

Q. Did she give a pint?  A. I do not remember how much she gave; I have got it marked down in my notes.
Q. Did you take the whole of her milk in your sample bottle? A. I do not remember; I have it in my notes; my brother, I believe, has got the notes.

Q. Do you know how much Fanny gave? A. I do not think the name of that cow was mentioned when I last testified.

Q. Do you know how much Star gave that morning? A. That is in my notes also; I do not remember exactly.

Q. Do you know whether you took all her milk in your sample bottle or not? A. If you will allow me to refer to my book, I will tell you; I do not remember.

Q. Will you swear that the milk of Star or the Mooley cow was either of it that morning more than a pint and a half? A. I told you I do not recollect without my notes.

Q. You do not know? A. I do not remember; my brother has my notes; if you will allow me to refer to these, I could tell you.

Q. Have you within the last week represented yourself to Mr. Mulford or have you sent a message through Mulford to any one that you were from the Board of Health and desired to see some gentleman in his house? A. I have not.

Mr. Lawrence—I move that that question and answer be stricken out as irrelevant to this case.

Q. Have you in the presence of Mr. Mulford, and of Dr. Waller, and Dr. O'Connor, and Mr. Root or any of them heard Mulford say that in counting the yield of his cows he did not count the strippers and distinguish between the strippers and the milking cows? A. I do not remember of having heard him make any such statement.

Q. Was any such remark made by any one there present to Mulford in your presence at any time, that he did not count the milk of the strippers?

(Objection to on the ground that the defendant has nothing to do with outside statements; objection sustained.)

Q. Do you know how many regular milkers there are in Mr. Mulford's herd at this time? A. I do not know what you mean by regular milkers; I saw twelve cows milked there.

Q. Have you the names of them? A. I do not recollect them; I think I have got all the names in my note book; Dr. Waller has got them all, I believe; I think I saw Dr. Waller write them all down in his book.
Q. Will you swear that there are more than four regular milkers in that herd of Mr. Mulford's?  A. I think I answered that question before; I stated I saw twelve cows milked; will you be kind enough to explain what you mean by regular milkers?

Q. No, sir; I leave it for you; you know as well as I do; if you cannot answer it say so; if you do not know the difference, my impression is you said you did a little while ago?  A. I saw twelve cows milked; I only saw them milked once, so that if I understood the fine distinctions which you wish to make——

Q. Will you swear that there are more than four regular milkers in that herd of Mr. Mulford's?  A. I do not understand in what way you want me to answer that.

Q. I would like to have you to tell the truth.  A. That is what I have been endeavoring to do.

By the Court—Q. You cannot say whether there were or not?  A. I cannot say; there were twelve cows milked.

By Mr. Prentice—Q. Did you ever see the whole of the milk of Mulford's herd in any one vessel taken together?  A. I have seen cans full of milk; I did not know them to be the whole milk or whether they were a part of the milk of several days' milk.

Q. Do you know how many times he sends milk to market?  A. I do not know whether it is once or twice a day; I do not remember.

Q. Do you not know that the whole of the milk of Mr. Mulford's herd is less than thirty-seven quarts a day?  A. I do not; I do not know how much it is; I never asked him the question.

Q. Did you see the cow Gipsy?  A. Yes, sir.

Q. Do you know whether she is a regular milker, or not?  A. I do not remember.

Q. Do you know whether the cow Charlie is a regular milker, or not?  A. I have not got my notes with me; I did not expect to be called on the stand here or I should have had them with me.

Q. Do you know whether the cow Red Heifer is a regular milker, or not?  A. I do not remember any such name; I remember a cow by the name of Red.

Q. Do you know whether she is a regular milker or not?  A. I do not.
Q. Do you know whether the cow they call the "blue cow" is a regular milker, or not? A. I do not remember.

Q. Can you tell me what proportion of the milk of either of these cows, Gipsy, Charlie, Red, or Blue, bears to the milk of Star, Mooley, or the black cow, which gives the most? A. I cannot make an answer from memory; I have got it all down in my notes; I would not like to make an answer from memory because I might be mistaken.

Q. Do you know whether or not, Mr. Mulford is to milk the cows Star, Mooley and black cow. any longer?

(Objected to; objection sustained.)

ROBERT OGDEN DOREMUS, sworn and examined by Mr. LAWRENCE, testified as follows:

Q. What is your profession, Dr. Doremus? A. I am a chemist by profession.

Q. What experience have you had as an expert in criminal cases? A. In this very building, some eighteen years ago, we had an important trial involving reputation and life. Two whole bodies were analyzed, the first and only time this was done. The earth around the grave was analyzed, the coffin was analyzed; the lining of the coffin and the nails of the coffin; the Croton water was analyzed; the glass and porcelain vessels employed were analyzed and for the first time with my able assistant, Dr. B. L. Budd, and especial care was taken that the private laboratory with every vessel new and with all the chemicals pure and many of them made pure—

Mr. PRENTICE—Is it necessary to go into this?

The Court—I suppose not; we all know how eminent a chemist Dr. Doremus is. We do not want a history of this case.

Q. Doctor, have you made the subject of milk a specialty? A. I have, sir.

Q. Have you lectured a great many times on milk? A. I have lectured upon the subject since the year 1850, in medical colleges, and am lecturing now each year upon this thing, devoting from two to three lectures each season upon it. In 1854, I think, I made an examination of what was called solidified milk. I accompanied a number of gentlemen from the Academy of Medicine to a locality
up the Hudson river, where a vast number of cows were kept and the milk was there in our presence solidified. I made a report upon the subject. Some years later I was requested by the Common Council of this city to make an examination of the milk of cattle that were kept in stables under confinement and known popularly under the name of stump-tailed cow milk. With the late Dr. Chilton of this city, I made a series of analyses and the report is now in the archives of this city. This was at the request of the Common Council. I have since that time made repeated examinations of milk both from the country, and more especially with medical students have discussed the matter of the examination of milk, for we claim that our medical graduates should be familiar with the methods of distinguishing between the milks of wet nurses as to their capacity of yielding the proper variety of milk. I also made examinations of milk in connection with this matter of the lactometer as employed by the Board of Health.

Q. Do you remember, Professor, visiting Orange County in this State, and testing milk there in September, of 1875? A. I did, sir.

Q. Will you state what you did there? A. I went with two gentlemen to a locality in Orange County, which county, as is well known, is celebrated for its fine cattle and milk as supplied to this city; I went for the especial purpose of determining the gravity of milk by the lactometer as then used by the Board of Health; I made a series of observations, and if your Honor will permit I will read from the notes taken at that time; at a locality in Orange County, up in a beautiful mountainous region celebrated for its fine pasturage, at a Mr. Mulford's, at Greenville, I obtained milk, seeing the cow milked, from a cow known as the bob-tailed cow; I cooled the milk to a temperature of 60 Fahr.; I found the gravity of that milk to be 92 degrees on the lactometer as then used by the Board of Health; another cow, known as Hetty Ann, I also saw milked; I cooled the milk, as in the previous case, to the temperature of 60 and found the lactometer of the Board of Health to stand at 90; another cow, Pikery, I saw milked, and cooled the milk to 60 and found the gravity 95; another cow, part Alderney, I saw milked and cooled the milk to 60 and found the gravity 112; another called Sukey at 104; I went to a Mr. Charles Clark and there obtained
milk, one from an Alderney cow and one from a native cow; these milks were mixed, and the gravity at 60 Fahr. was 95; I may mention incidentally at 75 Fahr., when it was first tested, it stood at 91; at another place nearer Mr. Mulford's, called Uncle Richard's, I obtained milk from a cow which at a temperature of 93, just as it was drawn, of course this is not blood heat, stood 85 on the lactometer, the same lactometer being always used, at 79 as it gradually cooled it stood at 100; at 60 it stood at 110; in the same place another cow, Indiana, at 95 Fahr., it stood at 90; the gravity when cooled to 60 it stood at 112; another cow, the belt cow, one of those peculiar varieties that have a white band around them looking as though a sheet had been wrapped around the cow, at 89 Fahr. the gravity was 108, and at 60, 106; I made an experiment with the milk of the bob-tailed cow, allowing the milk to stand over night, removing the cream; the half skimmed milk at 60 Fahr. had a gravity of 105, whereas the night previous at 60 it stood at 92; your Honor will perceive that there was a gain of 13 degrees by the lactometer; if the buoyant power of the milk is expressive of its goodness the half skimmed milk, by the lactometer, is better than the milk containing all the cream; I tested also at that place the amount of cream which would rise on allowing the milk to be placed in tubes 11 inches in length, and found that the milk from the first cow mentioned as Uncle Richard's, as it is called, which stood at 110 on the lactometer, gave seven-eighths of an inch of cream; the one called the Indiana cow, which stood at 112, one and one-eighth of cream; the belt cow, which stood at 106 on the lactometer, gave one and three-sixteenths of cream; another cow, part Alderney, which at a temperature of 60 gave a gravity of 108, yielded fifteen-sixteenths of cream the first half of the milk, while the second half of the milk of the same part Alderney cow which stood at 100 on the lactometer gave two inches of cream; the cow named Star, which stood at 103, gave eleven-sixteenths of cream; the bob-tailed cow, which stood lowest of all in this series, 92 on the lactometer at 60, gave an inch and a half of cream; plainly showing that the lactometer affords us no indication of the richness of milk in cream; I brought samples of his milks to my laboratory and submitted some of them to chemical analysis, with the following result: With the thousand-grained bottle, the gravity of milk, such as this, your
Honor, a light glass bottle provided with a glass stopper, which stopper is perforated so that we may fill it to a fraction of a drop; this at a temperature of 60 Fahr. holds a thousand grains of pure distilled water; it is known under the name of pycnometer or thousand-grained bottle; with the thousand-grained bottle the milk of this cow, the bob-tailed cow, stood at 1.026.39 on the analysis, the water proved to be 87.57, butter 4.31, caseine and sugar 7.73, the salts 0.54; the cow mentioned as Pikery, with the thousand-grained bottles, stood at 1.027.74, the water was 85.39, and the butter 6.27; I would ask your Honor to observe how large the amount of butter in this case where the lactometer was low, 6 per cent. of butter; the caseine and salts was 5.38 and the sugar 3.16; the cow called Star, where the gravity was high, 103, it stood at 1.028.24 by the thousand-grained bottle; the water 85.83, the butter 3.46, the caseine and sugar 9.62, and the salts 0.7; the skimmed milk from the bob-tailed cow contained butter to the extent of 0.512; these experiments at the farm and in my laboratory demonstrated that the lactometer accompanied by the thermometer affords not a proper indication of the value of milk, for, as you recollect, your Honor and gentlemen of the jury, when we removed the cream the lactometer rises, whereas the milk very rich in cream makes the lactometer to descend.

By the Court—Q. From your note book you said from the quantity or weight of water, as I suppose established by the analysis of one of the cow's milk, taken from one of the cows, was 87.7 or something like that? A. Yes, sir.

Q. And that means the weight of water in that cow's milk—that was the proportionate weight in the hundredth parts? A. Yes, sir.

Q. The weight in the hundred parts of milk as compared with all the other component parts of the milk? A. Yes, sir; that is to say, out of 100 grains of milk there would be that proportion of water; the residue would be the other elements.

Q. Does it follow therefore that the average specific gravity of milk as shown by experience depends more on the quantity of water it contains; the weight of water it contains, than any other element, than all the other component parts combined? A. It does not, your Honor, for the reason that on the examination of pure cream,
that is the cream taken from the top of the cream, as they would say in French, the "creme de la creme."

Q. Do you understand my question? A. Yes, sir.

Q. Usually does not the specific gravity of pure milk depend more upon the quantity of water it contains than the weight of all the other component parts? A. It does not, sir; because there are two substances in the milk lighter than milk; the one is the water to which your Honor alludes, and the other is cream; it is this cream that makes the lactometer.

Q. I do not see yet why the richness of cream, that is the value of the milk to make butter, the quantity of fat in it, and all that, is one thing, but when you come to take the specific gravity of combined elements as they come from the cow's bag, which is called pure milk, and without any analysis or test other than to show the specific gravity of the milk, does not the specific gravity of the milk depend more upon the quantity of water than all the other elements? A. If your Honor will permit me to answer as I had commenced, I think I can make it very clear to your Honor's mind. I tested the gravity of very pure cream at a creamery; I took off the top of the cream from a number of cans and placed the lactometer in it at a temperature of 60 Fahr., and the lactometer sank gradually down to 32.

Q. The lactometer showed the other day cream stood at 44? A. Yes, sir; that was not pure cream; mine was the purest cream, for it was the top of a number of cans; here say are 30 or 40 cans; I took a spoonful of the top of the cream, the lightest portion of cream, as the Irishwoman said, "Arrah, would you give the children the scum?" it is the "scum" that rises, it is that disturbing element; if the illustrious men of the Board of Health can eliminate the cream, then the lactometer is a good instrument, but with the cream it is impossible with the lactometer to tell whether milk is low from cream or low from water; I would defy any of the illustrious experts that were here the other day to demonstrate from those bottles that were so often presented, whether if the gravity was low it was due to water or cream—none of us could without analysis; the cream is light, the water is light, and there are two light bodies.

Q. If you have a given quantity of pure milk as it comes from the cow, and you add to it a considerable quantity of water, say a
pint of milk and add a gill or two gills of water—is it not more likely to decrease the specific gravity of the milk than if you had a gill or two gills of cream—which will lessen the weight of the milk more? A. Water will undoubtedly lessen the weight of the milk if the water is not brackish; cream will also do it, but 'no chemist can assert with the use of the lactometer and his senses that a sample of milk owes its low gravity to water or to cream, unless you take a very extreme case or two extreme cases, it is impossible; your Honor, this is a point; I propose to demonstrate the falsity of the instrument which has been in use; I presume that the experiments that have already been made show that the cream was light, and, that therefore milk rich in it as my analyses show, and as some of the tables I will refer to show that a milk may be light owing to its exceeding goodness and not to its badness, to its good and not to its bad qualities, to its richness in cream and not its adulteration with water.

Q. By Mr. Lawrence—Doctor, did you take notice of the condition of the cows from which you obtained the samples of milk to which you have referred, in September, 1875? A. I did, sir.

Q. State what it was, please? A. The cows appeared to be in perfect health; there were no ulcers upon their udders; there was no soreness of the feet or about the mouth; I do not profess to be a cow doctor, but I looked, of course, to see that I was examining fair samples of cows.

Q. Were any of those cows strippers and others milkers? A. They were all giving good yields of milk.

Q. Did you take especial care to see that no water found its way into that milk? A. As a matter of course going merely for the object of seeing cows milked and to cool the milk and to put the thermometer and lactometer into the milk I used precautions as an expert, and, of course, I did not put water in purposely or accidentally, or allow it to be put in purposely or accidentally.

Q. Was this rich, good milk, Doctor, you obtained? A. This, by analysis, proved to be rich, good milk; 6 per cent. of butter is considered such.

Q. You visited a creamery, did you not, while there, I believe? A. I also visited several creameries.

Q. Did you see the process of skimming milk? A. I went early
one morning by daybreak to a creamery where I saw a number of cans, say about four or five, say four feet in height, and about eight inches in diameter; they were standing in a pool of water where there was a spring to keep them cool; that was where I took the cream off, a little off each, and the operation was being conducted there of removing all the cream; this was set aside and the residue was put into large cans, and these cans were placed upon a vehicle with a couple of horses and driven off to the railroad, where it went I do not know; this is what we call half skimmed milk; if it stands twenty-four hours then it is considered wholly skimmed.

Q. Is the process of placing milk in cans and allowing the cans to stand in running water the usual manner of cooling milk? A. That is the usual manner; I have stated already that I visited several creameries and witnessed——

Q. By the Court—We are investigating the question whether the liquids found in the prisoner's possession was milk and tested by Dr. White; whether it had been watered and not how much cream it had? A. Cream makes milk lighter, but, nevertheless, if you add to the milk a very large percentage of cream you make it lighter.

Q. By Mr. Lawrence—But if you add cream to milk you may make it lighter; if you add water to milk you make it lighter; we claim there is nothing in this case to show which were added? A. May I be permitted, your Honor, to state that the milks that I had examined had by no means been watered; that they were pure milks; that I saw them taken from the cow; that I myself tested and supervised the testing of the lactometer; I am talking now of milk as it comes from healthy cows in a healthy region of country, Orange County; I went especially because we always see Orange County milk lauded in this part of the world.

Q. In the month of September last did you receive from your son, Dr. Charles A. Doremus, other samples of milk procured by him at that place? A. I did, sir.

Q. Did you, with him, test the specific gravity of milk and analyze it, and if so, will you state the results in September, 1876? A. I sent my son, Dr. Chas. A Doremus, alone to Orange County, requesting him to visit a number of dairies and to bring me samples of milk from those cows that I might test the specific gravity and an-
alyze it; on the 25th of September, 1876, he brought me the following samples: No. 6, with the thousand-grain bottle gave the gravity of 1.027.25.

Q. What was that by the lactometer? A: I presume he had better testify concerning that; he stated on analysis it yielded of water 81.06, butter 9.

Q. That was milk standing at 94? A. 1.029 is the standard of the Board of Health; 9.475 of butter, caseine and sugar 8.373, salts 0.836; No. 8, marked E, because it was the evening milk from a part Alderney cow; these were from Mr. Mulford, as he stated—1023.629, water 86.078, butter 6.099, caseine and sugar 7.058, salts 0.765; may I ask your Honor to observe in answer to your question, this by the lactometer was 85, and here we have 6 per cent. of butter; the same cow in the morning, 8 A.M., it is marked by the lactometer was 92, and by the thousand-grain bottle 1.026.75, water 87.046, butter 4.337, caseine and sugar 7.71, salts 0.896; from a native cow, No. 9, evening milk, 1.028.5, water 86.613, butter 5.557, caseine and sugar 7.097, salts 0.728; evening milk from a native cow, No. 10, lactometer 88.5, by the thousand-grain bottle 1.025.66, water 90.152, butter 2.917; here your Honor will perceive that the low gravity was due to a large amount of water; 90 parts of water, and yet this was yielding from this cow caseine and sugar 6.243, salts 0.688; No. 1, I will mark it Clark’s; he will state where he obtain-it from Mr. Clark’s—92, on the lactometer at 60, I am talking of now, gentlemen—1.026.6, water 87.646, butter 4.290; here your Honor will perceive the butter was quite high; caseine and sugar 7.337, salts 0.691; another from Clark’s 99.

By Mr. Prentice—What number do you give that, Professor, No. 2? A. This is marked No. 3, Clark’s; the pedigree of the cow and so on will be given by one competent to state, I suppose; this stood at 99, 1.028.5, water 87.552, butter 5.771.

By the Court—Do you think it is much more important for the Board of Health to secure the public against the removal of cream from milk than to secure it from being watered? I suppose you were aware the ordinance under which the second count of the indictment is drawn, not only forbids the keeping the watered milk for sale but skimmed milk for sale. This man is indicted for keeping for sale milk from which a large portion of cream had been removed.
You certainly appear to be decidedly of the opinion that it is better for the Board of Health if they cannot do both things they had better secure the public against the removal of cream, but they have done both.  

A. If your Honor will allow me, perhaps, to show to your Honor and to the jury a very simple method by which the amount of water and the amount of butter may be told in a very short time; will your Honor permit me to finish this analysis, this last one of Clark's? caseine and sugar 5.919, salts 0.758.

By Mr. Lawrence—Q. Does that conclude it?  

A. It does.

Q. Did you, on December 18, 1876, receive from your son, Thomas C. Doremus, larger samples of milk, procured on that day, about which he testified in Court on Friday?  

A. I did, sir.

Q. Will you state whether you examined those with the lactometer, and analyzed some of them, and the results?  

A. If I am permitted by your Honor I would state that I requested my son to bring some samples of milk, some of low gravity which might be shown to the Court and jury, and these were contained in the bottles that were so often presented, and which were so repeatedly refused to be tested; it was simply to show that there was milk of low gravity, and these bottles contained it; those are pure milk, but they were all scared and would not tell by the lactometer, and all the senses combined, whether it was milk or not; the first was from the blue cow, that is what it was called; I tested it with the lactometer, which has been shown in Court; at a temperature of 60 Fahr. that stood at 122; another from the cow Star, at the same temperature, stood at 97.5.

Q. The bottles were numbered, and perhaps you have the numbers in your analysis, the samples were numbered here?  

A. I have not the numbers, but I suppose my son can identify them; one called Black No. 81, another called Mooley, 99. Three of these, your Honor will observe, below 100, and one markedly above it; I was in hopes they would test this with the lactometer and the senses both, and see how they came out.

Q. Did you analyze any of those?  

A. I did not.

Q. Did you, on December 24th, last Sunday, receive from your son, Thomas C., other samples of milk?  

A. I did, sir.

Q. Did you test any of those with the lactometer?  

A. I did; late on Sunday night I received three samples, one from the cow
Fanny, which at 60 Fahr. stood at 95 on the lactometer, such as shown before the Court; another, Black, which at 60 Fahr. stood at 80 on the lactometer; and a third from a cow called Mooley; this I did not test with the lactometer. He will give his statement about it, for I believe there were other gentlemen present who witnessed the testing at the farm.

Q. Doctor, will you state within what limits the specific gravity of milk ranges by the hydrometer and lactometer? A. From my own experience the lowest is 1.023.2; another very near 1.023.5, and thus on up, the highest being 1.035.42.

By the Court—Q. You mentioned the two lowest; how many cows above it, Doctor? A. Well, sir, I think it is about forty-nine cows; all ranging from this low figure gradually up.

Q. And which is the lowest? A. The lowest was 1.023.2—that was about 80 on the lactometer.

By Mr. Prentice—Q. That is the black cow? A. Yes, sir.

By the Court—Q. Suppose this ordinance of the Board of Health instead of prohibiting in general terms the keeping for sale or selling watered milk, had prohibited the selling of cows' milk of a less specific gravity than 1.029, do you or do you not think that the enforcement of that provision of the ordinance would have tended to protect the public to some extent at least against the sale of watered milk? A. I do not; I hold that scientific men claiming that, and claiming that instrument with the use of the senses as the sole means of determining the value of milk, applying it to myself personally I would hold myself criminal in——

Q. You lose sight of my question; would it not protect the public against the selling of milk that had additional water put into it? A. I responded in the negative; I propose to demonstrate to you the reason for it.

By Mr. Lawrence—Q. Have you fully answered that question, Doctor, within what limits the specific gravity? A. I believe so.

Q. Now, sir, will you explain the lactometer to the jury if you can do so without going over any ground that has been gone over by the prosecution?

(Objected to.)

A. I will prove, your Honor, to your satisfaction, I trust, that the
knowledge gained by the lactometer is of no value; the lactometer will test the gravity of milk or any liquid approximating the gravity of milk; the lactometer tests the gravity of milk, which knowledge is of no value at all in determining the goodness of milk.

By Mr. Lawrence—Q. Professor, if you can state any important facts concerning the lactometer and its origin or uses which have not been stated please do so? A. Your Honor, we may go back three hundred years before the Christian era, when the illustrious genius Archimedes ran through the streets of Syracuse naked shouting Eureka, having discovered how he could tell how the crown of Hieron was made of pure gold mingled with silver; that is the first specific gravity discovered; he found his weight less in the water, and then his fertile brain suggested that which we now use as a means of testing gravity; we weigh the article in air, then in water and observe the difference; I merely suggest this as the origin of these things; more recently in the early part of this century an instrument was devised as applied to milk and a series of distinguished names are mentioned as having modified the instrument; it has already been described; a glass tube enlarged at the lower end with a weight at the bottom and a narrow stem at the upper part and sometimes a thermometer inserted in it.

Q. Professor Doremus, can you point out any mechanical defects in the lactometer besides those shown by Professor Chandler? A. If by the sinking of this instument an inch or a fraction of an inch we are to decide upon the commission of fraud, it should be graduated, your Honor; as you perceive this instrument, the lower grades are close together and the upper ones are widely separated.

By Mr. Prentice—Q. I would ask what that instrument is, that we may understand the evidence? A. This is a hydrometer to be used in light liquids; the gradations upon that are not equal.

Mr. Prentice—I think this is objectionable.

The Court—One is graduated for milk.

Witness—The same principle is involved; the foreign lactometers as described in the great works have a table of gradation moreover; one for skimmed milk and the other for milk which has not been robbed of its cream; they recognize the right of parties to sell skimmed milk in Paris and other places, which we do not here, and they sell it as skimmed milk and have the lactometer adapted
for that; I mention this point because if we are to depend upon the fraction of an inch to decide whether a man is guilty of a crime or not we ought to have the instrument exact; still I desire to brush away the lactometer; the Legislature will have to do that.

By the Court—Q. That is, you mean to brush it away for this purpose? A. For this use; I think your Honor will be convinced after you hear my story.

By Mr. Lawrence—Q. Will you explain the reason why the lactometer should be graduated with larger increasing spaces, with spaces becoming larger the further you proceed from the body of the instrument instead of regularly? A. To put it in very plain language—it could be put scientifically; the deeper it sinks in a fluid the more liquid it displaces, and as a consequence we need wider marks upon it to indicate equal variations; that is if I were to take the exact gravity with the thousand-grain bottle at different temperatures and then place this instrument in it, the lactometer, I would need wider spaces above than below.

By the Court—Q. Would it not be correct to say that the hydrometer or the lactometer does displace when inserted in a fluid a quantity which in weight precisely balances the weight of the hydrometer or lactometer; is not that correct? A. That is correct, but if you get an instrument costing a dollar, I defy any man ordinarily to expect that you will have accurate gradations any more than you will find thermometers hanging on the wall costing fifty cents to agree.

Q. Can you give me a rough estimate, supposing A. B. has twenty-five quarts of pure milk as it comes from the cow in a milk can, and he adds to it five quarts of pure Croton water, can you give me a rough estimate in what proportion would be about the probable gravity; how much would the gravity be diminished by adding that quantity of water to that pure milk? A. I could not nor could any chemist; you perceive, your Honor, that in consequence of the fact that I have already sworn to that some milk is very low in gravity, because of its richness in cream, it is impossible to tell.

Q. Would not the addition of that quantity of water to the quantity of pure milk diminish its gravity to an extent which could be determined with considerable safety and accuracy by the lactometer and with the aid of the senses? A. I think not.
By Mr. Lawrence—Q. The addition of that quantity of water to that quantity would diminish its gravity?    A. Yes, sir.

Q. Why would not that be sufficiently determined by the lactometer and the thermometer and the senses; what difficulty would present itself?    A. Because of milks varying in their chemical constitution.

Q. In what way?    A. Those which contain a large amount of cream will have the tendency to allow the lactometer to sink, and unless you knew the chemical constitution of each milk, you could not predict what it would be.

Q. Dr. Doremus, ought the lactometer to be correct at all points at which it is intended for use?    A. It certainly should; especially where reputation is involved.

Q. If it is the sole instrument, with the senses, to be used, is it important to use the thermometer in using the lactometer to test milk, and, if so, why?    A. Unquestionably; as when the milk is warm it expands and is lighter, and the instrument must sink to a greater depth, and when it is cold the reverse; that is patent, and has already been shown.

Q. Now, can you refer to one of these tables on that subject, I think if I direct your attention to the second, to show the importance of using the thermometer?

(Objected to.)

Q. Have you been present in Court, Professor Doremus, and heard the evidence of most of the witnesses for the prosecution?    A. I have, sir.

Q. You heard the evidence of Dr. White, did you not?    I did, sir.

Q. Now, what is your opinion of the lactometer, as used by the Board of Health in conjunction with the thermometer and the senses, as a test for the adulteration of milk by water?    A. I consider it unreliable.

Q. Why, sir?    A. I consider it unreliable; and where it, with the thermometer and the senses, is solely used to determine the value of a milk, I would hold myself——

The Court—Excuse me, Dr. Doremus, that is not the question.

By Mr. Lawrence—Q. Well, as to adulteration of milk by water?    A. It is unreliable as a means for determining the adul-
teration of milk by water, for the reason that cream will lower the lactometer as water does.

Q. Is that the whole of the answer? A. Yes, sir.

Q. Now, sir, we have heard a great deal about the use of the senses with the lactometer; is it always customary for chemists, when making any chemical tests, to use as many of the senses as are available? A. It is; we not only use the senses, but with the eyesight we employ the microscope; we employ the sense of sight not only, but that of taste; in all poison cases I invariably test by the taste the contents of the stomach and the intestines; we examine likewise by the sense of smell; thus, as in prussic acid, one of the tests is the peculiar characteristic odor of it.

Q. Dr. Doremus, are there any variations of the simple methods of testing milk? A. There are, sir.

Q. Will you explain them to the jury? A. If in a little platinum cup we place, say a dessert spoonful of milk, take its weight by an accurate balance, having previously weighed the little platina dish, warm it until all the water has evaporated, weigh it a second time, and the loss is water; pour on the residue some solvent for butter, such as ether, allow it to stand a few minutes, pour off the ether into a second weighed vessel, and repeat the treatment with ether until all the butter has been removed; you determine this by allowing a drop of ether to fall on the surface of the glass and let it evaporate; there is a greasy stain, of course, and some of the butter still remains; dry the residue, weigh it, and the loss is butter. We now know positively, your Honor, how much water and how much butter were present. That which remains in the little dish is the caseine or cheese, the milk-sugar and the salts; for many purposes this is all that is needed; but if we heat the vessel containing the residue red-hot, we burn up the cheese and the sugar; now, we weigh the residue the third time, and thus we have the salts; knowing the weight of the water and the weight of the butter, the weight of the salts, and subtracting these from the weight of the original milk, we have the cheese and the sugar. If your Honor will permit, I will make a little experiment.

Mr. LAWRENCE—We propose to show by taking a sample of milk, not a quart, not a pint, but a tablespoonful, and subjecting it to a total or partial analysis for the purpose of showing whether the
reading of the lactometer was correct, or the milk was pure or impure.

The Court—As to the quantity of water in it?

Mr. Lawrence—Yes, sir.

The Court—We cannot tell that the police regulations of Paris, or the department having control over the sales of milk think it important to protect the public by telling what amount of cream the milk contains. This ordinance does not provide for anything except ascertaining, so far as we are trying the question, except the prohibition of keeping for sale watered milk.

Mr. Lawrence—In the beginning of this case your Honor will recollect that for a long time there was a question whether the Board of Health intended to present the analysis of this particular milk. It has been admitted in this case and other cases that the Board of Health very often does take samples and make analyses; if it is necessary in one case why is it not necessary in another case?

The Court—If this can be done in a reasonable time you may go on.

Mr. Prentice—I stated, your Honor, that we should try this case on the lactometer; I said in cases of doubt we used analysis.

Dr. Doremus—I propose, your Honor, to start this experiment, and, if your Honor will permit my son to stand by and see that the heat is regulated; your Honor, and gentlemen of the jury, this is a sample of milk I obtained from an Alderney cow myself; I will place a dessert spoonful of it, mixing it carefully first, in a little platina vessel, which vessel, we will suppose, has been weighed beforehand; I would like to impress the jury as to the quantity; we use but little; here is a little milk poured in, we will suppose to have previously weighed the vessel; our platina dishes are all weighed; we have a record of their weights to show if they lost anything; we will place a spoonful in this; we will suppose it is carefully weighed; we merely warm it and let it discharge the water; we do this over a pan of water; to a second sample I add a little pure white sand; weigh the dish and then weigh the sand; here is a little pure sand thoroughly dry; to this we add another spoonful of milk.

Q. Why do you use the sand, Doctor? A. I will explain. If we wish quickly to evaporate, we employ some solid, such as sand,
sulphate of lime, or something else, because it dries more readily. In the making, your Honor, of that solidified milk that I first spoke of, in 1854, they found, in order to solidify quickly, they had to add sugar. You will perceive how much quicker the one with the sand has evaporated than the other. That merely dried it; we may dry it in many ways; this is but one of the many. I should state to the jury that it requires some little care in the weighing of the milk; it requires caution and a delicate balance, as any one could comprehend. In reference to drying the first milk, we would suppose it weighed a second time; it will have lost in weight; it cannot lose butter, it cannot lose cheese, it cannot lose sugar, nor can it lose salts by that gentle warmth; all it can lose is water. Now we have positive knowledge as soon as that is dry, of the exact amount of water; to make very exact we sometimes weigh it a second, third, or fourth time; weigh it until it loses no more weight by the application of heat. Our custom is, after we have considered it dry, to place it in a vessel where there is no moist air; just a little jar where there is some chloride of calcium; we weigh the original amount of milk; we weigh the milk when dry, and the loss is water. As soon as this is dried I think it would be interesting if the jurors would notice the time required; we do not need several days for the analysis, and if we had a dozen or twenty vessels, with a little arrangement for water, we could heat them all at the same time, and thus conduct a whole series of these, as, of course, every chemist knows. Your Honor, we will just now leave it to determine the water; after that, I will speak of the butter.

Q. Take the stand again, Doctor. You called attention to the unreliability of the lactometer because of the presence of cream in the milk; can you call attention to any other cause which leads to the same conclusion, the unreliability of the lactometer? A. I can do so. Your Honor and gentlemen of the jury will recall that I mentioned one case where we had ninety per cent and over of water, as yielded by the cow; a certain variety of cattle may give a low gravity of milk; this is proven, not only by the analysis which was made—perhaps, to refresh the memory, I had better refer to it. No. 10, a native cow, there was, your Honor, 90.152 of water; here the low gravity would be accounted for by the cow yielding milk abundant in water; containing more water than the standard that is
adopted; again, the gravity may be varied by the same cow giving at various times milks of varying qualities. I think you will be interested to learn how certain cows a year ago gave a low gravity of milk and this year gave a high gravity of milk, and some that in the latter part of September gave one gravity, in the month of December gave another gravity, depending, therefore, upon the variety of food; so that we may have normal milk that shall not only have low gravity from cream, but also from the water, and that one of the low specimens exhibited here, perhaps, will be testified on the other side as having a very low gravity not only, but rich in water, that is abounding in water, but it is natural, and that variety of milk comes to the city; the time of calving, the season of the year, as well as the variety of cattle produces a difference; then we may have the gravity of course raised artificially by a vast variety of methods; a little salt, or a little sugar, or a little starch or any other substance may raise it; I have indicated causes which may produce a low indication of the lactometer; I propose to indicate some that will tell us a high grade by the lactometer; the addition of a variety of substances, such as salt, sugar or brackish water, and a little sugar to correct the salinity of the taste, or the abstraction of the cream, which is one of the simplest, most efficient and most profitable methods, and the one most constantly performed.

Q. Now suppose that a milkman, having bought milk, adds starch or salt and sugar to it to escape detection by the lactometer, can that be done without changing the appearance, taste or smell of the milk?

(Objects to; objection sustained; exception.)

Q. In what way can watered milk be so manipulated as to deceive the senses of the milk inspector?

(Objects to; objection sustained; exception.)

Q. Now, sir, suppose an article is presented to you which looks, tastes and smells like milk of the gravity, say of 1.029, which you test by the lactometer and thermometer and which, when you remove the lactometer clings to the glass as though it was milk; can you pronounce that to be milk?

(Objects to as irrelevant; objection sustained.)

Q. Suppose, Professor Doremus, that a fluid was presented to you in a milk-can in a store, labeled milk, which looked, tasted and
smelled like milk and you tested it with the lactometer and found that it was 1.029, applied the thermometer to it and found that it was at a temperature of 60; you then withdrew the lactometer and the fluid clung to the glass when withdrawn; could you from all those tests and facts state whether that fluid was adulterated milk?

(Objected to; objection sustained; exception.)

Q. We will suppose, Dr. Doremus, that a fluid which you believe to be milk with all the accompanying circumstances embodied in my last question, could you after all those tests pronounce whether it was milk or not?

(Same objection and exception.)

Q. Can any deduction safely be drawn as to the adulteration of milk by water from the manner in which the milk runs from the lactometer when it is taken out? A. No sensible deduction can be made therefrom; I have seen samples of milk taken from the cow which ran off from the lactometer in a manner similar to that which has been described as characteristic of adulterated milk; when I say sensible deductions, I refer to deductions as to adulterations; there are cows yielding milk which produce a similar appearance on the lactometer, as to running off, as that which has been described as characteristic of adulterated milk; of course substances could be added to any milk which would simulate any appearance desirable.

Q. Chalk, I presume, would effect the clinging to the lactometer? A. Chalk or oils or a variety of substances; but I am speaking now, your Honor, of milk just as it comes from the cow; I have put the lactometer in milk just as it comes from the cow; you would say if it was purchased in an obscure part of the city that that was adulterated milk; the lactometer shows that; if your Honor desires, I can show it to you.

By the Court—Q. I understood you to answer that you cannot tell by looking at the milk as it runs off from the lactometer whether it was thick or thin? A. No, sir; I did not answer that; excuse me; I assert that the milk as it comes from the cow will produce a similar effect.

By Mr. Lawrence—Q. Did you hear the testimony of Dr. White, Dr. Doremus? A. I did, sir.
Q. Do the tests made by Dr. White in the shop of the accused, as testified to by him, show whether the fluid tested was adulterated milk?  
A. They do not.

Q. From such tests, if made by yourself, would you be willing to give it as your opinion that the fluid tested was adulterated?

(Objected to; objection sustained; exception.)

Q. If you had made the tests in this case made by Dr. White, would you have been willing to testify that the fluid tested was adulterated milk?

(Objected to; objection sustained; exception.)

Q. Now, what causes may vary the specific gravity of pure milk?

A. I have mentioned that water would make it lighter, and cream as accomplishing the same result; cheese, sugar, and salts, reversing this in fixing the gravity; the condition of the cow; the period after calving; the nature of her food, and so on.

Q. Will the pasturing on which the cows are fed vary the gravity of the milk?  
A. It will.

Q. Will the question whether the cows are or are not fed with salt vary the gravity of the milk?  
A. It will.

Q. Now, does the specific gravity of the milk usually change as it grows older?  
A. The gravity of the milk we have found by experience to change as we bring it from the country into the city, even that brief time, and after a day or so it changes again; what this is due to is obscure, though many claim that it is a peculiarity of the cheese portion of the milk, not from the loss of any one of its ingredients, but the condition of the caseine or cheese. This is a well established fact.

Q. How does this affect the lactometric test?  
A. This would cause the lactometric test at the dairy to be one thing, and at the city another.

Q. Now, what is the effect on the specific gravity of the milk of adding brackish water?

(Objected to; objection sustained; exception.)

Q. Dr. Doremus, is not the butter in the milk strictly nutritious and important?

(Objected to; objection sustained; exception.)

A. What ingredients in milk vary most in quantity?  
A. The water, caseine and butter.
Q. When the butter and caseine are removed what name is applied to what is left? A. Whey, or technically speaking, serum.

Q. Can the purity of the milk, as to adulteration by water, be better ascertained from the specific gravity of the whey than from the specific gravity of the milk?

(Objected to; objection sustained; exception.)

By the Court—Q. In answer to the question put by the counsel, you said the specific gravity of the milk changed while it was being brought from the cow and after it got here; does not that process go on successively, must it not be conceded to be a fact that the water of milk is constantly evaporating? A. If we place in a bottle the milk we obtain from a cow, and cork it up and seal it tightly, the specific gravity will vary, if after some hours we make that test as compared with that specific gravity as first indicated.

Q. Do you mean the aggregate specific gravity of the matter in the bottle or do you mean the specific gravity of certain component parts of the liquid in the bottle? A. If the lactometer is put in the milk at a certain temperature of 60, just as it has been cooled after coming from the cow, then the milk is allowed to stand perfectly quiet or moderate agitation, if you please, and in a number of hours it is again tested by the lactometer, it having been closed in such a manner that no water could evaporate, the specific gravity will alter.

Q. Do you mean lessen or increase? A. It will increase at one time and lessen in another; that is not my own authority, your Honor, but I will quote the various books that refer to that; it is a mystery that we do not comprehend; it is due to some peculiarity.

Q. Does that alter its specific gravity? A. It does change its action with the lactometer.

By Mr. Lawrence—Q. Now, Mr. Prentice, the cooking operation is completed. Witness—Your Honor, here is the milk that is mingled with sand; the one with the sand dries a little sooner than the other, as a rule, depending of course, upon the quantity; now, to see that it is thoroughly dry, we heat it a second time, and weigh it a third; as to the exact number of minutes depends upon the temperature, the current of air, the moisture, the atmosphere, etc.; this is the milk without the sand; no one can testify that that is perfectly dry, unless he uses the balance; it must be weighed and then heated
again, and weighed a second time, and weighed until it loses no weight; that, I presume, is understood, whether it takes fifteen or twenty minutes, or an hour; the method is simple; the first I showed your Honor, was the dried milk with the sand, the second one was the dried milk without the sand; the second step, gentlemen, is to dissolve it, which can be done with many substances; ether is one; I will pour a little ether on both of these, and pour the ether off, and you will remark——

Mr. Prentice—We have got beyond the test.

The Court—We will assume that ether will take out the butter; there can be no doubt about that.

By the Court—Q. Do you know the quantity daily consumed in the City of New York; do you happen to know about the average quantity of milk consumed here? A. I do not know positively.

Q. You do not know the average quantity brought here? A. No, sir; I have heard it stated; it is enormous, of course.

By Mr Lawrence—Q. If you see two or more cows milked, and each yields milk of a low gravity, may not the low gravity in one case be caused because the milk is unusually rich in cream, and may it not in another case be caused by the fact that the pure milk contains an unusual quantity of water? A. It may.

Q. Can you tell by the lactometer, the senses, the thermometer and the tests used by the Board of Health, in which milk the low gravity is produced by the presence of much cream and in which it is produced by the presence of much water? A. I cannot.

Q. Are there any means of detecting the adulteration of milk by water which can be used by persons not specially instructed, milkmen for instance? A. None to my knowledge.

Q. In making milk analysis, what quantity of milk is usually used; do you use as much as a quart ever? A. Not more than a tablespoonful.

Q. In your opinion is the lactometer when used in conjunction with the senses and the other methods of the Board of Health, a test that can be safely used by milkmen to show the purity or the impurity of milk or the adulteration by water? A. It cannot be safely used by them; it is a most erroneous guide.

Q. What is the surest method of determining whether milk is pure or impure? A. Chemical analysis.
Q. Is that more sure on the question of adulteration by water than the lactometer? A. It is.

Q. Are you familiar with the authors upon milk? A. I am, I believe.

Q. Will you name some of the best of them, or name a number of them? A. Von Baumhauer, Quevenne, Bouchardat, Hoppe-seyler, Ambrose Tardieu, one of the most distinguished savants in his department, Watts' Chemical Dictionary, Wurtz, the editor of the French Chemical Dictionary, which is not yet quite completed, Wanklyn, Hassal, Bloxam, Letheby, and many others I might mention.

Q. Are you familiar with the recent milk reports of the milk inspector of the State of Massachusetts? A. I am, sir.

Q. Are they authority on the subject? A. They are, sir.

Q. What is the opinion of the best authorities upon the subject concerning the sufficiency of the tests used by the Board of Health, to determine the adulteration of milk by water? A. They are condemmatory of the use of the lactometer with the senses solely, as a means of judging of the value of milk.

Q. Doctor, what do you mean by the word value? A. I mean as to its adulteration by water or the removal of cream, or its modification in any way in which human ingenuity may devise.

Q. You include all adulterations in the term value? A. All adulterations, and some of these authors employ the most denunciatory terms that their native languages will permit; allow me to allude to M. Tardieu.

Q. That is one of the books referred to by one of the witnesses of the prosecution, as confirmatory of the lactometer? A. It is one of the books referred to in the prosecution; I will read it in the original; speaking of the two instruments which are modifications of the lactometer, he says: "They are instruments, therefore, which instead of denouncing fraud become regulators of it."

By Mr. Prentice—Q. What page do you read from of Tardieu; have you the book before you? A. I have the translation made by the translator of the Court, page 311; this is the Dictionary of Hygiene, by Ambrose Tardieu, Paris, 1854; these instruments, your Honor, he said, are instruments which, instead of detecting fraud, as I have said before, are instruments for protecting fraud on the
largest scale; he alludes to Professor Champolion, who has given a critical resumé of this subject; he positively, not in mincing but in the most positive terms, denounces the use of this instrument.

Q. Read the extract from Hoppe-seyler? A. This is a handbook of physiological and pathological chemical analysis, third edition, Berlin, 1870, page 363; this is a translation: "Determination of the specific gravity of milk—The specific gravity of milk has often been considered as proof of the quality of milk, and is used in many places by the police authorities as a means to test the milk; the method commonly in use of testing with the areometer is objectionable; the careful determination of specific gravity by the picnometer can give no certain evidence whether it (milk) is good or bad; it is true that if milk appears blue, transparent and shows with the areometer a low specific gravity, then the milk is thin and bad, but a blue transparent milk with a high specific gravity is perhaps not better; the blue transparent appearance is therefore more important for the test than the specific gravity; richness in butter lowers, and richness in caseine and sugar raises the specific gravity of the milk, because the determination with all instruments which have to be immersed is not to be made use of; the picnometer, that is the little thousand-grain bottle has to be used for this purpose; before filling it, as a matter of course, the milk to be tested must be well shaken and airy bubbles are to be carefully avoided; it might be believed that the areometer would show the specific gravity of the milk serum, but it is not the case; the areometer shows often a lower specific gravity than the picnometer."

By the Court—Q. Is there anything there condemning the use of the lactometer for the purpose of ascertaining the specific gravity of milk—is there anything to show that the lactometer will not ascertain the specific gravity of milk?

Mr. Lawrence—We will admit that a good lactometer will tell the specific gravity.

A. I stated at the outset I admit that, but that that knowledge was of no use to us.

Q. "Milk Analysis, by J. R. Alfred Wanklyn, M. R. C. S."; is that a standard authority upon the subject on which it treats? A. It is.
Q. Is the milk of the lower animals or of some of them of much heavier specific gravity than that of the cow?

(Objects to; objection sustained; exception.)

Q. Doctor Doremus, on which side of this question are the greatest number of authorities, the question as to the sufficiency of the lactometer to test the adulteration of milk by water, as to the lactometer being a sufficient test for the adulteration of milk by water, on which side of that question are the most authorities?  A. They are antagonistic to it and some of them, as I have stated, express, in the most vigorous terms that their language is capable of allowing, their opposition to its use, in the manner which has been described.

By the Court—Q. Do they express opposition to the use of the lactometer for the purpose of ascertaining the specific gravity?  A. To its sole use?

Q. For the purpose of obtaining that simple fact?  A. No, sir; I misunderstood you—that is the adulteration of milk.

Cross-examined by Mr. Prentice:

Q. Doctor, you have mentioned the most important authorities which give the view that you have just expressed concerning the determination—concerning the specific gravity of milk, have you not?  A. I have mentioned a few.

Q. Have you mentioned the most important, or have you left the most important unmentioned?  A. I think I mentioned some of the most important.

Q. Are there any as important as those that you have mentioned?  A. There are many others; I gave a list which I was excluded from reading.

Q. I will ask you, Dr. Doremus, are the reports of Doctor Voelcker, the chemist of the Royal Agricultural Society of England, upon the examination of milk, its supply and adulteration, authorities on this question?  A. They are, sir.

Q. Has Doctor Voelcker in a paper published in the year 1875, in England, expressed this opinion, that "a great many experiments have led me to the conclusion that within certain limits specific gravity is the most trustworthy indicator of quality?"  A. He has;
I would ask your Honor's attention to the phrase "certain limits," and I will ask also to introduce some other remarks by the same authority, Voelcker.

Q. I will ask you, in this book by Tardieu in the edition subsequent to that from which I understand you quoted—which was the edition of 1854? A. I believe it was.

Q. In the edition of 1862, do you find this sentence as translated: "In one word the frauds marked by the lacto-densimeter are certain, but it is far from indicating all the frauds and it is not susceptible of general application;" now sir, will you be good enough to read that passage? A. There is nothing remarkable about that; I accept it as you read it; that is so, it is stated here.

Q. I will ask you has there been a late treatise on the subject of milk by Charles Marchand, the son of Professor Marchand, who is mentioned in the book of Quevenne, which you have cited? A. There has.

Q. He is an authority? A. He is, sir.

Q. And will you see if he has stated on page 97, of this book, this: "And every time that we shall meet milk whose density shall be lower than 1.030 at the temperature of 15 degrees Centigrade, and which shall contain less than 30 gr. of butter and 50 gr. of lactine, we shall affirm with certainty and without fear, that the milk is falsified"? A. I should claim the right to read all the books I referred to; I will show half a dozen of strong antagonistic authorities in favor of one the others will offer to sustain that.

Q. Dr. Doremus will you tell me how, by analysis, you determine the amount of adulteration by water, or in other words the amount of added water? A. I will, sir; I would add to the milk rennet.

Q. I will not ask the method; what shall be the determination of it?

(Objected to; objection sustained.)

Q. Dr. Doremus, will you tell me if you determine the amount of water added to milk in testing its specific gravity, or whether you simply determine the amount of water in the milk which you test? A. Simply the amount of water present in the milk; by that method it is impossible to tell whether it has been there or not.

Q. By which method? A. By the method you refer to, specific
gravity, but I was about describing a method by which it could be determined.

Q. Is there any normal standard of milk as to the percentage of water it should contain? A. I give it up; I leave that, your Honor, to the Board of Health to regulate; I have no standard.

Q. You have no standard? A. I have no standard.

Q. If there is no standard how can you tell if water has been added to it? A. I can tell that, but as to the standard of what the specific gravity of milk shall be, is another question.

Q. I did not ask that. A. I understood you so.

Q. Can you tell what is the standard of water in milk? (Objected to.)

Q. Can you tell me the percentage of water in milk? A. It varies with the different authors; and different chemists have different standards; and the Board of Health have adopted a different standard; I do not profess to say what shall be the standard.

By the Court—Q. The question is, what is the average percentage of water found in milk? A. I can state in answer to this what I have found, but I won't state that as a standard, by any means.

By Mr. Prentice—Q. Is there any such thing as an average percentage of water in milk? A. There is an average percentage differing with different chemists; some claim one and some another.

Q. Is there any agreement upon it at all? A. There is none.

Q. Within what limits does it range? A. Well, sir, from perhaps 80 to 90 per cent., or a little over; I could refer your Honor to various authorities; some put the lowest gravity down to 1.026 and others again to 1.028, others at 1.030, others at an average of 1.029 and a half, others 1.030, others 1.028; I could give you half a dozen of authorities; there is no fixed standard.

Q. I understood you to say, that you could determine the amount of water added to the milk in adulteration by a process of your own? A. Yes, sir.

Q. If there is no fixed standard of the percentage of water in milk, how can you distinguish between that which is added and that which belongs to the milk? A. There is in the serum of the milk an average standard; it ranges from a certain point to a certain point.

Q. Does not the gravity of the serum vary with the amount of
sugar, and does not that vary in different milks? A. The amount of sugar is one of the most uniform of all the constituents of milk.

Q. Does it not range from 2 to 6 per cent? A. This chart expresses it, yes, sir—2.8.

Q. It varies from 2.8 to what? A. Up to 6, that is according to this series of tables taken from Wurtz' Dictionary of Chemistry, the last edition; the work is still incomplete; yonder chart will give you the specific gravity of the serum.

Q. Do I understand then that the maximum that that table presents is the percentage of 6 of sugar?

(Objected to.)

A. Yes, sir.

Q. Did you hear the citations read from Wanklyn, upon the examination of witnesses for the prosecution as to the necessity of fixing a standard for milk? A. Well, I believe I heard them read, but I did not pay particular attention to them, for that author gives such sweeping denunciations of the lactometer, that I was surprised to hear any reference made to it.

Q. Have you found this in reading Wanklyn, "In dealing with milk supply on a large scale, we are little concerned with the possibility of single animals giving abnormal milk, and need only concern ourselves with milk of normal quality, all departures from the standard being looked upon as sophistications." A. I heard that.

Q. Do you agree with him or not? A. I agree with him.

Q. You do agree with him? A. Yes, sir; this is the work, your Honor, in which it says, "From a careful consideration of the whole subject, I am convinced that one of the most necessary steps to be taken in milk analysis is to abandon the use of the lactometer."

Q. Are you familiar with this Dictionary of Hygiene, by Professors Tardieu and Blythe? A. I know of it.

Q. I suppose one of the works referred to by you? A. No, sir; I referred to another one of Tardieu.

By the Court—Q. You have said that the percentage in pure milk of water as distinguished from the other constituents of milk, ranged from 80 to 90; now that being, so far as you have stated, the range of quantity, is not the specific gravity of a given specimen
of pure milk from the cow more likely to depend upon the quantity of water in the milk than upon the weight of all the other constituents of the milk or not? A. Your Honor, I consider that the cream balances the water, for the reason that as I have shown some of the lowest gravity of milks exhibit the cause of their low gravity by their abundance of cream, not water.

Q. Is it not more likely—could you ascertain by the lactometer the specific gravity of a certain given quantity of milk; it is conceded that if that is properly graduated, it ascertains that fact without making any further analysis or investigation as to the relative weights of the different constituents of milk; is not the specific gravity of that milk more likely to depend upon the weight of the water it contains, than the weight of all the other constituents of the milk, the weight of the water as shown by experience being much greater? A. I think that the most that can be said, if you omit the cream relationship that I speak of, is that it is merely suspicious and only warrants one to make a further examination such as the law in Paris requires, that if the lactometer is very low, then be cautious to take a sample and submit it to a chemist for an examination.

By Mr. Prentice—Q. This is an instrument that you have testified to before as used for what purpose? A. For testing the gravity of alcohol.

Q. What do you call it? A. An alcoholometer.

Q. How much greater is the range of scale on this instrument than on the lactometer? A. Well, sir, it passes from the gravity of water to the gravity of pure alcohol.

Q. In degrees, how much greater is the range of this scale than that? A. It is apparent to the eye; it is nearly twice the length.

Q. I am not talking about the measure, I am talking of the number of degrees; if the degrees on this instrument were as long as the degrees of that instrument, would not this instrument be very much longer? A. It would be longer, but the principle would be the same.

Q. Would it be over 6 feet longer? A. No, sir, I do not think it would.

Q. It would be very much longer than this? A. It would be
longer than this; they are all on the same principle; they are areometers; if it is a heavy liquid—

Q. Are you able to swear that there is no difference; are you able to say positively that there is not a difference upon the scale of degrees upon this lactometer?  A. I doubt if I could; I have not observed it critically.

Q. Is it not stated that the smaller intervals on the hydrometer’s scale may always be subdivided into equal parts by estimation or otherwise, without appreciable error; is not that the rule laid down?  A. I know in Watts’ Dictionary very distinctly that a full page is devoted to the correction of these irregularities in the measurements of instruments giving figures as to how much wider they should be.

Q. How many specimens of milk of cows did you take for examination of those which you have testified about in Orange county?  A. Of those that I first spoke of?

Q. How many were there?  A. I believe about a dozen.

Q. And were there more than five of those that fell below the standard?  A. No, sir.

Q. Only five?  A. No, sir.

Q. And that lowest one that you have testified to to-day was the milk of the black cow?  A. That was not obtained by myself personally.

Q. But the one you have mentioned?  A. As low gravity, simply?

Q. That was the black cow, was it?  A. It was.

Q. How came you to go to Orange county?  A. I was asked by Mr. Lawrence if I would make an examination.

Q. That is the counsel in this case?  A. The counsel in this case.

Q. And have you been for several years employed by the milk association?  A. I have not, sir; at the time I went I was not aware that there was a milk association in New York.

Q. Who went with you?  A. Two gentlemen, one Mr. Pond, an American gentleman, a most original character, and another, Mr. Schaffer, whom I have since learned was president of the milk association, which I was not aware of at the time.

Q. Did Mr. Pond belong to the milk association?  A. Not to my knowledge; it is an association, I believe, of Germans.
Q. The experiments that you mentioned as having been made there, were they made in open vessels? A. They were, sir.

Q. Were there not three gentlemen, Messrs. Pond, Knauer, and Schaffer? A. I think there were but two of them; my printed testimony would tell.

Q. These experiments of cooling the milk were made in open vessels? A. They were, sir, under my personal supervision.

Q. Can you tell me how much milk the bob-tailed cow gave? A. I do not know whether I can or not; I will look, but all the cows were giving pretty liberally at that time; it was a favorable season of the year; that is my impression; I will see if I have a record of it; I have a record of the amount.

Q. Have you a record of the amount of any of the other cows? A. I think I have not; I would like to add to that that they were all giving their milk liberally; it was not strippings of cows dried up.

Q. You are the Dr. Doremus who testified in the case of Kneib? A. I am, sir.

Q. Do you know there was a trial subsequent to that, the case of Joechter? A. I do not; I know there have been a number of trials, but I never heard of that case before.

Q. Do you know there was a case tried subsequent to the case of Kneib in which experts testified as to the lactometer?

(Objected to.)

Q. In the trial of the Kneib case did you give this testimony on page 37, in answer to the question, "Then you regard distillery waste in a state of fermentation as a nutritious article of diet for cows?" "I know it to be a wholesome article of diet." Did you answer that in that way on that trial?

(Objected to; objection sustained.)

Q. Have you at any time stated that you believe distillery swill to be a nutritious and wholesome article of diet for cows?

(Objected to; objection sustained.)

Q. Have you not recommended as food for cows the use of distillery slops and waste?

(Objected to.)

Q. Are you the Dr. Doremus mentioned in this article: "A meeting of the Milk Dealers' Association was held last evening at 98
Allen street. Henry Schaffer said that a decision was necessary as to what action should be taken with reference to the recent arrests of milk dealers by order of the Board of Health; he claimed that Professor Chandler was in error when he attributed to the lactometer any power to test the quality of milk, and said in his opinion he was sustained by Professor Doremus; it was impossible to arrive at any decision except by a thorough analysis, for the most impure swill milk often showed a higher degree of specific gravity than pure milk; a letter from Professor Doremus was read as follows: 'Let me suggest that if your society intends to fight the lactometer this fall, you should now visit the part of Orange county that we were at a year ago, to collect additional evidence by testing the milk of cows in that region; at this season of the year milk of very low gravity can be obtained; a few weeks later it may not be so readily got?'

(Objection to; objection sustained.)

Q. Have you not been lecturing and talking against the lactometer?  A. I have always talked against the lactometer, and believe it to be one of the great causes of fraud in our city. It is worthy of the talent of Herod.

Q. You have been present at this trial during all the days, have you not?  A. Not entirely; a good part of them.

Q. Did you hear the evidence of the expert witnesses for the prosecution?  A. Most of them; I did not hear those few towards the last.

Q. Do you agree or disagree with them, as to the use of the lactometer; how is that?  A. As regards the use of the lactometer?

Q. Yes, sir.  A. With all the senses?

Q. Yes, sir.  A. I disagree with them most markedly.

By the Court—Q. But you do agree with them so far as they stated the lactometer properly constructed and graduated would determine the specific gravity of the fluid in which it was inserted, the milk?  A. I do, sir, but I also stated that that knowledge was of no use.
Wednesday, December 27, 1876.

Mr. Prentice read by stipulation the evidence of Prof. Geo. F. Barker, taken in the case of John Joechter, tried Feb. 2, 1876.

George F. Barker, sworn:

Q. You are a professor at Yale College? A. I am not now.

Q. You were? A. Yes, sir, I was.

Q. What was your chair, and what is your present position? A. I had the chair of physiological chemistry, and I am now professor of physics in the University of Pennsylvania.

Q. What has been your professional experience? A. My profession at Yale college was chemistry, and at Albany, doctor of medicine. Since 1861, I have been a professor of chemistry up to three years ago in various institutions. Three years ago I moved to Pennsylvania, and took the chair of physics. My business of course has been instruction.

Q. Has the subject of pure cow's milk, and the method of testing it, been under your inspection? A. Yes, sir, it has occupied my attention in discharging the duties of my chair, and the investigations I have made with a view to instruct my classes.

Q. Have you lectured on the subject of milk? A. I have.

Q. And the literature upon the subject, the standard works, you are acquainted with them? A. Yes, sir.

Q. You have heard the evidence of President Morton? A. Yes, sir.

Q. And the lactometer, you consider it to be a hydrometer? A. Yes, sir.

Q. How is it as giving the test of the specific gravity of liquids? A. It is a floating body, and a floating body floats in virtue of the principle that a floating body thrown into a liquid will sink, until it displaces its own weight of that liquid; if the liquid be heavier than water it will not have to sink as far; the hydrometer is the generic name of all instruments used for floatation; the lactometer is used for testing milk.

Q. How do you determine the specific gravity of pure cow's milk? A. By the lactometer.
Q. Now, a lactometer graduated upon the scale of 1.029, as a test for the specific gravity of pure cow's milk, what is your opinion in relation to that?  A. My opinion is that any form of the hydrometer may be as accurate as any other instrument, and the lactometer is no exception.

Q. Now take it at the graduation of 1.029, now, sir, I ask that as the scale for the testing of the specific gravity of pure milk, the scale of 1.029—what is your opinion as to its reliability, or the propriety of that grade? A. As I understand the question, it is in reference to this instrument; I cannot tell by inspection what this instrument is graduated for; each instrument must be tested by itself.

Q. Now, sir, what would in your opinion be a proper standard for a lactometer to test pure milk?

(Question objected to by the defense; overruled; exception.)

A. The specific gravity of 1.029, in my opinion, would be a correct figure of the minimum for the correct gravity of milk.

Q. Do you know what the standard of the Board of Health is in its lactometer? A. Not of my own knowledge.

Q. Can it be pure milk, which has not been manipulated in some way, if it stands below 100 degrees? A. No, sir.

Q. In experimenting upon milk, do the conditions under which the experiment is made have any effect upon determining the accuracy of the experiment? A. They do.

Q. If milk should be found at a temperature of 60 degrees Fahr. to stand at 88 degrees on a lactometer graduated to the scale of 1.029, what would that prove as to the gravity of the milk? A. It would prove that some lighter substance had been mixed with it.

Q. Which is the lighter, water or milk? A. Water.

Q. Would milk tested under such conditions standing lower than 88 degrees be pure milk?

(Question objected to by the defense; overruled; exception.)

A. No, sir; it would not.

Q. If the milk which is tested has been cooled in an open pan in water and not cooled by yourself, would you consider that to be a safe condition in determining the accuracy of the instrument which you were using? A. My confidence in the result would depend entirely upon the confidence I had in the person making
the experiment; if I made the experiment alone, entirely without any outside interference, I would consider it reliable.

(Question repeated.)
A. I should not consider it safe.

Cross-examined:

Q. How many methods are there, Doctor, of ascertaining the purity of milk? A. I really do not know.

Q. Is there any more certain method of testing the purity of milk than by the lactometer, which I understand you to say is only a test of its gravity? A. Yes, sir; as to quality.

Q. What is it? A. The shortest method is analysis.

Q. That is the shortest method of determining whether or not milk is pure? A. Yes, sir.

Q. Then if you were to take, Doctor, a sample of milk and were requested to determine whether it was pure milk, the surest method of ascertaining whether it was pure milk would be by making analysis? A. Yes, sir; with the same restrictions as before.

Q. The lactometer is simply a test of the gravity of the milk? A. Yes, sir; that is all.

Q. And the surest method of ascertaining whether milk is adulterated or not is to make an analysis of it? A. Yes, sir.

Re-direct:

Q. In determining the adulteration of milk by water is the analysis any more certain method of detection of impurity of this kind without reference to the degree of impurity, than the lactometer? A. It would not.

Q. The lactometer is just as sure a test of adulteration by water as the analysis? A. It is.

Re-cross:

Q. If milk is adulterated with water it of course lessens its gravity? A. Yes, sir.

Q. Then a lactometer when inserted would simply indicate what the gravity of the milk was, and indicate that it was watered? A. Yes, sir.
Q. If it fell below a certain degree?  A. Yes, sir.

Q. Then take a case of absolutely pure milk from a well fed healthy cow and a test is made with the lactometer; doesn't it show a less degree of gravity than in a case of skimmed milk?

(Question objected to by the prosecution; overruled by the Court; exception taken.)

A. It does.

Q. Then in a case of skimmed milk where the lactometer would show a higher degree than in a case of absolutely pure milk, if you desire to ascertain whether the skimmed milk was adulterated it would be necessary for you to make an analysis, wouldn't it, as a sure test?  A. I should say not.

Q. Then do I understand you to testify that the lactometer when inserted in skimmed milk, would be a sufficient indication to your mind, if it showed a certain gravity, that the milk was adulterated, simply by the test of the lactometer?

(Question objected to by the prosecution; overruled; exception taken.)

A. The fact that the lactometer stands higher than in pure milk would be proof positive to my mind that the pure milk has been adulterated by water to make it skimmed milk.

Q. Aren't there certain substances, which if put into skimmed milk, would make it show higher on the lactometer?  A. Yes, sir.

Q. Skimmed milk will show higher than pure milk?  A. Yes, sir.

Q. It does show higher than pure milk?  A. Yes, sir.

HENRY W. VAUGHAN, sworn and examined by Mr. WAEHNER:

Q. What is your profession?  A. State Assayer of Rhode Island and Analytical and Consulting Chemist of the City of Providence and City Inspector of Milk of the State.

Q. Have you made the subject of milk a special study, and have
you made practical experiments for some time past?  

A. Yes, sir; I have.

Q. How long?  

A. I have held the position of City Inspector of Milk, I think, five years; during that time I have constantly been analyzing and examining milk and making milk a subject of investigation, and before that time I analyzed milk for Doctor Wiggins, who was then the Inspector.

Q. Have you made tests of milk with the lactometer?  

A. Yes, sir; I have.

Q. Frequently?  

A. Yes, sir.

Q. Have you found pure milk standing below 1.029 to your own knowledge?  

A. Yes, sir.

Q. Many instances?  

A. Yes, sir; a good many.

Q. Did you have any evidence that the condition of the cows was healthy from which such milk came?  

A. I believed them to be so; they were from the farm of Governor Sprague, a choice selection of cattle.

Q. Will you state what the practice in Providence and in the State of Rhode Island is, as practiced by you, of testing milk?

(Objected to.)

Counsel—We desire to show that the evidence of the lactometer is not received in the State of Rhode Island; that it is not regarded as a test, and we bring here an experienced witness, the Inspector of Milk of the City of Providence, to demonstrate that the instrument is an unreliable instrument.

The Court—I exclude the evidence upon the ground that I remarked yesterday generally that it is irrelevant to the issue.

Counsel—We except to the ruling of the Court.

Q. Now, sir, from the evidence of the senses in conjunction with the lactometer and thermometer would you give it as your opinion that an article was adulterated milk with water or not?  

A. I would not swear that it was milk by testing it with the lactometer; I could not tell whether it was milk or not.

Q. I am putting it in conjunction with your senses, whether you would say, from the evidence of your senses coupled with the lactometer—whether you would say it was adulterated with water or not?  

A. No, sir; I do not think you could swear to it; you would surmise that such was the case; I do not think the report could be
given from the lactometer and the senses in regard to whether it was adulterated milk or not.

Q. Is there any method of ascertaining with accuracy whether or not milk is adulterated with water, that you know of? A. The answer is, practically, yes, sir.

Q. What is that method? A. By chemical analysis.

Q. Any other method that you know of? A. No accurate method.

By the COURT—Q. If by that kind of hydrometer called the lactometer, properly graduated and properly used, used with care for the testing of milk, if you inserted it into a liquid looking like milk and tasting like milk, and the hydrometer should mark 75 specific gravity, indicated on the graduated scale of the lactometer 25 degrees below 100, could you not by examining it with the eye and taste and touch and by the senses generally, could not you determine whether the milk was watered or not, could you pass any opinion upon it? A. May I ask one of the scientific gentlemen present, would the degree of 75 correspond to the true specific gravity; there are different lactometers in different cities?

Q. It appears by all the evidence, bearing on the point in the case, that the lactometer which was used in the case we are investigating here on this trial was absolutely correct—there is no contradictory evidence on that point—at 100 on a graduated scale; by absolutely correct is meant as showing the specific gravity at 1.029; I believe 75 was another point. A. Now, I will answer your question.

Q. My question is assuming that the lactometer showed a specific gravity of 1.021? A. The general inference would be, that such milk was adulterated by water or some lighter substance than the milk, if it were normal to start with.

By Mr. PRENTICE—Q. What other substances, Doctor, than water could it be adulterated with, milk? A. It could be adulterated with alcohol; practically water would be an adulterant; it is naturally the cheapest fluid to add to it.

Q. Well, how much cream would it take to reduce to that point? A. To reduce it to 1.021?

Q. Yes, sir; 8 degrees. A. I cannot give you the figures; it
would take an enormous amount of cream, a large amount of cream to bring it to 1.021.

By a Juror—Q. If so much was added could that be detected by the eye; could any one tell that was accustomed to look at milk? A. Cream naturally looks rich and yellow.

Q. Could an inspector of milk? A. I see a large amount of milk daily, and I become more or less accustomed to its appearance; I can judge more or less accurately as to its adulteration; we use the smaller cans in Rhode Island, the ten-quart cans; I go out in the morning with the officer who is appointed to accompany me; he pours from one can of milk to another, and if I think that is too high in color brown sugar has been added.

By the Court—Q. Does not the water of normal milk, ordinary pure cow's milk, the water which has entered into its composition and which is secreted by the secretions of the cow, weigh a great deal more than all the other constituents of the milk put together? A. Yes, sir.

Q. Is not the proportion something like this—87 or 88 to 12 or 13? A. Yes, sir.

Q. Assuming that the weight of water in normal average pure milk is 87 or 88, now when you find a specimen of milk which is of the specific gravity of 75, is it not a fair conclusion that that has come from water or something lighter that has made it, which was put into the milk? A. Yes, sir; either an excess of water or an excess of some lighter fluid, water probably.

Q. Is not the extraordinarily diminished gravity from a standard more likely to depend on the quantity of water that the specimen contains than the quantity of anything else? A. Cream and water would have the same effect in reducing its specific gravity.

By Mr. Prentice—Q. I understood you to say that cream could be distinguished by one accustomed to observe it? A. Yes; unless they resort to a method which is frequently practiced down east of adding burnt sugar to the milk to give it that yellow appearance which cream ordinarily has.

Q. Would the consistency be any different then? A. I beg your pardon; I did not exactly comprehend the question.

Q. Would the thickness of the fluid be different in one case than
in the other? A. There is frequently added to the milk burnt sugar and a saline solution of the same specific gravity as milk.

Q. I am not talking about the weight, I am talking about the thickness of the fluid; I am told the scientific term is viscosity; would there be any difference between the two? A. I understand your question; I say that burnt sugar has a tendency to approximate that color; it is added for the purpose of deceiving the eye.

Q. I am talking of what I call thickness in vulgar language; now, sir, how about that? A. I say it is rather difficult to see the thickness pouring from one can to another; you would get the difference by determining its specific gravity, either, if it were rich in cream——

Q. Suppose you observe it on the glass lifting the lactometer, would there be a difference? A. Yes, sir; there would be a difference.

Q. Now, sir; you have published annual reports, have you not? A. Yes, sir; they should be annual; they have not followed every year.

Q. Will you be good enough to look at these two and see if they are your reports? (Papers shown to the witness.) A. Yes, sir; they are.

Q. Will you be good enough to say if this is your own report: "It is found that good milk has a specific gravity from 1.029 to 1.033, water being 1.000; in testing milk, the lower number is selected as a fair gravity for pure milk, and whenever the gravity falls below this number, it may be considered as containing an excess of water"? A. You will pardon me one moment; I think that the following sentence has a bearing upon the other one; I cannot say that it does, but it is my impression.

Q. You have a right to make any explanation. A. I think I can possibly answer the statement and bring out what you wish to get at without any further questions possibly, that it is rather uncommon to find a milk of a lower specific gravity than 1.029.

Q. My question was, is that your report and are those your words? A. Yes, sir.

Q. Was that correct? A. Yes, sir.

Q. Those were your words? A. Yes, sir.

By the Court—Q. You are a public officer? A. Yes, sir.
Q. It was a report of yours as a public officer?  
   A. Yes, sir.
Q. Made to whom?  
   A. Made to the Mayor and Board of Aldermen.
Q. By whom you were appointed?  
   A. Yes, sir.
Q. Then the report is an official act done by you in the performance of an official duty?  
   A. It is.

By Mr. Prentice—Q. Well, sir; I read now from your report of 1875; please say to me if you made that report, and if these are your words: "Good milk has a specific gravity of from 1.029 to 1.033, water being 1.000; the lower number is selected as a fair gravity for pure milk, and whenever the gravity falls below this number it may be considered as containing an excess of water"; is that yours?  
   A. Yes, sir.
Q. And that is from your report?  
   A. Yes, sir.

By Mr. Waehner—Q. But in giving your testimony as to whether or not there had been added water, would you swear that there had been?
   (Objected to).
Q. If you found a sample of milk standing lower than 1.029 would you swear that it had been watered?
   (Objected to; objection overruled.)
   A. I stated before that I examined milk having a lower specific gravity than 1.029.
Q. Would such an examination amount to anything more than an inference.
   (Objected to; question withdrawn.)
Witness—In justice to myself, as the report may be published, I wish to state that 1.029 is as low as milk is ordinarily found under certain conditions; the specific gravity may be less, but 1.029 is lower than the average milk in Rhode Island.

Thomas C. Doremus, Jr., recalled by Mr. Waehner:

Q. Mr. Doremus, I understand that you visited Mr. Mulford's establishment upon the 18th of December, and procured from there certain samples of milk?  
   A. I did, sir.
Q. Did you see all the cow's milk from which you procured these samples?  
   A. Yes, sir; I did.
Q. Did you test the milk which you thus procured with the lactometer and thermometer? A. I did, sir.

Q. Now you paid a visit on the 24th of December also to the same place and procured certain samples of milk? A. I did, sir.

Q. Now, did you test those samples of milk with the lactometer and thermometer before passing it out of your possession? A. Yes, sir; I did.

Q. Now, have you your memorandum book with you containing memorandums made at the time of your second visit? A. Yes, sir.

Q. Will you produce that in Court and state exactly what you did at Mulford's establishment? A. I went to Mulford's and there met Dr. Waller.

By the Court—This is the last occasion you speak of? A. The last, the 24th of December, and there met Dr. Waller and Dr. O'Connor; in the morning we all went into the cow stable, and when we arrived there we found that they gave the impression they were on our side of the case and we on the other; we all went into the stables and saw the cows milked and we tested the milk together, they with their lactometers and we with ours; we saw a cow named Charlie.

Q. State the quantities of each so that we will see how much strippings there were from each? A. Cow Charlie on the lactometer was 108 5-10, 60 degrees Fahr., gave about four quarts; the Red cow 104 on the lactometer, 60 Fahr., six quarts; blue cow 112 on the lactometer, 65-10 Fahr., six quarts; the cow Gypsy, 107 on the lactometer, 60 Fahr., five quarts; the cow Andrew, 104 on the lactometer, 59 Fahr., half a pint; the cow Fannie, 91 1-2 on the lactometer, 59 5-10 Fahr., one pint; the cow Star, 103 5-10 on the lactometer, 60 Fahr., one pint; the cow Ryder, 103 on the lactometer, 63 Fahr., three pints; the cow Mooley, 98 5-10 on the lactometer, 61 Fahr., one pint; the cow Yaller, 102 on the lactometer, 60 Fahr., three pints; the black cow, 78 on the lactometer, 60 Fahr., one pint and a half.

Q. Let me ask you in relation to cow No. 78; did she appear to be a healthy cow? A. There is one more.

Q. Go on with the list? A. The cow Spot, 108 on the lactometer, 60 Fahr., one pint; all this milk is sent to New York, I believe; I would like to state in the case of Fannie—
Mr. Prentice—That is not responsive to the question; all this milk was sent to New York?

Witness—I am speaking of the milk from this dairy; this is all mixed together and sent to New York, I believe; the cow Fannie, I was going to state, on the first visit I made there she stood several degrees above a hundred, and on this second visit she stood at 91 1-2; the cow Star, that stood on my first visit at 92, stood on my second visit 103 5-10, both at 68 Fahr.; I would like to state also that Dr. O'Connor and Dr. Waller and we all made tests together, and we agreed in every instance, I believe, with the exception of the cow Mooley; they read it 99 and I read it 98 1-2, and their thermometer at 60 Fahr., whereas I read it at 61 Fahr.; in the case of the black cow they read it at 79 instead of my 78; in every other instance I believe we agreed; we all looked at the cows together and I believe we all agreed that the cows were pretty healthy looking cows.

Cross-examined by Mr. Prentice:

Q. On your first visit, December 18, Mr. Doremus, will you tell me the quantities that these cows gave of milk? A. On the first visit the blue cow—there were four samples of milk that I speak of; at that time you only questioned on sample No. 3.

Q. I am not talking about any other examination; I am now asking you if you will be good enough to give me the gravity and quantities that the cows gave on your first visit? A. On the first one, the blue cow was about six quarts.

Q. At what gravity? A. 115; 60 Fahr.

Q. Now, sir, if you will go on and give the rest? A. Star about, only 92; the thermometer 60 degrees Fahr.

Q. How much did Star give? A. About one quart; the other two, Nos. 3 and 4 I can only tell you approximately; as I said the other day they were contained in those bottles that you speak of.

Q. How much; what quantity? A. Those bottles hold a little over a pint.

Q. Upon the first visit—No. 3 is the black cow? A. That is the one you questioned me on.
Q. I ask if No. 3 was the black cow? A. No. 3 was the black cow.

How much milk in quantity did she give on the first visit? A. You asked me yesterday that question and I answered it was contained in that bottle which held a little over a pint; I told you the other day I did not measure it.

Q. Was it about a pint the black cow’s milk the first visit? A. Yes, sir, about that; I did not measure it; it was contained in a bottle, about a pint.

Q. How much do you know these cows gave on the second day; was it by the bottle or some other measure? A. As I said about in every answer it was only just an estimate; we did not measure it.

Q. By the size of the bottle? A. No, sir; in some cases we just judged from what was in the can; there were four of us there.

Q. Well, sir, I will take these two—did you measure the milk of the black cow and No. 4? A. Are you referring to the last visit?

Q. Yes, sir? A. No, sir; we did not measure it.

Q. You did not measure it on the last visit? A. No, sir; we did not measure it; we all agreed that it was about so much; Dr. Wal- ler and O’Connor.

Q. Do you know what these cattle were feeding on, what was their feed? A. It was on hay and straw.

Q. Did you see any hay there at all? A. I did, sir.

Q. Will you swear that they were eating hay; was it not simply and exclusively oat straw? A. No, sir; it was not simply straw.

Q. Did you hear Mr. Mulford say, in answer to a question, that he was feeding his cattle on oat straw? A. I heard him say, if I remember correctly, that he was feeding them on hay and straw and cornstalks.

Q. Was Dr. Waller and O’Connor present at any such conversa- tion? A. I do not know; I believe so.

Q. Do you think they were when he said that? A. Yes, sir.

Q. Now did you hear Mr. Mulford say that he should not milk his strippers after Sunday? A. I heard him say that several cows that were milked that day, one or two may be, I do not remember the number, that he was not going to milk them any longer, not for some time, I suppose.
Q. Did he call them strippers at that time in that conversation?  
A. Not as I remember.

Q. You cannot say whether he did or not?  
A. I cannot.

Q. Who went up with you this last time?  
A. A friend of mine, Mr. Root.

Q. What is his first name?  
A. Leonard S.

Q. Was he present at those conversations?  
A. I believe so.

Q. Now, sir, do you know what the whole amount of milk from these cows was upon that day?  
A. No, sir; I do not suppose I could tell you about the quantity.

Q. Is it not a fact that the whole amount of milk of these cows, Fannie, Star, Mooley, and the black cow, that the whole amount of the milk of those cows, you and Drs. Waller and O'Conner took and divided it between you?  
A. Yes; we did as I stated; there was a pint in one case, a pint in another, and a pint and a half in the third case.

Q. Including the milk of the black cow, do you know what the average on the lactometer rates; look at those figures?  
A. I do not profess to be an expert.

By Mr. Waechner—Q. Did you mix the milk of those cows together?  
A. We did not; those figures are right.

Q. It is over 101 on the lactometer?  
A. Those figures and divisions are correct.

Q. Eleven samples, what is the aggregate on the lactometer, including the black cow?  
A. The aggregate as stated there; those figures are correct.

Q. How much is it?  
A. 101 7-11.

Q. The milk of the black cow that you took that morning on the 24th, would it pass through the strainer before it was broken up?  
A. I would like to state that the strainer was very dirty at that time; I would state that the last portion of the milk did not run through very well on account of the strainer being dirty.

Q. Were there not clots in that milk?  
A. The milk had a somewhat curdy appearance.

Q. The milk did have a curdy appearance?  
A. It did, sir.

Q. Did it look like ordinary milk?  
A. It seemed to be good looking milk, except this curdy appearance.

Q. It did have this curdy appearance?  
A. Yes, sir.
Q. By Mr. Waehner—It all went through the strainer?  A. Yes, sir.

ANTON S. CASPAR, sworn and examined by Mr. Waehner through the interpreter:

Q. Do you know Mr. Doremus?  A. Yes, sir.
Q. Did you go to Mulford's place on the 18th of December with him?  A. Yes, sir.
Q. During the time you were there, did he give you in charge any samples of milk that were taken from the cows there?  A. Yes, sir.
Q. Did you, or did anybody in your presence, put any water or anything else in those samples of milk?  A. No.
Q. Or anything else?  A. No.

CHARLES A. DOREMUS, sworn and examined by Mr. Waehner, testified:

Q. What is your profession?  A. My profession is a chemist.
Q. How long have you been such?  A. Well, I have grown up in the laboratory.
Q. You have studied abroad, and have been an instructor in chemistry?  A. I studied in this country from the year 1865 to the year 1870, taking almost daily lessons in the laboratory, and then pursued a special course of scientific training in Germany at the universities of Heidelberg and Leipsic for three years, and since that time I have been an assistant to the Department of Chemistry at the Bellevue Medical College, and instructor in practical animal chemistry.
Q. Have you made a special study of milk and its analysis?  A. I have, sir; for some years past.
Q. You have made practical tests and experiments?  A. Continually.
Q. Do you recollect the case of John Kneib?  A. Perfectly.
Q. Do you recollect the samples of milk that were in evidence in that case, referred to in that case?  A. I do, sir; very well.
Q. Did you make the analysis of milk on that case?  A. I
assisted in making the analysis and in determining the specific gravity of the milks testified to by my father in that case; I saw all the samples and assisted in many of the analyses.

Q. Have you your memoranda of the analyses made at that time? A. I have, sir.

Q. Your memoranda agree with that of your father? A. They do, perfectly; they prove that the milk was pure.

Q. Did you visit Mr. Mulford's establishment in September last? A. On the 23d of September, 1876, on Saturday afternoon of this year, I paid an unannounced visit to Mr. Mulford's farm in Orange county, New York; they knew nothing of my coming, and received no intimation of my coming.

Q. State what took place and what the results of your visits were? They had already commenced milking some of the cows, and I lost therefore the milk of the cows which I was anxious to obtain; I obtained them, however, the next morning, and from the determinations which I made there, I made up the following table. The cows with but one or two exceptions, were the same cows that we tested the year before, and many of the cows were the same as those tested by my brother within the last two weeks; I have found a sample of milk coming from the yellow cow; it is marked No. 6 on my table; the whole milk, the evening milk, when thoroughly mixed together at the temperature of 60, stood at 94 on the lactometer.

By Mr. Prentice—Q. What quantity? A. There were two and one-third quarts of milk; the cows were then in full milking; she had calved in February of that year; I was particular to find out the time of calving, the age of the cow, the number of calves she had had, the quantity of milk, and everything I thought would bear upon the testimony in this case, and make a report as thoroughly as I could; on analysis that milk yielded nearly 81 per cent. of water and 9 per cent. of butter; thus showing that the richness of the milk influenced its specific gravity.

Q. There was less water in that milk? A. There was less water in that milk than in any I have found; that was a fair average sample of that cow's milk; she was then not a stripper in any sense of the word; none of the cows were strippers when I visited the place.
Q. Proceed, Doctor? A. The next sample of milk that I found came from a cow which I marked No. 8 in the stable; it was the white cow, if the gentleman would like to refer to it; she was a part Alderney cow and gave very little milk, not quite a quart—about three-quarters of a quart; she had calved in March, and was therefore in good condition for milking; the cow does not at any time give much milk; she is a cow too that is eight years old; the specific gravity of that milk by the lactometer was 85 in the evening and 92 in the morning; now from the analysis your Honor will see that the evening milk, which was the lowest, was the best milk of the two; it contained six per cent. of butter, and the morning milk only contained four per cent. of butter, showing that the high specific gravity was because the milk was pure milk; the next cow was a cow called Rider, marked No. 9 in my table; the lactometer marked 99 in the evening; I would like to state in regard to that white cow in the morning it was half a quart and in the evening it was three-quarters; I made a mistake in the reading; one was seventy-five-hundredths, that was the evening milk, and the morning milk was only one pint; the morning milk was pure milk and less in quantity; now the cow Rider, No. 9, stood at 99; this cow gave three quarts of milk in the evening—she was not a stripper, either; I would like to state here that the highest amount of milk given by any of these fifteen cows was only a little over three quarts and a half; the most they ever yielded Mr. Mulford said is about five quarts; the cows referred to by my brother were not there when I was first there; cow No. 9, Rider, stood at 99; she gave three quarts in the evening and three quarts and a quarter in the morning; she was seven years old, and came in March; she was a native cow also; now the milk from that cow gave 86.6 per cent. of water and 5.5 of butter, and was therefore, so far as butter is concerned, gave less good milk than the one that stood at 85; these cows that I have referred to so far were all pasture-fed cattle; now the next cow was fed on pasture and she had a couple of pumpkins to eat besides.

By Mr. Prentice—Q. What is the name of the cow? A. The Bob-tailed cow; this is the only one that I found that gave a low gravity among the same herd that my father found; it stood 88.5 on the lactometer in the evening and 97 in the morning; she gave
two and a half quarts and two and three-quarters in the morning; the pumpkins told on the quality of milk; it was the biggest amount of water that I had ever found in the milk up to that time.

Q. What was it? A. Ninety per cent.; I tested the milk the other day and it contained over 90 per cent. of water.

By the Court—Q. You mean by analysis? A. Yes, sir.

By Mr. Prentice—Q. What was the butter in that Bob-tailed cow? A. The butter was 2.5, the salts .688, and caseine and sugar together was 6.234.

By Mr. Waehner—Q. Proceed with your table? A. Now the next cow was Fanny; this cow gave next to the greatest quantity of milk given by any of the cows in the dairy at that time; in the evening it stood at 100 exactly as I found the lactometer which I used; the 100 mark corresponding with the specific gravity 1.028.5 determined very carefully and accurately; that would make it stand between 98 and 99; I was very careful in testing this lactometer by a specific gravity salt solution as prescribed by Professor Chandler as his method of doing it; she gave three quarts in the evening and three quarts and a half in the morning; the morning milk was 98; that of course is subject to correction; that would be, I suppose, 96 or 97 tested with the same lactometer; there was no analysis made of that milk; that last cow was pasture-fed also; it was in September and the pasture was in first rate condition; they were grass-fed cows, nothing abnormal about them.

By Mr. Prentice—Q. Is that the last on your list? A. No, sir; not yet; among all those cows the one that gave the highest gravity of milk stood 115; that was the highest; she only gave a quart.

Q. What cow was that that you just spoke of? A. That was Cherry; it has not been mentioned in this case so far; she gave only one quart and she stood at 115; now, I went to another dairy; they did not know about my coming.

By Mr. Waehner—Q. Have you given all your cows on that table? A. I have seventeen cows in all and out of the seventeen there were five went below 100.

Q. All the others on that table are above 100? A. Above 100.

Q. How high up; what are the extremes? A. 115 is the highest.
Q. Next to that? A. The next to that is 113, she only gave a little over a quart and a quarter; oh, I see there were two at 115; there is one here at 110 and 111; now, I went to an entirely different dairy, it had no connection with Mr. Mulford and they did not know that I was coming; in this dairy, Mr. Clark's, the cattle instead of being native were most of them cattle with a pedigree as you might say, they were fine cattle; the first cow that I tested the milk went below 100.

By Mr. Prentice—Q. What was its name? A. They had no names; I marked it in my table No. 1; she was three years old and had two calves; she calved in April; she was three-quarters Ayrshire and one-quarter Short horn; she was a pure breed of cow and pasture-fed; the milk stood at 92.

Q. How much? A. I could not measure the quantity in this place; there was no opportunity; but the cows seemed to be giving about half a pail of milk; they were all in good milking condition; I suppose on an average the cows were giving there, I do not think there was one of them went below three or four quarts; they were all fair yielding milk cows; the milk of that cow stood at 92; the analysis proved that there was 87.6 per cent. of water, 4.2 of butter, 7.3 of caseine and sugar and 0.610 of salts, showing the milk to be normal.

By the Court—Q. What did the lactometer say? A. It said 92; the next cow I will mark No. 5; this cow was a pure Jersey cow, a beautiful little beast; she had calved on the 31st of May, that was the first day of June; the man kept a record of all the days on which the cows calved; he had everything tabled.

Q. You do not mean a New Jersey cow? A. No, sir; she was an Alderney; she was four years old and had two calves and the milk stood at 100, that is 1.028.5, 98 properly on the Board of Health lactometer, provided it was correct; the lactometer I used was not correct, I proved it was not correct by experiment in the laboratory; the 100 corresponded to the specific gravity of 1.028.5; now, No. 3; there was no analysis made of that milk; the lactometer stood at 99; the cow was a native cow; the milk yielded on analysis 87.5 of water, 5.7 of butter, nearly 6 per cent. of butter, 5.9 of caseine and sugar, nearly 6 per cent. and 0.7 of salts; here again your Honor will see that the percentage of water is almost exactly that which
was in the first case, and yet there was seven degrees difference on
the lactometer, showing that the lactometer will not tell the amount
of water either adulterated or naturally present in the milk.

By Mr. PRENTICE—Q. Is that your opinion? A. That is my
opinion; the two last cows were fed on pasture and some pump-
kins.

Q. How many cows have you of Clark's dairy? A. There
were fifteen cows and three went below 100; the highest one was
at 115, the table is at your disposal; I visited another dairy, Uncle
Richard's, but unfortunately they had commenced milking before
I arrived there, so I only had a chance of testing the milk from five
cows, and they all went above 100; I tested therefore in all thirty-
seven cows and got 8 samples below 100; a fifth of the cows there-
fore gave milk less than 100.

By Mr. WAEHNER—Q. Now, Doctor, did you make an analysis
of the milk contained in that mysterious bottle? A. I did, sir.

Q. That was No. 3? A. No. 3.

Q. What were the results? A. I found 90, 668 of water, butter,
1.94, caseine, 7.305, salts, 0.087; I would like to state in regard to
these analyses, that I would not like to say that they were absolutely
correct, for I was very much pressed for time and had not the pos-
sibility of going into it as I did with the other analyses; the other
analyses were very carefully made, but I think that Prof. Chandler's
analysts will substantially agrees with these analyses.

Q. Now, sir, have you examined the instrument known as the
lactometer? A. I have, sir.

Q. Can you enumerate to this jury any mechanical defects con-
ected with that instrument? A. Besides those defects showing
that the instruments did not agree, I could point out that the
scale is not properly graduated according to the rules laid down in
scientific books; if you will hand me Watts' dictionary, I would
like to refer to that.

Q. What page do you cite in support of that proposition? A.
206, Vol. 3, under the subject called gradation, showing that the
degrees on the gradation should not be equal; this is applied to all
hydrometers; I would like to have Hoppe-seyler.

By Mr. PRENTICE—Q. That is the other book you cite in con-
firmation of your views? A. Hoppe-seyler; I do not know the page,
but if you will give me the book I can immediately refer to it; he speaks about looking at hydrometers when you buy them to see whether they are correct or not; I would like to quote from page 14 to the middle of the page: "In buying a hydrometer it is necessary to see that the stem shall be as cylindrical as possible, and that the divisions on the scale shall not equal each other, but be inversely proportional to the specific gravities which are given by the bounding lines of division; that applies to all hydrometers."

Q. Have you made any practical tests with milk, comparing it after being transported or after some delay in the time of its milking? A. I have, sir.

Q. What has been the result of those tests? A. It always changes in specific gravity.

Q. Can you assign any reason for it, or give any reason for it? A. I cannot positively assign any reason; I believe the reason given by authors is that some change takes place in the caseine of the milk; the fact, however, remains that the change does take place; that I have verified by my own experiments.

Q. Now what is the effect of mixing an equal quantity of milk of high and low specific gravity, one being rich in cream? A. I took three samples of milk bought; one stood at 110 and the second and the third which purported to be First avenue cream, stood at 92; it was simply rich milk; I took equal parts of the sample No. 1 and sample No. 3, and I mixed them; they were equal quantities of milk at 110 and milk at 92; by calculation the resulting specific gravity would have been 101; by actual experiment its specific gravity was only 98, three degrees out of the way; I then took sample No. 2, which stood at 110, and mixed it in equal quantities with the milk at 92, and the resulting specific gravity was in that case, not a calculated specific gravity, but 99, two degrees out of the way, showing, may it please your Honor, that when you mix equal quantities of rich and fair milk that you cannot calculate the specific gravity, because both of these samples which stood at 110 were mixed with equal quantities of milk at 92 and they did not agree in getting a resulting specific gravity, but one differed from the other and they both differed by two and three degrees from the specific gravity by average; I made another sample which I also wish to refer to, for fear the objection might arise in regard to milk being purchased...
milk; I made another experiment and I took milk which I knew was pure, a milk which stood high and which stood low and mixed them in equal quantities, and again the calculated average of specific gravity was at fault, the resulting specific gravity by experiment was one degree below the calculated average.

Q. Then from the table presented this morning of those 11 samples the deduction of 101 and something is not a true method of arriving at the result? A. It is perfectly impossible to state what the average specific gravity of mixed milks will be by figures.

Q. Would the different quantities of milk have something to do with it? A. A great deal to do.

By the COURT—Q. What quantities of milk did you buy? A. I mixed equal quantities.

Q. I mean what quantities did you originally buy? A. I sent out and bought a pint of each milk.

Q. Did you test them by the lactometer? A. I took a fraction of a pint of each.

Q. After you tested each? A. Then I mingled them in equal quantities.

Q. You tested each quantity of milk, that is the parcels of milk that you bought, with the lactometer? A. I did, sir.

Q. Now, if you had added to each of the parcels of milk you bought two gills of water and put in your lactometer, then after adding it, would not that fact affect the gravity? A. Certainly.

Q. The quantity being a pint and then say two gills of water added to the pint, that would make a pint and two gills after the water was added; can you tell about how much those two gills of water would have reduced the specific gravity of a specimen of milk? A. If I took a sample of milk standing at 120 and a sample of milk standing at 105—

Q. You have got a given quantity of three different milks, all at different places or at the same place, you keep them separate, you test the specific gravity of each by the lactometer; one shows so much and the other so much; you add two gills to each, and now you put in your lactometer at a temperature of 60, what will be the result? A. They will all be lower in specific gravity undoubtedly.

Q. About what ratio of the lessening of the specific gravity would
the two gills make?  A. That would depend entirely upon the composition of the milk originally.

Q. You do not understand me; this same quantity of water is added to each specimen of milk; I want to know if you can state what would be about the probable difference of the gravity?  A. You can add about 15 per cent. of water to milk standing at 120 before it goes below 100.

Q. Do you mean to say that that carries it 15 per cent. below?  A. If the milk stands at 120 and you add 15 per cent. of water, it will bring it down to 105, and therefore, you reduce it 15 degrees.

By Mr. WAEHNER—Q. But it would be impossible to state accurately without making an accurate experiment, what the result would be?  A. If I did not know what the specific gravity of the milk was—

(Objected to.)

By the COURT—Q. You took samples of milk, you had tested them with the lactometer, you leave your laboratory, you returned not knowing whether water had been added, you put in your lactometer, you find that the specific gravity had gone down 10 or 15 per cent., what would be your conclusion?  A. I have taken samples and sealed them up so that nobody could put water to them, and they had lowered in gravity; I could not tell whether water had been added.

Q. What would be your conclusion as to the gravity?  A. Either that the milk had changed in and of itself, or that water or cream had been added.

Q. Which would you think would be your natural conclusion?  A. I should think that the milk had undergone some change.

Q. Fifteen per cent. in gravity you mean by chemical change?  A. I have known the chemical change to go almost as far as that, your Honor; from actual experiment I have known the milk to vary that degree.

Q. If the gravity had lessened 15 per cent. I want to know what your conclusion would be?  A. I stated either one of three things, either that the milk had changed or that water had been added, or that cream had been added; I could not tell from the indication of the specific gravity which had been done.

Q. If there was a pump near by would not you think water had
A. I suppose of course, if somebody went there and put water in they would lower the gravity by putting it in; I would not be willing to swear in court which had been done.

Q. Water is a cheaper article? A. Of course it is cheaper than milk.

By Mr. Waechner—Q. Look at sample bottle No. 3 in relation to that matter; have you a practical knowledge in such case of change of milk of the sample brought from Mulford's establishment by you? A. I have several cases.

Q. Give me the one that was tested by yourself and your father, which you brought from Mulford's? A. I did not bring it from Mulford's, I brought it from Mr. Clark's; I cannot state exactly, because at that time my attention was not particularly called to it, but one of the samples I obtained from Mr. Clark; in fact two samples were obtained from his place.

By Mr. Prentice—Q. What numbers were they? A. I do not want to make any mistake; I know in regard to one; I may be mistaken in regard to two; I will limit it to one; I know that one sample was so much lighter, but only had been kept a short time.

Q. Which one was that? A. I cannot say; I made no record of it at the time; it may be one of the samples which was here in the list of one of those; I brought several down which stood near 100; it had lessened so much by keeping that I could not verify the reading that I had made on the lactometer by a determination by means of the specific gravity bottle.

Q. Had it increased or decreased in gravity? A. It had diminished largely.

Q. Was this test made in conjunction with your father? A. It was; he observed the fact at the time.

Q. Could you from the evidence of your senses and the lactometer, determine whether an article was milk or not? A. I could not, sir.

Q. What in your reading have you found to be the range of specific gravity of milk? A. There are a great many authorities that give the specific gravity of pure milk, whole milk well mixed together, as being much below 1.029. There is a table on the other side copied from "Hassal, Adulterations of Food"; the specific gravity of milk is given in one case, it goes as low as 1.008. There
are forty-two samples there, and I think there are over twenty that range below 1.029. It is proper for me to state that Hassal says in some of these cases that the milk was exceptional, and that in other cases it was a fair average sample of pure cow's milk.

Q. Now on this table are there any other observations? A. There are; there is an observation on the Chart Filhol.

By the Court—Q. You say something about the change in the specific gravity of milk which I do not understand. Now if you take a given quantity of milk and put it in a vessel hermetically sealed, and you take the weight of the vessel and the milk after it is so sealed, and it remains hermetically sealed, and it stands a day, and you weigh it a day after, not open it but you weigh it again, will it be the same weight or not? A. The specific gravity—

Q. Answer my question; will the vessel and the thing in it, the fluid in it which you then put aside, will it weigh the same? A. I suppose it will.

Q. Therefore when you say it changes, don't you mean a chemical change may take place in the constituents of the milk which when you unseal the vessel and undertake to test it with the hydrometer, the gases or something which has been chemically manufactured will escape? A. Undoubtedly some of the gases; if there is any gas there it would escape.

Q. Would not water evaporate? A. If you will allow me, your Honor, the actual weight of the bottle with the contents is a different thing entirely from the weight as given by the specific gravity. If I should take a volume of milk and weigh it on one day and take exactly the same volume and weigh it on another day, the two weights would not agree.

Q. If you mean by that that a tumbler of water stay there and I am gone a week it has not been changed, but some portion has evaporated? A. If I should fill that tumbler up with milk and let it stand, some milk would run over, or perhaps the milk would decrease so that the tumbler would not be full, or it would fall over. I found in one sample of milk put in that little bottle filling it up, it would weigh so much, and in filling it again it would weigh less; therefore the specific gravity had decreased by keeping; its specific gravity is the weight of equal volumes; the volume of milk changes, and therefore the specific gravity must change; a quart of milk at
one time will weigh more or less than the same quart at another
time; if I took exactly a quart of milk and let it stand it would not
fill the quart measure.

By Mr. Waehner—Q. Suppose you took a cubic inch, would that
weigh the same? A. If I took a cubic inch on Monday and a cubic
inch of the same milk that had been sealed up on Tuesday, the
cubic inch of Tuesday would weigh less than the cubic inch of
Monday.

_Cross-examined by Mr. Prentice:_

Q. Under certain circumstances does milk ferment, and does it
change to koumiss or some other substance? A. Milk undoubtedly
goes through fermentation, but I am not speaking of fermented milk
when I speak of milk kept—

Q. Answer my question? A. Undoubtedly it does, it gets sour.

Q. Now, sir, is it a fermentation in which the sugar of the milk
changes to alcohol? A. The sugar of the milk may possibly change
into alcohol.

Q. Is alcohol lighter than water? A. Oh, undoubtedly.

Q. Now, sir, will this change take place in one day? A. I do
not know, sir, I have never tested any of these light samples of
milk, milk which has grown lighter whether it was by alcohol or
some other substance.

Q. You have made a quotation from Watts' Dictionary? A. I have.

Q. In that same article, on page 208, will you tell me if this is a
correct sentence: "The smaller intervals on the hydrometer scale
may always be subdivided into equal parts by estimation or other-
wise without appreciable error?" Is that so there? A. It is so
written and printed in the book.

Q. Is it not a fact that the largest difference between the degrees
of the lactometer is one 550th part of an inch? A. I never meas-
ured it.

Q. Do you know? A. I have never had the Board of Health
lactometer in my hand.

Q. How do you know anything about the proper sizes of the de-
degrees? A. I know the general principles that all hydrometers should be so graduated for it is so laid down in the books.

Q. Is it not true that the difference between each degree and the next degree is one 55000th of an inch on the lactometer? A. I have simply had the lactometer of the Board of Health in my hand here; I do not know, I have never measured it.

Q. Can you say that there is no difference on the Board of Health lactometer? A. Neither one nor the other.

Q. Can you say it is not? A. No, sir, I cannot say it is not; the gradations seem to be very close.

Q. But you cannot say? A. No, sir.

Q. Now, sir, how came you to go to Mulford's and Clark's farms? A. I was requested to do so by my father.

Q. How were those farms designated to you or to him, if you know? A. I went up to Port Jervis and had found out where Mulford's farm was; I had no positive direction; they were in the neighborhood of Port Jervis, I was told to go to Charles Mulford's.

Q. Were you told to go to Clark's too? A. Yes, sir; Charles Clark; I had to hunt them up; my father did not know where they were.

Q. Now, sir, will you turn to your notes and tell me if there is not rather an extraordinary resemblance between the analysis of the Bob-tailed cow and the analysis of the Black cow's milk? A. If it is so stated I believe those are correct; those analyses were very carefully made.

Q. I ask you, as a chemist, whether it does not present rather an extraordinary resemblance. A. You refer to the Black cow?

Q. And the Bob-tailed cow, both, both of which milks you analyzed? A. You mean the Black cow analyzed this year; yes, sir, there is quite a striking resemblance; the amount of water is in both the same.

Q. And in other particulars? A. Yes, sir, very little fat, very poor milk.

By Mr. Waehner:

Q. Does not this also occur in Watts' book?

(Objected to; objection sustained.)
TESTIMONY OF DANIEL SCHRUMPF.

Q. Had those various samples of milk which you discovered had decreased in gravity or changed in gravity, undergone fermentation at the time when you tested them?  A. They had not to the eye or to the test of paper; they poured exactly as if they were good milk.

Q. Now how long were they kept before they were re-examined; how long after they were obtained?  A. I think only a day; perhaps a day and a half.

Q. At what temperature?  A. Below 60; they were kept in ice-water, well corked and sealed, that no water should get in.

DANIEL SCHRUMPF, sworn and examined through the interpreter, testified as follows:

By Mr. Waehner:

Q. You are the defendant in this case?  A. Yes, sir.
Q. What is your business now?  A. Milk business.
Q. How long have you been in that business?  A. Seventeen years.

Q. On the 25th of August last, tell me what took place at your store?  A. A professor, a milk inspector, came in, I do not know his name, and asked for a cup of milk and tested it; then he showed his authority of his being an officer of the Board of Health and that he intended to inspect the milk; then he inspected the milk and said the milk was weighing ninety degrees, and that he intended to enter a complaint against me.

Q. Where was the milk when he tested it with the lactometer?  A. The milk was in the ice-box; he took it from the ice-box; he took a sample from it.

Q. Well, what did he do with your sample?  A. He immersed the scale into the sample.

Q. Into what did he put this sample of milk?  A. In a glass.
Q. Did he taste the milk at all while it was in the milk can?  A. No, he did not.

Q. Did he warm or cool the milk when it came out?  A. He did not do anything else but weigh it after he took it from the ice-box.

Q. Did he insert a thermometer into this glass tube which he had?  A. He had two instruments; I do not know what they were.
Q. Did he put them into the glass?  A. Yes, sir; he did.
Q. Did he tell you what degree the thermometer was at? A. No, he did not.

Q. Did Dr. White say anything to you at what degree the lactometer stood? A. We did not quite agree; I saw that it was 90 and he said it was only 85.

Q. Now, Mr. Schrumpf, did you put any water into this milk, or put anything in it whatever after you received it? A. No.

Q. From whom and when did you receive it? A. On the 25th day of August, from my son.

Q. When and what time of day was it you received it? A. One part of it about five o'clock in the morning, and another part between nine and ten.

Q. Now in either of these quantities of milk received by you did you put any water or any other substance into it? A. No.

Q. Now from the time that you received the milk up to the time that Dr. White inspected it who had access to it? A. Nobody but myself.

Q. Have you ever been charged before with selling adulterated milk? A. Never in seventeen years.

Cross-examined by Mr. Prentice:

Q. Did you talk any English with Dr. White? A. I understand a good deal but he cannot talk, and he talked with me in English as much as he could (Court Interpreter).

Q. Did you speak to Dr. White in English? A. I spoke to him as much as I could in English.

Q. Can you talk English at all? A. He says he was not schooled in English.

Q. You have now understood my questions without the use of the interpreter, haven't you, Mr. Schrumpf? This milk was in a large can in the ice-box, was it not? A. Yes, sir.

Q. And it was taken from that large can in the ice-box to be tested by the inspector, Dr. White? A. Yes, sir.

Q. How much was there in the can? A. About 25 or 30 quarts.

Q. Mr. Schrumpf, you read the lactometer yourself, didn't you, the degree? A. Yes, sir, I did see it.

Q. You have had your milk tested before by inspectors, have you not? A. Yes, sir.
TESTIMONY OF JACOB SCHRUMPF. 235

Q. How many times?  
(Objected to as immaterial.)  
A. Only once before.  
Q. When was that—it was before this time?  
A. Yes, sir, before this time, over a year ago.  
Q. And did he read the degree on the lactometer at that time?  
(Objected to as immaterial; objection sustained.)

By Mr. WAENNER—Q. Are you in the wholesale milk business?  
A. I used four cans a day, forty quarts each.

JACOB SCHRUMPF, sworn and examined by Mr. WAENNER, testified:

Q. Mr. Schrumpf, you are the son of the defendant here?  
A. Yes, sir.

Q. Where did you obtain this milk that you delivered to your father upon the 25th of August?  
A. I got it up at the 48th street depot.

Q. Did you during the time that that milk was in your possession that day put any water in it or adulterate it in any way?  
A. I did not.

Q. Had any person access to that milk or have it in charge during that time up to the time you delivered it to your father but yourself?  
A. No, sir.

JOHN H. COMER, sworn and examined by Mr. LAWRENCE, testified as follows:

Q. Where do you live, Mr. Comer?  
A. Goshen, Orange county, New York.

Q. And you do business in this city?  
A. I do, sir.

Q. What is your business?  
A. I am a practical farmer and in this city I am an expert accountant.

Q. Are you connected with the sale of milk?  
A. No, sir.

Q. Have you formerly been largely connected with the sale of milk in this city?  
A. Yes, sir, to a moderate extent.

Q. How long have you been familiar with practical farming?  
A. Well, sir, I was brought up on a farm when I was a boy and then resumed it again some six or eight years ago.
Q. Are you acquainted with the use of the instrument called the lactometer?  A. Yes, sir.
Q. Have you used it yourself?  A. I have.
Q. Within what period?  A. Constantly, or not constantly, but at intervals during the past five or six years.
Q. How often have you used it?  A. I could not answer that question; a large number of times.
Q. You used it as a test for milk?  A. Yes, sir.
Q. What is your opinion of the lactometer as a test for milk?  (Objected to; objection sustained.)
Q. How long have you kept and raised cows?  A. For the past six years.
Q. How long were you engaged in selling milk?  A. I should think in the neighborhood of three years, perhaps a little more.
Q. About what quantity did you sell daily during that time?  A. I commenced with selling four or five hundred quarts and ran up to two thousand.
Q. When did you first begin to use the lactometer?  A. About six years ago I should think, sir.
Q. Now, sir, in what way did you use that, and for what purpose?  A. For testing milk to see what results would follow—to see whether I could tell anything about it.
Q. Well, sir, describe your manner of making tests?  A. I would take the milk, for instance, from a single cow and cool it down to a point of 60 and then very carefully put in the lactometer and note the result.
Q. How many times have you done that?  A. Well, sir, I do not know; a great many times; I could not say how many times.
Q. Do you think you have done it upwards of one hundred times?  A. Yes, sir; I should think fully that.
Q. With different cows?  A. Different cows.
Q. Different breeds of cows?  A. Yes, sir.
By the Court—Q. Do you mean you tested milk of different cows—the milk that you saw milked from the cows?  A. Yes, sir.
Q. Did you test milk coming from New York?  A. I have done both.
Q. Where did you get the lactometer?  A. I had one that was
used by the State of Massachusetts and one that was made by a gentleman on Pearl street.

By Mr. Lawrence—Q. What is his name? A. Tagliabue, on Pearl street, near Fulton street—something like that.

The Court—Q. Do you want to ascertain from this witness the actual results?

Mr. Lawrence—Yes, sir.

The Court—The question as to his opinion of the lactometer I exclude; that he may give evidence to show the results of the actual tests he made may be admissible.

By Mr. Lawrence—Q. Will you state what results you have observed from tests made by yourself of pure milk with the lactometer? A. Well, sir, I have observed very diverse results; in many cases the lactometer would indicate a very low standard.

Q. How low? A. 93 and 94.

Q. Very often? A. Yes, sir; quite a number of times.

By the Court—Q. Standard of what do you mean? A. I mean that the indicator on the lactometer would indicate that the milk stood at 93 or 94 by the scale of the lactometer.

Q. What did you suppose that indicated? A. I supposed that indicated 100; pure milk.

Q. What did you suppose was to be inferred from the fact that the lactometer did stand at a certain degree, a certain mark—what did you infer was the result—what did it show? A. I inferred that if it showed 100 and upwards that it was pure milk; that anything over 100 it had not been adulterated in any way or anything taken from it.

By Mr. Lawrence—Q. Well, sir, how many times did you find samples of milk that stood at 93 and 94? A. Quite a number of times; in that neighborhood, 93, 94, and 95; quite a number of different times.

Q. Did you note other and higher results? A. Yes, sir.

Q. State them? A. I have known them very frequently to be over 100; I think I never in any one instance obtained just 100, but in many cases have gone over 100.

Q. And did you notice any difference with milk rich in cream and milk not as rich in cream, produced by the lactometer? A. Well, sir, of milk rich in butter produce I have noticed a great
difference, that is to say taking the milk and churning, and the amount of butter produced, that very often the milk which apparently has a low gravity will give the best results in pounds and ounces of butter.

Q. Well, sir, good butter-producing milk, how low have you found that? A. I think sir, at 94.

Q. Mr. Comer, are you familiar with the practical authorities on the subject of dairy farming? A. Yes, sir; so far as they are in the English language.

Q. "Practical Husbandry," by Willard, is that an authority on that subject? A. It is sir; in this country decidedly.

Q. "The Dairy Cow," is that book an authority upon the subject—by Sturtevant Bros.? A. Sturtevant Bros., of Farmington, Massachusetts, it is an authority.

Cross-examined:

Q. Did the majority of instances stand above 100? A. I think it would be very hard to say; I cannot say positively.

Q. What is the standard of the Massachusetts lactometer, do you know? A. No, sir; nothing except as marked on the scale; 100 as I understand, it is the scale; that is all I know about it.

Q. And this other lactometer, do you know what standard it was regulated by? A. I do not know anything, except 100 is the standard.

Q. Do you know how many kinds of lactometers there are? A. No, sir.

Q. You do not know anything about the different standards by which they are regulated? A. No, sir; I do not

Mr. LAWRENCE—I now propose to offer certain evidence as to which I think there may be a question raised; I offer to prove by customers of the defendant, Daniel Schrumpf, who were customers in the month of August last, and for a long time, that the milk sold by him was good wholesome milk, particularly on the 25th day of August.

The COURT—By customers you mean parties who bought milk of him.

Mr. LAWRENCE—Parties who are in the habit of purchasing milk from him.
The Court—I do not think it is admissible; I do not suppose water is very injurious; a person who thinks he is going to buy milk does not want to buy water.

Mr. Lawrence—There are certain witnesses whom we expect here who are not here now, and I am forced to rest the case for the defence.

Rebutting testimony:

Elwyn Waller recalled by Mr. Prentice:

Q. Dr. Waller, did you write the article on hydrometer in Johnson's Encyclopedia? A. I did.

Q. Will you look at this instrument [instrument shown to the witness]; that is the lactometer graduated at 1.029, the standard of the Board of Health, is it? A. Yes, sir.

Q. Is there any mechanical error in its construction? A. None that I can see.

Q. How much difference ought there to be in the size of the degrees? A. The degrees at the upper end should be—there is no apparent difference here—but the degrees should be about one-550th part of an inch longer than the degrees at this the lower end of the scale.

Q. How much would be the difference of the size of one degree from that next to it? A. Since there are 100 degrees, the difference between the size of one degree and its next neighbor should be the one 55000th part of an inch.

Q. Ought the lactometer to look like the alcoholometer? A. No, it should not; if it looked like the alcoholometer I should consider it incorrect; I believe that experiment would carry out that view.

Q. If you could distinguish any difference in the size of degrees with the eye would you consider it accurate? A. I should not.

Q. Did you visit the farm of Mr. Mulford in Orange County? A. Yes, sir; I did, last Saturday; I visited his farm and saw the cows milked in the evening—that is all the cows which he milked; there were only four that evening; those he called his regular milkers; there were some which he called strippers.
COUNSEL—We move to strike out what Mulford called them.

The Court—I will strike it out.

By Mr. Prentice—Q. You say, sir, that those four were all of his regular milkers? A. Yes, sir.

Q. Was there any difference in his herd between regular milkers and others? A. Yes, sir; he distinguished several times between regular milkers and strippers.

Q. Do you know if there was any difference from what you saw? A. Yes, sir; I do know.

Q. What was the difference? A. The strippers were milked but once a day and gave varying quantities, but very small amounts; one of them I believe gave over a quart of milk and the rest under a quart.

Q. Which were the strippers and which were the regular milkers; give their names and the quantities? A. In the evening the regular milkers, the first one Charley gave between three and four quarts.

Q. What did it stand? A. It stood 105 at 59 degrees; the next one is the Red Heifer and gave about three quarts of milk which stood 100 degrees on the lactometer at 61; the Blue cow gave four quarts which stood 104 degrees at 61; the Gypsy cow gave four quarts which at 59\(\frac{3}{4}\) on the thermometer stood 102 on the lactometer.

Q. Now, sir, did you see the whole herd milked the next morning? A. I saw all that he milked; there was some that were dry at the time.

Q. State all that he milked the next morning? A. The next morning he milked those same four cows.

Q. How did their milk stand in the morning? A. Charley gave six quarts which stood 108 at 60; Red Heifer gave four quarts which stood 104 at 60; the Blue cow gave six quarts which stood 112 at 60\(\frac{1}{2}\); the Gypsy cow gave five quarts which stood 107 at 60.

Q. Now, the strippers? A. Of the strippers Andrew gave about half a pint which stood 104 at 59 or thereabout.

Q. What was done with that milk? A. That was put in with the other milk; no, it was not, for it was distributed between Mr. Doremus and myself; no, that was not taken as a sample; that was put in with all the other milk.

Q. What was the next one? A. Fanny gave about a pint which stood 93 at 59; a sample of that was taken.
Q. By whom?  A. Mr. Doremus took a portion of it and I took another part.

Q. Thomas C. Doremus?  A. Thomas C. Doremus.

Q. He was present?  A. He was present in the morning.

Q. Go on?  A. Star gave between a pint and a quart, about a pint and a half, which stood 104 at 59½; Rider gave three pints which stood 103 at 60; the Mooley cow gave about a pint which stood 99 at 60; a sample of that was also taken; the Yellow cow gave a little over three pints, just about three, which stood 102 at 60; the Black cow gave about a pint and a half which stood 78 at 60; a sample of that was taken.

Q. What was done with the whole of the milk of the black cow?  A. That was divided between Mr. Doremus and myself for samples.

Q. Any other samples taken?  A. There were but three samples taken one from Fanny, another from the Mooley cow, and the other from the Black cow; the other cow I have not mentioned; Dr. O'Connor saw that cow milked.

Q. These strippers with the exception of the black cow, were they with calf?  A. Yes, sir; they were; they were expecting the calves to be born within two months.

Q. What are strippers?  A. Strippers is a name applied to cows which are drying off and therefore giving less milk; the black cow was called a stripper in so far she was drying off and not being a good milker she was to be fatted for beef: the others were called strippers.

Q. Was the black cow in calf?  A. The black cow was not in calf.

Q. Was the milk of the strippers like other milk?  It does not appear to me from the examination I have made since I returned.

Q. Now, sir, what was the food of these cows?  A. I only saw the food given them to be oat straw; while we were standing looking at one of the cow's milk Thomas Doremus took a wisp of hay from near by and handed it to one of the cows, and then as they all seemed very eager for it he pulled some more and handed it to them; that was all the hay I saw them get.

Q. Was there any conversation in Thomas Doremus' presence about the food of the cows and their care?  A. I think there was, I do not remember exactly.
Q. State the substance, if you recollect it, of the conversation? A. I do not remember anything with regard to the food of cows; we had conversation with regard to the amount of milk they gave, but that is another point.

Q. What was the appearance of these cows? A. Their coats were apparently rough, though that may have been due to the cold weather, and those who were with calf were big with calf and showed it in that way.

Q. Now, sir, have you analyzed the samples of milk from these strippers? A. I analyzed the three samples which I brought with me for the amount of water; if you wish the results I can give them to you.

A. Yes, sir, give the results if you please? A. The milk from the Mooley cow, which stood at 99 contained 86.66 per cent. of water; the milk from the Black cow, which stood at 78 contained 91.54 per cent. of water; the milk from Fanny, which stood at 93 contained 86.97 of water; I also allowed them to stand to measure the amount of cream; the milk from the Mooley cow I could not see any definite line of cream at all; the milk from the black cow after standing raised about 11 per cent. in bulk, something which was not cream, it was a curdy substance that might have contained more or less cream but did not have the regular appearance of cream and undoubtedly was not; there was also a sediment in it, a small amount; the milk of Fanny raised 11.5 per cent. by bulk of cream.

Q. Was there any alkaline reaction in this sample? A. The reaction was strongly alkaline in all three.

Q. Is that a usual thing in normal milk? A. It is not, not so strong an alkaline reaction; the reaction of milk is very faintly alkaline, good milk.

Q. This was strong? A. This was strong.

Q. And in fresh milk the alkaline reaction is faint? A. The alkaline reaction is faint, it passes away when milk is sour and that will soon happen if the milk has been kept under conditions favorable for souring.

Q. Has this milk been soured? A. When I tested it; I do not know whether it is now, because I have not tested it since.

Q. Now, these samples did you keep under your own care from the moment the milk came from the cow till this moment? A. The samples which I took I did.
Q. State what precautions you took? A. I watched the cows milked, and then the milk was taken into the house and it was tested and then the samples were taken and placed in these bottles which I have here, the green bottles, and sealed up.

Q. By yourself? A. By myself.

Q. With a private seal? A. With a private seal; I am wrong, I put a different seal on each one so as to distinguish them.

Q. Have you kept charge of them since? A. I have kept charge of them since.

Q. The milk of the Black cow when it was taken, state its appearance? A. It appeared watery, and there were these curdy masses floating in it, which, when the milk was placed on a strainer, seemed to prevent entirely its running through, or nearly so. Mr. Root, I believe, put his finger in and rubbed them in this way, and the milk finally got through; the milk was strained before we took our test.

Q. Which is a sample of the Black cow’s milk? A. This is a sample of the Black cow’s milk [bottle produced]; I put some here in a colorless glass, a glass of less color, so that it might be seen; so that it might be more visible.

Q. Do you consider that normal milk from a healthy cow? A. I do not consider it milk in a normal condition; I should no more want to taste that, than I should want to taste matter from the ground.

Q. I understand you to say that you would not taste of it? A. Not any more than I would matter from a running sore.

Q. The outward appearance of the cow, did it seem healthy. A. So far as I could judge; her coat was rough, as I said.

Cross-examined by Mr. Waehner:

Q. Now, Doctor, do I understand you to say that all the cows in this dairy, with the exception of four, were strippers? A. All cows that were milked, with the exception of four, were strippers.

Q. The only knowledge that you had upon the subject that they were strippers was derived from information that you received from the farm, was it? A. I saw for myself that they were milked but once a day, and that they gave a very small amount.
Q. Now, how often had you been to Mulford's place?  A. That was the only occasion.

Q. You were not there upon the day preceding to ascertain whether these same cows had been milked?  A. To which day do you refer?

Q. Upon the evening preceding?  A. I was on Saturday evening, and saw them milked then; and also on Sunday morning I saw them milked again; and I saw the morning's and evening's milk.

Q. You left what time, on Sunday?  A. We left by the train which left there about half-past three.

Q. Then you will not swear that those same cows that had been milked in the morning were not milked in the afternoon?  A. I will not swear they were not milked on Sunday afternoon; I will swear they were not milked on Saturday afternoon; the man only milked the four cows and then came into the house, and was with me for an hour or so; all the male members of the family were about.

Q. Did he milk the cow Andrew?  A. Yes, he milked the cow Andrew on Sunday morning.

Q. Do you know whether he milked her on the evening preceding?  A. I know he did not.

Q. Was she a stripper, also?  A. She was a stripper.

Q. There were eight strippers?  A. Yes, sir; there were eight strippers.

Q. You did not take any samples from Andrew?  A. No, I did not.

Q. The milk by the lactometer stood 104, did it, in the case of Andrew?  A. In the case of Andrew, it stood 104 at 59.

Q. How much did she yield?  A. She yielded about half a pint.

Q. Star yielded milk at 103 and a half by the lactometer?  A. That might have been Mr. Doremus' record, mine is 104.

Q. She yielded but a pint of milk?  A. She yielded a little over a pint; I put it down between a pint and a quart.

Q. Can you say definitely how much over a pint?  A. I should think about a pint and a half.

Q. That is a stripper also?  A. She is a stripper also.

Q. Rider, with the lactometer at 103, and at 60, yielded three pints, that is a stripper also?  A. Yes, sir; three pints.
Q. Now, how long has that bottle been in your possession?
A. It has been in my possession since last Sunday.

Q. You have had this bottle in court here since that time, have you not?  A. I had this here yesterday.

Q. Taken it from here?  A. Taken it to my house.

Q. There is a change of temperature in your house, is there not?
A. I took care to put it into a cold room and let it remain there?

Q. Did I understand you to say that you had analyzed a sample of that milk?  A. I did.

Q. Is that all the sample that you took?  A. This is not all; the contents of these bottles is what is left; I brought the sample home; I unsealed the bottle on Christmas morning and took out sufficient for an analysis; I gave some to Doctor Chandler; he wished to let it stand to see how the cream raised; and then I put some in these bottles and sealed it up again.

Q. Then that is not the original bottle which you sealed at Mulford's?  A. These greenish bottles are the original bottles which I sealed there.

Q. But the smaller bottle is not?  A. The smaller bottle is not.

Q. You made an analysis, you say, of the milk from the Black cow?  A. Yes, sir; I did; that is for water; I did not test it for anything else.

Q. And Fanny also?  A. Yes, sir; and Fanny.

Q. You did not analyze the milk from Star?  A. I did not; I did not take any sample.

Q. Nor of any of the others?  A. I analyzed the milk from the Mooley also; those three.

Q. Then three that you only analyzed were the milk of strippers which fell below 100?  A. Yes, sir.

Q. And those which were above 100 were perfectly good milkers?  A. No, sir; I did not say anything of that kind.

Q. I ask it as a question?
(Objection to.)
A. I do not know whether they were or not; I do not think they were.

Q. Now this milk which stood at 103.5 was Star's?  A. I believe I made it 104.
Q. From the inspection of that milk and the test with the lactometer and the evidence of your senses did you regard that milk to be pure wholesome milk? A. I should not judge from the experiments, from the other samples.

Q. If you had not the other samples and should find a sample of milk standing at 103½ by the lactometer, which, upon analysis, would not show any abnormal condition, would not you regard that as pure wholesome milk? A. Well, if I applied all my senses to it; I did not apply the sense of taste to that; I did not test any of the samples of milk.

Q. Did you regard that standing at 103½ as the other which stood at 78?

(Objected to; objection sustained.)

Q. Have you any of those samples here which stood over 100? A. I have not.

Q. How many samples have you got here? A. I brought three samples.

Q. And all those stood below 100? A. All those stood below; one of them but one degree below.

Q. Upon your analysis of the milk of the cow Mooley did you discover anything abnormal about that? A. Not so far as I got; the percentage of water is about correct with the exception of a strong alkaline reaction which is in itself suspicious as to the quality of the milk.

Q. Will you explain what you mean by alkaline reaction? A. It turns the testing-paper blue.

Q. Well, did you regard that as pure wholesome milk from the cow Mooley? A. I should hardly think it was.

Q. That I understand you to say stood at 99 or 98½, which is it? A. I made it 99.

Q. Now the milk from the cow Fanny which had nearly 87 per cent. of water, what did your analysis determine there? A. The same as in the case of the cow Mooley.

Q. What inference did you deduce or what did you conclude from this alkaline reaction being apparent in those samples? A. That there was something abnormal in the milk; what I could not tell.

Q. You could not tell what it was? A. No, not without any
further examination; a microscopic examination might be necessary.

Q. Did you make any further examination? A. No, sir; I thought the state of the health of the cow was sufficient.

Q. Now concerning that strainer, Dr. Waller, don't you recollect the offer of some person present there to clean the strainer? A. Mrs. Mulford offered to clean the strainer, I believe she did offer to do so.

Q. Was not that obstruction of the strainer produced by the dirt in it at the time? A. No, it was not.

Q. Are you sure about that? A. I am sure about that because the dirt that was in the strainer was almost entirely straws and things that did not really clog the strainer at all, they just lay there.

Q. They were straws lying at the bottom? A. Straws lying at the bottom and dropped into the milk while milking.

Q. And it was necessary if you wanted the milk to run through to remove these straws? A. No, there were not straws enough for that; you could count them on your fingers, three straws about an inch long.

Q. Did anybody ask Mrs. Mulford to wash these?

(Objected to; objection sustained; exception.)

Q. This lactometer that you had with you, did you test that yourself? A. That was one of those that I tested myself.

Q. The results of these strippers, the milk that comes from the strippers, does not that come to the city the same as other milk does?

Objected to; objection sustained.)

JOSEPH T. O'CONNOR recalled, by Mr. PRENTICE:

Q. Dr. O'Connor, you were with Dr. Waller on the 23d and 24th of December on a visit to Mr. Mulford's farm? A. Yes, sir.

Q. And there met Thomas C. Doremus and Mr. Root? A. We did, the next morning.

Q. You witnessed the milking of cows? A. I witnessed some of them, not all of them; I was present in general, we divided up the work as it were, but in all cases the milk was brought into the
house and all four of us saw it there, and tested it and we all agreed substantially.

Q. You have heard Dr. Waller's testimony in regard to the circumstances of that visit now given? A. Yes, sir.

Q. Was it correct? A. Yes, it seems to me so.

Q. Did you test the milk of the different cows? A. Of some of them, sir. Dr. Waller and I tested together the milk of the four cows which were known as milkers; that was on Saturday night and on the next morning.

Q. Did you hear Dr. Waller read the tests? A. Yes, sir.

Q. Does your memory agree with his? A. My memory does of that Saturday night; I have no memorandum of Saturday night, because I put half of it down myself in Dr. Waller's book, but my memory is that it is correct, as I was present and saw the thing written down; of the next morning, however, I have a full memorandum.

Q. Now, sir, what cows were milked on Saturday night? A. The cow Charley; three or four quarts at 59 degrees stood at 105; the cows Charley, Red Heifer, Blue cow, and Gypsy were milked in my presence Saturday night.

Q. Any other cows? A. Not that night, sir.

Q. Now, sir; how about next morning? A. The next morning there were milked in my presence the same four cows just given.

Q. And is the test the same? A. Well, the tests were what Dr. Waller read I suppose; I have no doubt about it; we all agreed upon that point substantially, within a very small fraction.

Q. Go on. A. Following them came the cow Andrew.

Q. Any distinction in the cows? A. Yes, sir; these following ones are the strippers.

Q. Give them, if you please? A. Andrew, Fanny, Star, Spot, and I am not sure I saw the Yellow cow milked; I do not know, I have forgotten about that.

Q. Did you watch the milking of the Black cow? A. I did not.

Q. Did you see the milk of the Black cow after it was taken? A. I did, sir.

Q. What was its appearance? A. Its appearance was that of a thin fluid that looked to me to be perceptibly bluish, having float-
ing upon its surface, as it was floating in the pan, stringy clots; I should say round masses, well perhaps an eighth to a quarter of an inch in diameter and having a stringy appearance; I called the attention of the gentlemen to this appearance and it was noticed; upon being thrown on the strainer the first portion of it passed through readily, but it seemed to clog, and one of the gentlemen, as has been testified, in addition to simply removing the obstructions that were there to its passage, rubbed the stringy masses, crushing them through the meshes of the strainer.

Q. What were the obstructions?  A. I think it was this clotted substance itself, although there were some straws and particles of dirt.

Q. Did you judge that to be normal milk?  A. In no sense, sir.

A. From the indications that you then saw of the milk of that cow should you judge that cow to be a healthy one?  A. I should judge from the product that her bag gave that she was not in a healthy condition.

Q. You saw the cow?  A. Yes, sir; I saw the cow afterwards.

Q. What were the cows feeding on?  A. As far as my knowledge goes they were feeding on straw.


Q. Was there any conversation about the food of cows in the presence of Mr. Doremus?  A. I do not know whether those gentlemen were there; it seemed to me that we were all together passing into the barn. Somebody, I believe it was myself, kicked over a little stuff and said, What are you feeding? Is this hay? I would not say that Mr. Doremus was there; we were all in a crowd together, but my impression is Mr. Doremus was there; he may not have been beside me and may not have heard me; I do not know about that; we were all there together.

Counsel—I object to what other people said to him.

The Court—That is excluded.

By the Court—Q. Do you say you saw them feeding on oat straw?  A. I did, sir.

Q. You saw them eating nothing else?  A. I saw them eating nothing else.

By Mr. Prentice—Q. Now did you receive a bottle from Dr. Chandler?  A. I did, sir.
Q. Do you know what it contained? A. Well, sir, I can state what it was said to contain; it contained the milk—

The Counsel—We object.

Q. Was it like or unlike that milk you saw taken afterwards from the Black cow? A. It was like it except that I saw in his bottle none of the large clots with the stringy masses attached.

Q. But in other appearances it was like that? A. Yes, sir.

By the Court—Q. Which cow was that? A. The Black cow.

By Mr. Prentice—Q. What did your examination disclose; state how you conducted your examination of this and what it disclosed? A. I took that milk—

By the Court—Q. That was the Black cow? A. Yes, sir, and tested it with red litmus paper and found it strongly alkaline on the date I received the bottle.

Q. Did you taste it? A. I did by inadvertence.

Q. Did you intentionally taste it? A. No, sir.

Q. Well sir, go on? A. I poured it then into a conical glass which had been thoroughly cleansed by me, and allowed it to stand for some hours; I then examined a whitish sediment which appeared at the apex of the cone within the glass and made repeated examinations, taking up various portions and examined them through the microscope.

Q. You examined it with the microscope of what power? A. I estimate the power of the microscope as I used it to be about two hundred and fifty diameters.

Q. What did you find? A. I found this white sediment which was at the bottom of the glass to be loaded with fine pus corpuscles.

Q. What is pus?

(Objected to.)

Q. You are a doctor? A. I am a medical man by profession.

Q. How long have you been in practice? A. I graduated very nearly ten years ago.

Q. Have you made microscopic observations? A. I have made a large number of them.

Q. What is pus? A. Healthy pus, laudable pus—because there are a variety of pusses so that it is impossible to define them—laudable pus, as it is termed, is a thick creamy liquid of the specific gravity of somewhere about 1.030—a state of the liquid to a certain
organized substance within termed pus-cells. That is a definition of pus.

Q. Where do you find pus? A. Pus may be found in various conditions in various parts of the body.

Q. Is it a morbid secretion? A. It undoubtedly is a morbid secretion.

Q. Had this a healthy or unhealthy appearance? A. It was certainly unhealthy, it was a morbid product.

Q. Do you call this substance normal milk? A. It may contain the elements of milk, but it certainly has other substances added which makes it as a whole not milk as a natural normal product.

Cross-examined by Mr. Lawrence:

Q. When did you receive this bottle containing the pus? A. I received it yesterday.

Q. When did you test it? A. I tested it yesterday afternoon, I commenced the test of it yesterday afternoon.

Q. Where is it now? A. Well, I have used it up, a good deal of it.

Q. Where did you get it from? A. From Dr. Chandler here.

Q. Now can you state what that fluid was originally? A. No, sir.

Q. Can you state what the reaction was or what it would have been if tested when fresh? A. No, sir.

Q. Now, sir, can you state whether the alkaline reaction was due to ammonia or potash? A. It was not due to ammonia.

Q. What was it due to? A. It may have been one or the other of the alkalies; I made no test to examine for that.

Q. May not the reaction have been different a day or two before the time you made your test? A. It might have been. I do not know anything about its history before, as far as my own knowledge goes.

Q. Did you ever analyze milk that had been a long time from the cow? A. No, sir.

Q. Well, now, sir, have you ever taken the reaction of milk as it came from the cow? A. No, sir.

Q. Then how do you assume because there action is alkaline that it is unhealthy? A. Because I know that milk in that period, or rather the period that I was informed was the length of time ex-
pired from the time I got it, milk even at this temperature would have turned sour.

Q. What time was it?  A. It was a week ago last Monday, as I understand it.

Q. Then you pronounced it unhealthy because it soured within a week?  A. It had not soured in the first instance.

Q. Do you know at what temperature it had been kept?  A. I do not know, sir.

Q. You stated just now, sir, what healthy pus was; will you state what unhealthy pus is?  A. Unhealthy pus cannot be defined; as far as I take it there are various varieties; I would simply state that in all pus these peculiar bodies termed pus-cells are present.

Q. Now, sir, is not all pus unhealthy?  A. I said healthy pus, I meant to say laudable pus.

Q. What did you find that is praiseworthy in it; do I understand you correctly now that there is no such thing as healthy pus?  A. Well, sir, as all pus is the result of unhealthy processes, I take it there is no such thing as healthy pus, but the term healthy pus is used to apply to a pus which is not abnormally far from the pathological standard.

Q. Well, now, are there not white blood corpuscles found in this milk?  A. Yes, sir.

Q. How do you know the blood corpuscles may not have been mingled with the fluid?  A. I know that it is a principle in pathology that white blood corpuscles are not present outside of the blood in such immense numbers as I saw them, except under conditions of inflammation, and then they are termed pus.

Q. Well, sir, did you ever apply the microscope before to milk that was a week old?  A. I did not, sir, to milk a week old.

Q. Now can you state that at the end of a week milk a week old would not present the same results as were obtained by you from your analysis of this fluid—milk kept at varying temperatures I mean, sir?  A. No milk, no matter how long it could be kept, could have pus corpuscles develop in it; pus corpuscles must have been there when the milk was drawn.

Q. Is it your opinion that no healthy milk which had been kept
for a week in varying temperatures would present the same results that came from this fluid tested by you?  A. Yes, sir.

Q. Now what was the appearance of this fluid?  A. In which way, sir, under the microscope or in the—

Q. Under the microscope?  A. There were a large of number fat globules which are of course always present in any milk fluid, that is to say in fluid made by the admixture of milk or in an emulsion.

Q. Did you take the specific gravity of this fluid?  A. I did not.

Q. How much butter did you find contained in it?  A. I made no chemical analysis.

Q. You simply made a microscopic test?  A. A microscopic test.

Q. And never have tested milk a week old before with the microscope?  A. No, sir.

Q. Now suppose the milk which you saw come from the black cow was kept for a week in varying temperature, might it not at the end of the time present the same phenomena you noticed in this sample?  A. It could not present as a result of its keeping those bodies we term pus corpuscles.

Q. These corpuscles which you found in the other fluid?  A. Yes, sir.

Q. Now do you infer that anything had been added to this milk?  A. Not at all.

Q. Now, Dr. O'Connor, what, as far as you saw, was done with the milk from the various cows at Mulford's, including the strippers?  A. As far as I saw all the milk was placed in a can, with the exception of the milk from three cows which was equally divided, or nearly so, in each case between Mr. Doremus and Dr. Waller, they taking about half if I remember rightly; I think in each case they took all; I am not quite sure.

Q. Can you tell whether that milk was not sent to New York?  A. No, sir; I cannot tell that it was not sent to New York.

Q. Did you examine the cows from which some of this milk came?  A. In a cursory way by looking at them.

Q. Did you detect anything unhealthy about them externally?  A. I saw nothing special externally; they looked rather rough, that is all.
Q. Did you concur with the gentlemen present that they were healthy cows? A. I might say that a cow does not look to be healthy or unhealthy, and I would not mean by that that she was healthy.

Q. If a cow was neither healthy nor unhealthy what state was she in? A. She might have been in that negative state; I think I can consider such a state as possible.

Q. Will you describe the appearance of a cow that is neither healthy nor unhealthy? A. I just said it could not be described by appearances.

Q. Well, sir, what was the size and appearance of the corpuscles you found in this fluid? A. They were about I should judge, simply in a rough sort of way, they were larger than the three-thousandth part of an inch; I should say about the twenty-four-hundredth part of an inch; somewhere along there; they varied in size.

Q. Well, sir, will you state further what their appearance was? A. They were under a microscope; they had been lying in that liquid, and perhaps somewhat enlarged; globular bodies studded with dark granules apparently on their outside; under treatment with acetic acid, these outside appearances cleared up they became more transparent, and there were four or five dark bodies in there which are termed nuclei.

Dr. Chandler, recalled by Mr. Prentice:

Q. Dr. Chandler, you received a bottle—

Mr. Lawrence—I admit that I gave Dr. Chandler a portion of the contents of bottle No. 3, being the same that was so frequently referred to.

Q. Is that the bottle Dr. O'Connor has been testifying about? A. It is.

Q. You gave it to him? A. I did after testing it myself.

Q. Tell us what you found in it? A. In the first place I tasted of it; having heard the testimony of the witnesses that it was milk, healthy and under normal conditions, I did not hesitate to taste it; it had a very offensive taste, and I spit it out as quickly as I could; that drew my suspicion to the character of the sample and I examined it further after sending Dr. Waller and Dr. O'Connor up to
the farm to find out what was the matter with the cows; I found out that it had a very strong alkaline reaction which I never before saw in a sample of genuine milk, and that it did not lose this reaction, but retained it as long as it remained in my possession; I found further, that on allowing it to stand a scum formed upon it which was quite different from cream; a slimy scum; I determined the water in it, which was 91.64 per cent.; I examined it under the microscope, and it had an appearance entirely different from that of any sample of milk that I ever examined; it had, besides the fat globules which it contained, and exhibited under the microscope, objects which I had occasionally seen in urine containing pus, and not being a medical man and not specially familiar with morbid secretions, I turned the specimen over to Dr. O'Connor, who was an expert on such subjects, with the request that he examine these unusually strange objects to ascertain their nature.

Q. Did you test these other samples that were brought back on December 24th? A. I saw them tested.

Q. You have heard the testimony in reference to them? A. Yes, sir, I have; the only test which I saw applied was the test of reaction with litmus paper.

Q. For what? A. To see whether they had the usual reaction of milk or exhibited this extraordinary alkaline reaction.

Q. What was the case? A. They were all very strongly alkaline.

Cross-examined:

Q. Do I understand you, sir, you never found an alkaline reaction before in sour milk? A. I never did.

Q. Now sir, did you ever taste milk before that was a week old? A. I do not think I have because milk a week old is soured generally and its appearance forbids the application of the tongue.

Q. Would it not be likely to have a very offensive taste? A. Sour milk certainly, but this was not sour.

Q. Now, suppose a sample of milk had been kept a week and had been so kept that it could not get sour, what kind of a taste would it have? A. Natural taste I should say; I never kept a sample a week, however, without getting sour.

Q. That is not anything more than your opinion, is it? A. That is all.
Q. Well, what was the difference between that and other milk under the microscope?  A. Besides the ordinary fat globules it contained those globules which appeared to my limited knowledge of such subjects to be pus globules.

Q. Do you know whether pus globules might not appear in any milk a week old?  A. I have read about pus ever since I began to study chemistry; I always understood, though I am not a physician, that pus was a morbid secretion which formed in sores, and if that is the case it could not possibly be generated in milk, no matter how long you kept it.

Q. Might it not have been contained in milk when it came from the cow?  A. Yes, sir.

Q. How soon would the presence of pus in pure milk, I mean milk as it came from the cow, ordinarily become apparent?  A. Any time after it came from the cow when examined by the microscope.

Q. Do you deem a microscopic examination of milk necessary to show whether in its original state it contained pus globules?  A. It might be desirable as one of the many methods of investigating milk.

Mr. Prentice—May it please the Court, that closes our case.

Charles A. Doremus recalled by Mr. Lawrence:

Q. Did you receive a portion of the contents of bottle No. 3 of milk procured at Mulford's December 18, being the same bottle of which a portion was delivered to Dr. Chandler?  A. I did, sir.

Q. Was it subject to chemical analysis?  A. It was to a partial chemical analysis, the result of which I have here, simply as to the constituents of water and caseine, not to a microscopical examination.

By the Court—Q. You stated what per cent. of water?  A. I did the per cent. of water, caseine and sugar.

By Mr. Lawrence—Q. State the results of the examination of the milk I refer to?  A. I placed some milk on the slide of the microscope and examined it under the microscope to see if anything abnormal might be found; this was a sample from the Black cow which was kept in court.
Q. What was the result? A. Beyond the presence of fat globules, which are very easily recognized and a little clotted caseine, I saw nothing abnormal; I am conversant with the appearance of pus corpuscles and looked for something abnormal.

Q. You are familiar with pus corpuscles? A. Yes, sir; I found none.

Q. How powerful was your microscope? A. I suppose four or five hundred diameters.

Q. Did you taste this milk? A. I do not remember now whether I did or not; I looked at it when it was evaporating; I noticed nothing about its smell.

Q. What else did you observe? A. That has already been given; they agree with Prof. Chandler's analysis.

Q. Did you state anything else that was abnormal?

Mr. PRENTICE—A juror asked that we should take a sample of commercial milk which would stand not higher than 102 and reduce it in the presence of the jury fifteen degrees by water. If the jury desire that, we are ready to do it.

THOMAS C. DOREMUS, JR., recalled by Mr. LAWRENCE:

Q. Did you taste the contents of bottle No. 3 procured by you on December 18? A. I did, sir.

Q. When? A. I opened the bottle and took the seal off here in court and gave Prof. Chandler a sample of the milk; at that time I tasted it.

Q. Well, sir, was it sour? A. It was to my taste most undoubtedly very sour.

Q. That was on the 22d—was it not—last Friday A. I forget the date.

Q. I wish you would taste if that is the same thing?
(Bottle shown.)
(Objection.)
Q. Test that milk with litmus paper?
(Objection; objection sustained.)
Q. I asked him if he would take a piece of litmus paper and put it in that sample of milk and see whether it was alkaline or not. The milk from the Blue cow taken on the 24th.
(Objected to, first, for the reason that this gentleman is not a chemist and is not qualified as an expert to make that test. Whether that is litmus paper and whether that is the milk of the Black cow of the 24th or not we do not know. I simply put this witness on the stand for the purpose of identifying what had been given to test; it is no matter of rebuttal.

Mr. Prentice—I withdraw it.

Mr. Lawrence—Here is some milk, it is an unknown fluid; perhaps it may have been adulterated already, to the extent of 10 or 15 per cent. While I have not the slightest objection to the experiment we shall want to show to the jury the effect of adding 15 per cent. to pure milk.

The Court—Dr. Waller will proceed to make the experiment with the milk.

Dr. Waller—This milk is pretty cold; it stands about 117.

By Mr. Lawrence—Q. At what temperature, Dr. Waller? A. The thermometer stands a little short of 55; call it 55—it is a fraction short; about 116 the lactometer stands now.

Mr. Prentice—The jury desire that reduced to 100 in the first place.

Dr. Waller—I will add about one tenth; the water is cold and it has reduced the temperature.

By Mr. Lawrence—Q. How much water have you added? A. I added what I roughly estimated was about 10 per cent.; it stands at 105. The water is a little cold, and the thermometer, when I last looked at it, was 54.

By Mr. Prentice—Q. What is it now? A. It is 54.

By the Court—How low did it fall? A. It came down to 105.

By Mr. Lawrence—Q. About how many per cent. of water have you added? A. About 15 per cent.

Q. Any more than that? A. I may have added a little more than that, it may be as much as 16 per cent. The thermometer stands at about 55, the milk stands at 90.

By the Court—Q. What do you mean, 15 per cent of the whole volume of milk? A. Yes, sir.

Q. Not all the water in the milk, but all the whole milk? A. Yes, sir.
Dr. O'Connor recalled by Mr. Prentice:

Q. Where did you get that milk? A. I got it at Sandford & Woodhull's, 32d street, near Broadway. It was taken from a fresh can which had come down; it had not been opened on the way down, at least I presume so; the wires were intact; I saw the wires broken and saw this milk taken out.

By Mr. Lawrence—Q. Do you know this to be pure milk? A. I have not any doubt about it.

Q. Dr. O'Connor, don't you know the people where you purchased that milk are skimmed milk dealers? A. I do not.

Thursday, December 28, 1876.

Mr. Lawrence—I want to prove that the milk which was last tested yesterday afternoon has since been tried and found to be skimmed milk. We have in Court the most distinguished microscopist in America to prove that the milk of December 18 contains no pus, nor anything like it.

The Court—I think the evidence must be considered closed.

Mr. Lawrence—If we can limit it only to pus, it will take but a single moment; the other side had leave to open the case yesterday; we have the apparatus here in Court, and it is susceptible of proof in an instant; we want to show that Dr. O'Connor was grossly mistaken; if your Honor will not let it in any other way, I will shorten my summing up; I ask my friend to admit that it was skimmed milk.

Mr. Prentice—It was commercial milk; it came from the hands of the milk dealers, and the milk dealers are defendants in this case; I have the evidence before me.

The Court—I decline to hear it.

Mr. Waehner—We desire to renew the motion for an acquittal upon the close of the case of the prosecution upon the same grounds as then stated. The grounds upon which I moved for an acquittal on the close of the case of the prosecution were these: That first, the prosecution had failed, or at least so far as the indictment was concerned it was defective, in this, that it did not allege, in the so-called
second count, a further finding by the Grand Jury; that the second count is defectively drawn, in this, that it does not show a further or separate presentment, and that, therefore, there are two distinct statutory offenses substantially included in one count of the indictment. You cannot charge two distinct offenses in one count. I move, further, upon the ground that there is no allegation in the indictment that the sanitary code therein referred to is a code of sanitary laws applicable to the city and county of New York; that it was ever adopted by the Board of Health, or by any Department of the city government, or by any proper authority; that there is no allegation that that code was published as required by law; or that the ordinance, or that the ordinances constituting it were passed and published in conformity with law; or that the Health Department of the city of New York, in pursuance of the Act of 1873, conformed any of the ordinances theretofore existing to the Act of 1873; or that the predecessors of this Board had ever passed any code or ordinances whatever; or that that code of ordinances was published, as required by law. Upon that point I have direct authority that the indictment is defective. I stated that upon the opening of this case, and warned the prosecution at that time. The authority is in 1 Parker, page 481, Reed vs. The People.

The Court—If you are correct, you have the right to make a motion in arrest of judgment; I have not examined that question; I can see very well that there may be some question about it; it is a question of law; I rather think that the indictment is sufficient.

Mr. Prentice—There are two answers to that. In the first place, it has been held repeatedly that the Board of Health, as constituted for this city, is recognized in a different way from the Act of 1850.

Mr. Waehner—We shall ask you to charge this jury, as far as the first count in this indictment is concerned, they must acquit the defendant.

The Court—I think it is very plain that I must do it; but, Mr. Prentice, I shall hear you briefly.

Mr. Prentice argued in opposition to the motion.

The Court—I shall think it my duty, in view of the evidence in this case and of the law of the State under which the first count of the indictment was framed, to direct the jury that the prisoner is entitled to an acquittal on the ground that there is not sufficient
evidence to submit to them on the question whether he knew that the milk was watered. That is the first count. I do not see why you are so urgent on that point, because you have got the second count; I suppose that would be conceded. I should almost say to the jury that there was no evidence that it was milk he kept for sale, that he knew it was watered.

Mr. WAEHNER—I desire to have entered on the minutes the motion for an acquittal, in addition to the other grounds I have stated, on the ground that there is no evidence to sustain the second count of the indictment.

The COURT—the motion is denied. You can take your exception.

Mr. WAEHNER—Note an exception. I understand your Honor grants so much of my motion as relates to the first count.

The COURT—Yes, sir.

Mr. WAEHNER—And your Honor denies the motion as to the other points?

The COURT—I shall charge substantially as you requested me on the first count.

Mr. LAWRENCE and Mr. PRENTICE summed up.

THE JUDGE’S CHARGE.

Judge SUTHERLAND charged the jury as follows:

GENTLEMEN OF THE JURY—By the 82d section of an act of this State, passed April 30, 1873, entitled “An act to reorganize the local government of the city of New York,” the 82d section of the act provides as follows, after the previous section had provided for the organization of the Board of Health, or Health Department:

“It shall be the duty of said Board, immediately upon organization under this act, to cause to be conformed to this article the sanitary ordinances then or lately adopted by the existing Department of Health, which shall be called the sanitary code, and said Health Department is hereby authorized and empowered to add to such sanitary code, from time to time, and shall publish, additional
provisions for the security of life and health in the city of New York, and therein to distribute appropriate powers and duties to the members and employees of the Board of Health, which shall be published in the City Record. Any violation of said code shall be treated and punished as a misdemeanor.” It has been proved in a satisfactory manner by the certificate of the Clerk of the Board of Health, that on the 23d of February, 1876, the Board of Health adopted this ordinance, which I will read to you: “Section 186. No milk which has been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream, shall be brought into, held, kept, or offered for sale at any place in the city of New York, nor shall any one keep, have, or offer for sale in the said city any such milk.” You will notice that the words of the section of the sanitary code which I have read to you are not that no one shall keep knowingly for sale milk which has been watered, adulterated, reduced, or changed by the addition of water. The question of the constitutionality of the act to authorize the Board of Health to pass ordinances unknown to the Legislature, and which were thereafter to be passed, declaring violations of such unknown ordinances to be misdemeanors—that question has not been raised; but, if it had, I have looked over the opinion of Judge Daniels, in another milk case, at the General Term, and I am inclined to think that the General Term intended to pass upon that very question. They held that that section of the act of 1873, a portion of which I read to you, was constitutional; so I understand the opinion. It is plain, I think, that the word milk in this ordinance means cows’ milk, and I charge as matter of law that this is the meaning of the word, so far as I have the right to charge that matter as matter of law. The indictment on which the defendant is being tried has two counts. The first charges that on the 25th day of August, 1876, the defendant unlawfully and knowingly exposed for sale at his store in the city of New York blank quarts (the number not being filled in in the count, but being left blank) of impure, adulterated, and unwholesome milk, against the form of the statute. I think it may be presumed that that count was drawn under the act of the Legislature passed in 1864. The second count of the indictment charges that the defendant, on the 25th of August, 1876, at his store and place of
business in the city of New York, being the place where milk was kept for sale, did unlawfully keep, and have, and offer for sale ten quarts of milk which had been and was then and there watered, reduced and changed by the addition of water or other substance, in violation of the provisions of the sanitary code. In view of the wording of the second count of the indictment and in view of the provisions of the sanitary code which I have read to you, and of the provisions of the act of 1873 which I have read to you, and of the evidence of this case, I charge you that if the evidence in this case satisfies you beyond any reasonable doubt that the fluid which Assistant Inspector White saw in the milk-can in the defendant's store and place of business in the city of New York, on or about the 25th of August last, and a portion of which he then and there examined and tested with the lactometer, of which fluid Dr. White testified that the can appeared to be about half full, and of which fluid the defendant testified there was 25 quarts, was cows' milk which had been and was then watered, adulterated, reduced and changed by the addition of water, and that the defendant then and there had and kept such watered, adulterated and reduced and changed cow's milk for sale, you can and ought to find the defendant guilty of the offence charged in the second count of the indictment; otherwise you ought to find the defendant not guilty of the offence charged in the second count of the indictment. Will the evidence in this case, especially that of the defendant, of his son, and of Dr. White, permit you to doubt that the fluid in the milk-can was either cows' milk which had been watered, or cows' milk which had not been watered, that it was one or other of those fluids? Dr. White testified to certain facts or circumstances from which he testified that he inferred or came to the conclusion that the fluid in the can was milk to which 15 per cent. of water had been added. One of these facts or circumstances was, that upon testing the fluid at the temperature of 60, as shown by a thermometer and by the lactometer, for the purpose of ascertaining its specific gravity and then stating the result of such test. I do not mean to detain you by referring at all to the evidence in detail. The counsel for the prosecution claims that the fluid which Assistant Inspector White examined by his senses and tested with the lactometer and thermometer at the defendant's store and place of
business on the 25th of August last was cow's milk, the weight of which had been so much lessened and which had been made so thin and diluted by the addition of additional water, that the evidence in this case should satisfy you beyond any reasonable doubt that the fluid which he so examined and tested—that Dr. White could and did ascertain with reasonable certainty and beyond any reasonable doubt that the fluid was cow's milk which had been and was then watered by the addition of additional water; and that the evidence of Dr. White as to the manner in which he examined it and tested the fluid, and the evidence which may be called the scientific evidence in this case, should satisfy you beyond any reasonable doubt that the fluid which he so examined and tested was cows' milk which had been watered by the addition not of fifteen or ten per cent. of water, but had been watered by the addition of water. The section 186 of the sanitary code which I read to you and under which I presume the second count of the indictment was framed does not in terms prohibit the keeping of milk for sale below a certain specific gravity, but it does prohibit the keeping of watered milk for sale. The second count of the indictment does not allege that the ten quarts of milk mentioned in it was milk which had been watered by any certain specific per cent. or any specific quantity or weight of water, but it does allege that the ten quarts of milk had been watered and adulterated by the addition of water. One of the material questions which you are to determine in this case is whether the fluid inspected and tested on the 25th of August was cow's milk which had been watered; not whether it was cow's milk which had been watered by the addition of 10 or 15 per cent. of water, or of any particular per cent. of water, though the result of the test by the lactometer and thermometer as testified to by Dr. White, if you credit it, may be very material in determining the question whether the milk was or was not cow's milk which had been watered by the addition of water. There is no direct evidence in this case that the fluid which Dr. White examined on the 25th of August and tested, had been watered or had water added to it; by this remark I mean that no witness has testified that he saw or heard water poured into that milk. But it is claimed on the part of the prosecution that if you credit Dr. White's evidence, relating to his inspection and test of the fluid from which
it seems he came to the conclusion that it was cows’ milk which had been watered by the addition of 15 per cent. of added water, that from such circumstances, in view of the scientific evidence in this case, that you ought to be satisfied beyond any reasonable doubt that the fluid was cows’ milk which had been watered by the addition of additional water. Public officers in the execution of a public duty are entitled to the presumption as a presumption of law that they act in good faith and from proper motives, in the absence of any evidence tending to show otherwise; there is no direct evidence that the fluid which Dr. White inspected and tested was skimmed milk, and I think I may say that there is no evidence direct or circumstantial tending to show that that fluid was chemically and skillfully compounded by a skillful chemist; there is no evidence that the fluid was neither cows’ milk which had been watered nor cows’ milk which had not been watered; after the remarks I have made here during the trial it is hardly necessary to say to you that as to the second count of the indictment—and hence I have been particular in stating what that count charges and what the sanitary code is—that it was unnecessary for the prosecution on the part of the people to show that the defendant knew if this fluid was cows’ milk that had been watered that he knew it had been watered; I suggest to you whether you are not satisfied from the evidence in this case, this volume of scientific evidence, and I may say some evidence statistical, that the ordinance which should require the Board of Health to prove affirmatively that the milk was watered, and to what amount, amounted to but little. How could they prove it under ordinary circumstances? Now, gentlemen, the general question, of course, is under the second count of the indictment, and I will say a word about the other count in a moment—the general question for you to determine is did the prisoner commit or did he not commit the offense charged in that indictment? I say but little about the evidence, having seen with what attention you have listened to it, and presuming that you can, with precisely as much intelligence as I could, apply the evidence in this case, both scientific and the other testimony, to the questions involved in the determination of this general question of guilty or not guilty on the charge of the second count. I believe there is hardly a man on the jury that does not
recollect the evidence better than I do, because I have had other things to think of. Now, I submit the case to you with these remarks. I am tempted to extend them, to make other remarks, and perhaps only tempted because I thought it might be my duty to do so. I submit it to you with full confidence that you see the importance of the questions which may be involved in the determination of the issue formed by the defendant's plea of not guilty to the second count of the indictment. That is all I have to say to you, gentlemen, except so far as I am called upon to say something in pursuance of the requests which are handed up by the prisoner's counsel, and other requests he is going to ask me to charge. Now, the first is to acquit upon the first count in the indictment that there is no evidence that the defendant had knowledge of the adulteration. You will find him not guilty of the offense charged in the first count of the indictment, so that the question you will determine is confined exclusively to the second count in the indictment. The counsel requested me to charge, "First—That to convict the defendant the jury must first be satisfied beyond all doubt that the defendant did at the time and place charged in the indictment, hold, have, or offer for sale milk which had been watered, adulterated, reduced, or changed in some respect." Well, I will charge that, gentlemen, "all doubt," I suppose means reasonable doubt. "Second—That unless the evidence of the prosecution has generated a full belief of the matters charged in the indictment to have been committed by the defendant they must acquit him." Yes, I will charge that, gentlemen. "Third—That unless the jury have a full belief from the evidence of Dr. White that the fluid he tested at the place alleged in the indictment was first, milk, and, second, that it was adulterated by water, they must acquit the defendant." That I will charge, gentlemen, it is substantially what I charged I think. "Fourth—That unless the jury are satisfied beyond any reasonable doubt that at the time of testing the fluid found at the defendant's place of business, he [Dr. White] was qualified, by the evidence of his senses and the test with the lactometer and thermometer, to determine that said fluid was milk adulterated with water, they must acquit the defendant." I will charge that because I suppose he had as good eyes and as acute smell and taste: we have got to assume that, I suppose. "Fifth—That unless you are satisfied that the method adopted
THE JUDGE'S CHARGE.

by Dr. White, by which he reached the conclusion that the article found at the defendant's place of business was adulterated milk is accurate to determine whether it was adulterated milk, and generates a full belief in your minds that the same was adulterated milk, you must acquit.” I will charge that, gentlemen. “Sixth—that neither a mere preponderance of evidence nor any weight of preponderant evidence is sufficient for the purpose of conviction in this case unless it generates a full belief of the guilt of the defendant to the exclusion of all reasonable doubt.” That I will charge, gentlemen; I think I have substantially charged it.

Mr. WAEHNER—I request you to charge in addition to this that the statement of the counsel for the prosecution to the effect that four hundred thousand quarts of milk are daily brought to New York, and to that is daily added one hundred thousand quarts of water is not evidence, and should have no weight with the jury; it has not been proved.

The Court—Gentlemen, I charge you, that your verdict in this case should be from the evidence, and the law as laid down by the Court. You cannot look, and ought not to look to any statement by either counsel outside of the evidence in the case.

Mr. WAEHNER—Furthermore, right in that connection, I ask you to say to the jury that the statements of counsel with reference to the trial or the result of other cases is not evidence, and should be disregarded. It falls under the same ruling.

The Court—It certainly does.

Mr. WAEHNER—I desire to submit a very important proposition to your Honor, and refer you to an authority. “That if the tests made by the prosecution in this case upon the question whether the fluid found at defendant's place of business was adulterated milk furnished only questionable evidence of adulteration, it should not be regarded by the jury as sufficient to warrant a verdict of guilty; and if the jury find that analysis would remove the doubt and be necessary for the purpose of removing the doubt, it (analysis) should have been made and proven.”

The Court—I decline to do that; take an exception.

Mr. WAEHNER—I except to your Honor's refusal to charge that proposition; I ask your Honor to charge that the testimony given
on this trial establishes that analysis can be made and would be the surest test.

The Court—I decline to charge that; take your exception.

Counsel—Note an exception.

A Juror—Have they a right to put ice in the milk to transport it that season of the year, August?

The Court—I have read you the law; if the ice waters the milk—

Mr. Waechner—The statute gives permission to do so; they have a right to put ice in the milk.

Mr. Prentice—No, sir.

The jury retired, and after an absence of 45 minutes, returned with the following verdict: Guilty of the offense as charged in the second count of the indictment, and not guilty of the offense charged in the first count of the indictment.

Mr. Waechner—We ask your Honor to defer sentence in this matter to give us an opportunity to argue a motion in arrest of judgment.

The Court—You may state any grounds you choose to have on the record.

Mr. Waechner—We move an arrest of judgment upon the ground that the indictment is defective in this: First. That it is defective in joining substantially in one count two distinct offenses; that the second paragraph of the indictment, designated as the second count, is defective in not alleging and stating a further and separate presentation by the Grand Jury of a distinct offence. Secondly. Upon the ground that the indictment fails to state that the sanitary code therein referred to is a code applicable to and governing the city of New York; that that code was confirmed as required by the act of 1873, the charter of 1873, section 82, by the new Board of Health coming in office under that act, and that the original code of ordinances are not alleged to have been published as required by law, the act of 1866, and all the acts amending it, the act of 1867, and that it does not appear upon the face of the indictment that the ordinance proven, namely, section 186, was adopted by the Board of Health of the Health Department of the city of New
York; that it was ever published as required by law, and that, so far as the indictment is concerned and the proof given thereunder, there are two ordinances bearing upon this question; one is section 45 of the sanitary code, and the other section 186. I think that is all the grounds I desire entered on the record; also upon the ground I should say this—and that presented another question of law—that the Board of Health of the Health Department of the city of New York have no power to pass either ordinances section 45 or section 186, they being in conflict with the act of 1864.

The Court—That is not a ground in moving an arrest of judgment, because it does not appear on the face of the indictment; no matter; you have got it on the record.

Mr. Waehner—Your Honor denies my motion and note an exception.

The Court—Yes, sir.

The defendant was asked the usual questions before sentence was passed.

Mr. Waehner—As far as punishment is concerned, there is nothing vindictive about this.

The Court—I do not think it can be said there is any evidence that you knew that the milk that you are charged with keeping as watered milk was watered, but in view of the very great importance of the questions which have been discussed on this trial, which I may say was involved in the question whether you should be convicted or not, I think, I ought to pass a sentence which would satisfy you and your friends that it is best not to come here to be tried. I never have tried a more important question in the view I take of it than the question of your guilt. It would seem at first, however, it was rather a harsh law that you should be convicted of keeping watered milk when you did not know it was watered, but I can see plainly that unless that law can be enforced I do not see how the Board of Health is going to protect the public against watered milk. The idea, considering the quantity of milk that comes to this city, that they must resort to analysis and have a skillful chemist to analyze the milk would be very impracticable it appears to me. There are any number of acts of Parliament where the British subject is absolutely prohibited from keeping a certain article, and in a case which I read it was very learnedly discussed
whether, without any proof of guilty knowledge, that could be an offense, because the common law doctrine is, that there must be an intention to do wrong, to commit a crime, but the Court there came to the conclusion that the question was simply whether parliament prohibited. I think the question is here whether the Legislature authorized the Board of Health to prohibit the keeping of milk for sale when it was watered. Now, certainly, although this trial has been very tedious to me and has been a great tax on me and on the jury, I have not any feeling against you. I suspect you are as honest a man as there may be in your line of life; that is my own opinion. The sentence of the Court is that you be confined in the City Prison for the term of ten days, and that you pay a fine of two hundred and fifty dollars, and that you be confined from and after the expiration of the ten days, for a further term, until the fine shall be paid, not exceeding two hundred and fifty days.

Mr. Waehner—I suppose there is no objection to bail being taken after sentence by the Court. We are satisfied there are proper questions for review, and we ask you now to take bail.

The Court refused to take bail.
PAPERS ON APPEAL.

SUPREME COURT.

Daniel Schrumpf,
Plff. in Error,
vs.

The People, &c.

It is hereby consented that the above entitled cause be heard at General Term of the Supreme Court upon the Judgment Record only, and the making of the Bill of Exceptions and the service and printing thereof, so far as it relates to all matters, except such as constitute the Record, are hereby waived.

Dated February 14, 1878.

Lawrence & Waehner,
Attys. for Plff. in Error.

W. P. Prentice,

The People of the State of New York, by the Grace of God free and independent.—To the Court of General Sessions of the Peace in and for the County of New York, Greeting:

Because in the record and proceedings, and also in the giving of judgment upon a certain indictment which was in our said court before you against Daniel Schrumpf, for keeping and having for sale adulterated milk, manifest error hath intervened, as is said, to the great damage of said Daniel Schrumpf, as he complains, and we being willing that the error, if any, shall be corrected, and full and speedy justice be done to him, on that behalf do command you that if judgment be thereupon given, then without delay you distinctly
and openly send, under your seal, the record and proceedings and judgment aforesaid, with all things touching or concerning the same in any wise, to our Justices of our Supreme Court, at a General Term thereof (First Judicial Department), to be held at the new Court-House in the City of New York, on the first Monday of January next, together with this writ; that the record judgment and bill of exceptions aforesaid being inspected we may cause to be done thereupon for correcting that error what of right ought to be done.

Witness: Hon. Noah Davis, one of the Justices of the Supreme Court, at the new Court-House, in the City of New York, the 29th day of December, 1876.

By the Court,

[L. S.]

Wm. Walsh, Clerk.

Lawrence & Waehner,
Of Counsel for Plaintiff in Error.

[Endorsed.]

SUPREME COURT.

Daniel Schrumpf,
Plff. in Error,

against

The People, &c.

I hereby allow the within writ of error, and I do hereby direct and order that the writ of error is to operate as a stay of proceedings on the judgment upon which this writ of error is brought.

Dated the 29th day of December, 1876.

Noah Davis,
Justice of the Supreme Court of the State of New York.

Filed the 30th day of December, 1876.
New York, Dec. 29, 1876.—Having appeared for the prosecution upon application to me therefore, I waive service of notice of application for the within writ of error and stay of proceedings.

W. P. PRENTICE,
Counsel for the Board of Health.

The Answer of the Judges of the Court of General Sessions of the Peace, held in and for the City and County of New York.

A transcript of the Indictment and Judgment of the Court, together with all things touching or in anywise concerning the same.

We certify, under the seal of our said Court, to the Justices of the Supreme Court within mentioned, in a certain Schedule to this writ annexed, as within it is commanded.

By the Court.

[L. S.]

JOHN SPARKS, Clerk.

State of New York,
City and County of New York, 88.

Be it remembered, that at a Court of General Sessions of the Peace, holden at the City Hall, of the City of New York, in and for the City and County of New York, on the first Monday of November, in the year of our Lord one thousand eight hundred and seventy-six, before John K. Hackett, Esquire, Recorder of the said City of New York, Justice of the said Court, assigned to keep the peace of the said City and County of New York, and to inquire, by the oaths of good and lawful men of the said County, of all crimes and misdemeanors committed or triable in the said County, to hear, determine, and punish according to law, all crimes and misdemeanors in the said City and County, done and committed.

It was then and there presented as follows: that is to say,

City and County of New York, ss.
The Jurors of the People of the State of New York, in and for the body of the City and County of New York, upon their oath, present:

First Count.—That Daniel Schrumpf, late of the Seventeenth ward of the City of New York, in the County of New York aforesaid, on the twenty-fifth day of August, in the year of our Lord one thousand eight hundred and seventy-six, at the Ward, City and County aforesaid, unlawfully and knowingly did expose for sale at the store of him, the said Daniel Schrumpf, then and there situate,—quarts of impure, adulterated and unwholesome milk, against the form of the statute in such case made and provided, and against the peace of the people of the State of New York and their dignity.

Second Count.—That Daniel Schrumpf, late of the Seventeenth Ward of the City of New York aforesaid, on the—day of August, in the year of our Lord one thousand eight hundred and seventy-six, at the Ward, City and County aforesaid, at the store and place of business of the said Daniel Schrumpf, being premises known as Number two hundred and six Avenue B, in the Ward, City and County aforesaid, and the said premises being then and there a place where milk was kept for sale, unlawfully did then and there keep, have, and offer for sale ten quarts of impure and unwholesome milk, which had been, and was, then and there, watered, adulterated, reduced, and changed by the addition of water or other substance, and that such impure, unwholesome, watered, adulterated, reduced, and changed milk was then and there, by the said Daniel Schrumpf, unlawfully held, kept, and offered for sale against and in violation of the provisions of the Sanitary Code, and of such Sanitary Code then and there, and at all times thereafter, in force and operation, and against the form of the statute in
such case made and provided, and against the peace of the People of the State of New York and their dignity.

And the said Daniel Schrumpf afterwards, to wit, on the first day of December, in the year of our Lord one thousand eight hundred and seventy-six, at the place last mentioned, before the said Justice above named, came in his own proper person, and being brought to the bar here in his own proper person, and arraigned upon the said indictment, and having heard the said indictment read, and being asked whether he demanded a trial upon the said indictment, answers that he does require a trial thereon, and says that he is not guilty thereof; and thereupon for good and ill is put upon the county.

And Benjamin K. Phelps, Esquire, District Attorney for the City and County of New York, who prosecutes for the People of the said State of New York, in their behalf doth the like.

And afterwards, to wit, at a Court of General Sessions of the Peace held in and for the said City and County of New York, at the City Hall of the said city, on the twenty-eighth day of December, in the year of our Lord one thousand eight hundred and seventy-six, before Josiah Sutherland, Esquire, City Judge of the City of New York, and Justice of said Court, comes the said Daniel Schrumpf and the said Benjamin K. Phelps, Esquire, District Attorney, likewise comes. Therefore let a Jury thereupon immediately come before the Justice last above mentioned, of free and lawful men of the said city and county, each of whom hath, etc., by whom the truth of the matter may be better known, and who are not of kin to the said Daniel Schrumpf, to recognize upon their oath whether the said Daniel Schrumpf be guilty of the misdemeanor in the indictment aforesaid, above specified, or not guilty.

And the Jurors of the said Jury, by William C. Conner, Esquire, Sheriff of the City and County of New York, for this purpose empanneled, and returned, to wit:

John Murphy, John A. King, Jr., John Carey, Jr., James McDer- mott, John P. Winthrop, Isidor Busch, Thomas C. Lyon, George S. Lester, Adam Brautigam, Emil Mayer, John Haug, Henry Morrison, who, being called, come; and who being then and there elected, tried, and sworn well and truly to try and true deliverance make between the People of the State of New York and the said Daniel Schrumpf,
then at the bar, whom they should have in charge upon the said indictment, and a true verdict give according to evidence, who, upon their oath aforesaid, say that the said Daniel Schrumpf is guilty of the misdemeanor charged in the second count of the indictment aforesaid, above alleged against him.

And afterwards, at the same session of the said Court, the said Daniel Schrumpf came in his own proper person here before the Justice last above named, and moved that judgment upon the verdict aforesaid be arrested, and thereupon the Court overruled and denied the same.

And upon this it is demanded of the said Daniel Schrumpf, whether he hath or knoweth anything to say wherefore said Justice here ought not, upon the premises and verdict aforesaid, to proceed to judgment against him, who nothing further saith, unless as before he has said. Whereupon all and singular the premises being seen, and by the same Justice here fully understood, it is considered, ordered, and adjudged by the said Justice that the said Daniel Schrumpf, for the misdemeanor aforesaid, be imprisoned in the city prison of the City of New York for the term of ten days, and pay a fine of two hundred and fifty dollars, and to stand committed until said fine be paid.

Benj. K. Phelps,
District Attorney.

Judgment signed this 6th day of March, 1877.

Josh. Sutherland,
City Judge.

[Judgment affirmed by the General Term of the Supreme Court, First Department, April Term, 1878. See 14 Hun R. (S. C. R., 21), p. 10.]
APPENDIX.

I.—THE LACTOMETER.

1. The lactometer is a hydrometer which indicates specific gravities between 1.000, the gravity of water, and 1.0348.

2. It is used to determine the specific gravity of the milk.

3. As the specific gravity varies with the temperature, the observations are made at a standard temperature of 60° Fahr.

4. The specific gravity of the average milk at a milking of a healthy cow, properly fed and in a normal condition, varies from 1.029 to 1.0348. The former number being the lowest or minimum gravity, 100° is placed at this point on the lactometer; 0° is placed at 1.000, the gravity of water; the intervening space is divided into 100°, and the graduations are continued to 120°, which corresponds to the specific gravity 1.0348.

5. To apply the lactometer, the temperature of the milk is first noted with the aid of the thermometer; the lactometer is then carefully inserted, taking pains to avoid wetting the portion of the stem above the milk, and to free the surface of the milk from foam. The degree to which the instrument sinks is then noted. Bearing in mind the effect of temperature on the gravity, the inspector now decides whether the gravity will probably be below 100° at 60° Fahr. If he thinks it will, he carefully cools or warms a sample of the milk, as the case may require, to 60° Fahr., and again inserts the lactometer. If it stands below 100°, the gravity is below that of any genuine milk. He carefully notices the consistence to determine whether he has before him a sample of thin watered milk or a sample of thick cream. The black background of
the shot in the lower bulb enables the inspector, as the milk runs off the lactometer, to judge of its consistence. The color is also noted, as well as the odor and taste. Low specific gravity (below $100^\circ = 1.029$), together with abnormal watery consistence, and a watery taste, establish the fact of adulteration by water, which is the most common form of adulteration, because the simplest and most convenient.

If the specific gravity be above $100^\circ$, it does not follow that the milk is pure and unadulterated. Skimming, by removing the lighter cream, increases the gravity of the milk; so skimmed milk is heavy; but it appears at the same time very thin, and the inspector's attention will be at once arrested by the inconsistency of high gravity and a watery character. In this, as in other cases where the inspector suspects adulteration of any kind which cannot be proved by the above-mentioned tests of gravity, consistence, color, and taste, he is instructed to take a sample for further examination by the cream test, chemical analysis, and the microscope.
### Value of Lactometer Degrees in Specific Gravity

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II. REPORT OF DOCTORS WALLER AND O'CONNOR ON THE COWS OF THE MULFORD FARM.

Note.—Samples of low gravity milk from this farm were introduced by the defence to prove that genuine, unadulterated milk, from healthy, well-fed cows sometimes shows a specific gravity below 1.029 (100° on the lactometer), the standard used by the Board of Health, and others, as the minimum gravity of pure milk.

W. DE F. DAY, M. D., Sanitary Superintendent.

Sir:—We have the honor to report that, at the request of the President of the Board of Health, we visited the farm of Mr. Charles Mulford, in the neighborhood of Guymard, Orange Co., N. Y., about 80 miles from New York. We reached there on the afternoon of Saturday, December 23, 1876, and were present at the evening's milking.

His herd consists of some 22 cows, of which but four were at that time regular milkers; eight were "stripers," or cows that were nearly dried up, and the rest were dry. Only the regular milkers were milked that evening.

Evening milking—"milkers"; milked twice a day.

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<tr>
<td>&quot;Blue&quot;</td>
<td>7 &quot;</td>
<td>2 &quot;</td>
<td>4 &quot;</td>
<td>104</td>
<td>61°</td>
</tr>
<tr>
<td>&quot;Red Heifer&quot;</td>
<td>5 &quot;</td>
<td>5 &quot;</td>
<td>2 &quot;</td>
<td>100</td>
<td>61°</td>
</tr>
<tr>
<td>&quot;Gypsy&quot;</td>
<td>7 &quot;</td>
<td>4 &quot;</td>
<td>4 &quot;</td>
<td>102</td>
<td>59°</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>13½ qts.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The cow Charley was stated to be half Ayrshire; all the others were of the common breed.

That evening, after all had retired, Mr. T. C. Doremus and his friend, Mr. Root, arrived, and the next morning (Dec. 24th) the cows were milked in our presence, and the milk tested with the lacto-
ON THE COWS OF THE MULFORD FARM.

meter, both by the above-named gentlemen and by ourselves. The results were as follows:

**Morning milking—“milkers;” milked twice daily.**

<table>
<thead>
<tr>
<th>Cow</th>
<th>Amount yielded</th>
<th>Lactometer</th>
<th>Temperature F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Charley&quot;</td>
<td>6 qts.</td>
<td>108</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Blue&quot;</td>
<td>6</td>
<td>112</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Red Heifer&quot;</td>
<td>4</td>
<td>104</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Gypsy&quot;</td>
<td>5</td>
<td>107</td>
<td>60°</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21 qts.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**"Strippers;" milked but once daily.**

<table>
<thead>
<tr>
<th>Cow</th>
<th>Amount yielded</th>
<th>Lactometer</th>
<th>Temperature F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Andrew&quot;</td>
<td>1/2 pint.</td>
<td>104</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Fanny&quot;</td>
<td>1 &quot;</td>
<td>93</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Mooey&quot;</td>
<td>1 &quot;</td>
<td>99</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Ryder&quot;</td>
<td>3 &quot;</td>
<td>103</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Yellow&quot;</td>
<td>3 &quot;</td>
<td>102</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Spot&quot;</td>
<td>1 &quot;</td>
<td>108</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Star&quot;</td>
<td>1 1/2 &quot;</td>
<td>104</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Black&quot;</td>
<td>1 1/2 &quot;</td>
<td>78</td>
<td>60°</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12 1/2 pints</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With the exception of the Black cow, all of the strippers were with calf and were expected to be delivered in about 2 or 2 1/2 months. The Black cow had never yielded much milk since her calf was taken from her, and was to be fattened and killed for beef. Her milk looked very thin and watery, and was full of stringy curds which clogged the strainer. Indeed the product from all the strippers was not true milk, and was in no way suitable for domestic use. The product from the pregnant cows was essentially colostrum.

The total yield of the four regular milkers for the evening and morning together, was 34 1/2 quarts, an average of 8 5/6 quarts per day from each cow, which is considered a fair average yield for the winter season.
The total yield from the eight strippers was $12\frac{1}{2}$ pints, or an average of $1\frac{1}{2}$ pints per day.

The food of the cows, so far as we saw, was oat-straw only.

Mr. Mulford stated that after that morning he should not again milk the strippers Fanny, Star, Andrew, Mooly, Spot, or Black, until after calving.

Samples of the milk from Fanny, Mooly, and the Black cow, all whose milk stood below 100 on the lactometer, were taken, and, on reaching New York, they were submitted to examination. The results were as follows:

**Examination of the low gravity Milk (?) from Strippers.**

<table>
<thead>
<tr>
<th></th>
<th>Fanny.</th>
<th>Mooly.</th>
<th>Black Cow.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction</td>
<td>Strongly alkaline.</td>
<td>Strongly alkaline.</td>
<td>Strongly alkaline.</td>
</tr>
<tr>
<td>Lactometer</td>
<td>93°</td>
<td>99°</td>
<td>78°</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.02697</td>
<td>1.02971</td>
<td>1.02262</td>
</tr>
<tr>
<td>Cream (?)</td>
<td>11.50 per cent.</td>
<td>No distinct layer.</td>
<td>10.50 per cent.</td>
</tr>
<tr>
<td>Water</td>
<td>86.97 &quot;</td>
<td>86.66 per cent.</td>
<td>91.52 &quot;</td>
</tr>
<tr>
<td>Fat</td>
<td>4.65 &quot;</td>
<td>3.45 &quot;</td>
<td>1.73 &quot;</td>
</tr>
<tr>
<td>Caseine and Albumen</td>
<td>5.14 &quot;</td>
<td>7.58 &quot;</td>
<td>4.39 &quot;</td>
</tr>
<tr>
<td>Sugar</td>
<td>2.40 &quot;</td>
<td>1.03 &quot;</td>
<td>1.45 &quot;</td>
</tr>
<tr>
<td>Salts</td>
<td>0.84 &quot;</td>
<td>1.39 &quot;</td>
<td>0.89 &quot;</td>
</tr>
</tbody>
</table>

Milk from Mooly yielded no well-defined layer of cream. Milk (?) from the Black cow yielded 10.5 per cent. by volume of scum—curdy matter mixed with fat globules. It also deposited a sediment.

Respectfully submitted,

ELWYN WALLER, Ph. D.

J. T. O'CONNOR, M. D.

NEW YORK, Jan. 12, 1877.

Note—The sample of milk (?) from the "Black cow" on the "Mulford Farm," produced in court as "pure milk," "standing at 78° on the lactometer," by Mr. T. C. Doremus, before the visit of Doctors Waller and O'Connor, was examined by Prof. Chandler and Dr. O'Connor, who found it after standing a week to exhibit a strong alkaline reaction, (which it has not yet lost after three weeks' standing up to the time this note was written), to deposit a considerable
ON THE COWS OF THE MULFORD FARM.

sediment, and to possess a disagreeable taste. Analysis showed it to contain:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>90.64</td>
</tr>
<tr>
<td>Fat</td>
<td>2.64</td>
</tr>
<tr>
<td>Caseine</td>
<td></td>
</tr>
<tr>
<td>Albumen</td>
<td>6.04</td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
</tr>
<tr>
<td>Salts</td>
<td>0.68</td>
</tr>
</tbody>
</table>

100.

The microscope showed the sediment to contain pus corpuscles. This is an abnormal fluid, which cannot properly be called milk.
ARGUMENT OF THE COUNSEL FOR THE PROSECUTION.

Closing argument of W. P. Prentice, Esq., in the case of the People vs. Schrumpf, tried upon an indictment for the adulteration of milk, in the Court of General Sessions in New York, December 28, 1876, Judge Sutherland presiding.

May it please the Court and gentlemen of the jury: When we come, at this stage of the proceedings, to take up the points of interest and discussion, which have detained you so long, the first feeling that I have in my mind is one somewhat of commiseration for you, that you have suffered so much, though I believe it to be in a good cause, and then, again, of admiration for your patience, that you have so pleasantly indulged the learned gentlemen who represent the defence, in all their efforts to bring before you the requisite facts to determine this, which for them and their trade shall be the decisive case, as they have promised. Now I confess that I have entered upon the discussion with less

NOTE.—The indictment against the prisoner, Daniel Schrumpf, was of two counts. The first count charged him with knowledge, "knowingly offering and having for sale," etc., etc. The second count was drawn under the ordinance quoted in the argument.

About thirty other milk dealers, under like indictments, most of them members of "The Milk Dealers' Association," were brought to trial at the December term of the court, 1876, and this case was selected as the first to be tried. It was on trial from December 18 to December 28, 1876, adjournment being had over Saturday and Christmas day—Dec. 23 and 25—and in this interval the examination of the Mulford herd of cows was made by Doctors Waller and O'Connor, who testified, on the 27th, to the facts set out in the report in the appendix.

The prisoner was found guilty
advantages than those which you have been assured of in the learned gentlemen who represent the "distinguished defendant," as the prisoner has been generally called. I confess that to understand the language with which your ears have grown familiar, I have had to take recourse to the dictionary. Yesterday, you will observe, it was necessary to seek a translation of the word glutinous, which was termed viscosity. Last night I looked up the term viscosity, and found that it means glutinousness. I also, pursuing the same studies and considering the subject which has interested you for these ten days, have found it a long road now coming to its turn, indeed a milky way, and I sought Loomis' Astronomy to find that a milky way is a galaxy. This definition may properly refer to the scientific stars whom you have heard and who have made so distinguished an appearance. Prof. Loomis, speaking of the "Milky Way," says: "To the naked eye it presents merely a diffused milky light, stronger in some parts than in others." Gentlemen, I shall endeavor to show you where the strong parts lie. Now it has been a matter of interest to me, in the discussion which we have had this morning, to discover what the issue, what the case was which the learned counsel for the defendant was proposing. Is it the Board of Health that is on trial? Is the question that of skimmed milk, or is the question that of the success of the distinguished family of the learned professor on the side of the defence in seeking for "samples of pure, healthy cow's milk" which he can compel the witnesses for the prosecution to taste? You know whether it is or not. I think not. We proceed under this ordinance: "No milk which has been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream, shall be brought into, held, kept, or offered for sale at any place in the City of New York, nor shall any one keep, have, or offer for sale in said city any such milk." Now the learned counsel in closing for the defence said that the Court had settled the question that there was no moral guilt in this case, that the defendant was morally innocent. I ask you, gentlemen, to wait until you receive the charge of the Court, for, unless I am
greatly mistaken, the Court will say to you that it has simply dismissed one count of the indictment; that there are two counts, and they embrace the same offence, but as to the moral guilt or innocence of the defendant, this will be for you to determine.

The Court.—The Legislature had constitutional power to authorize the Board of Health to pass the ordinance which I read to the jury, and to declare a violation of it a misdemeanor. There is no question of morality in the case; that question has long been settled in similar cases brought under acts of Parliament.

Mr. Prentice.—It seems to me, in deciding whether or not the prisoner has been guilty, you will have settled a question of great importance. Remember, gentlemen, that you sit in this place representing the community in which you live. You are the people. You are those for whom these ordinances were made, and the public officers in this case are but your representatives and your servants. It will remain to be found and decided whether you shall approve of the action that has been taken for the best interests of the people of New York, or whether you shall accept the result that is proposed to you by the defence, whether you will sweep away all safeguards, take away all limits, and leave the clients of these gentlemen, whether you will leave this class in the community to pursue a trade, whose injuries are well known, without any restriction by law or in courts of justice. Now the vastness of this question may excuse to you the length of the trial and the delay in bringing it to a conclusion. It appears that the daily milk supply of New York embraces a hundred and fifty thousand quarts by the Erie railroad, thirty-six thousand quarts by the Midland railroad.

Mr. Lawrence.—This is not evidence.

Mr. Prentice.—It is an official document.

The Court.—Strictly speaking that is not in evidence.

Mr. Prentice.—Gentlemen of the jury, in my opinion, which I believe is founded upon sufficiently accurate facts, there is brought into the city of New York about 400,000 quarts of milk a day, and to that quantity at least 100,000 quarts of water are
added, making the daily supply of the so-called commercial milk of this city as it is sold here. I ask you to remember the fact at the outset, that we have had the evidence of Mr. Doughty, a milk dealer, about the standard of commercial milk in this city, and it is corroborated by the evidence on the other side, or is at least without any conflict of evidence, and is confirmed by the evidence of our inspectors. Mr. Doughty tells you that the standard of commercial milk in this city is above the standard of the Board of Health, that it does not come down to 100 on the lactometer. Therefore we may safely assume that the milk offered for sale in the city of New York—the commercial milk—is above the standard of the Board of Health, above 100. That evidence is uncontradicted, and you cannot go any further than the evidence. Now the importance of this adulteration, or of an adulteration which shall be carried, as in this case, fifteen degrees below, it is hardly necessary to dwell upon. I read from Beck’s work on Adulterations, he says: “It is not without reason, therefore, that the great mortality among children in Paris is ascribed chiefly to the bad quality of the milk with which such a large number are constantly fed.” I read from Dr. Voelcker, who is regarded as undisputed authority in this case: “Milk may be regarded as a kind of model food. It supplies all the various elements of nutrition which are required to build up the bony frame and muscular tissue of the young, and, at the same time, supplies materials for supporting respiration and keeping up the animal heat of the body. Undiluted with water, milk is both a readily digestible and valuable, if not indispensable, article of food for children. Breeders of high priced short-horns know full well how essential it is to the early development of a sound and strong frame, round which the flesh and fat may be afterwards deposited in symmetrical forms, not to stint the calf in milk; and it is to be feared that the children of the artisan and the poor in towns, and of the agricultural laborer in the country, are not nearly so well supplied with milk—both as regards quantity and quality—as the progeny of the well-cared-for herd of short horns, or Ayrshire or Devon cows. If it be remembered that the bodily
health of the adult is affected in no small degree by the amount and quality of the food with which the infant, from the time of its birth and throughout the period of childhood, is fed, and also that much physical suffering might be prevented if children were not stinted in a milk diet, it is doubly desirable that the scanty allowance of milk in which the children of the poor are generally indulged should be unadulterated, and of the best quality that can be procured. We hail, therefore, with pleasure, the enforcement of the food adulteration act, for there can be no question that before the act came into practical operation, the milk sold alike to the rich and poor in London and other large towns, was watered much more generally, and to a greater extent, than it is at present, in places where public analysts keep a watch over the milk-men.” It is a matter of public record of which the court and you will take cognizance that the Board of Health in this city began its operations in 1867. It found at that time the death rate in this city, of children under five years of age, to be fifty-three per cent. of the whole number of deaths. Now I will not stop to consider the general decrease which has been marked, year by year, in the rate of the mortality in this city, but I will show you this one fact, that in 1875 the death rate of children under five years of age, to whom of most importance is this question of the purity of milk, their principal food, the rate of mortality had decreased to 48\(\frac{1}{2}\) per cent. This means, upon the whole mortality, gentlemen, saving the lives of three thousand children per year. That decrease in the rate of mortality is owing, more than anything else, to the safe-guards that have been thrown about them in various ways, and especially their protection in the purity of their food. Now, statistics of writers go further upon this subject, and they say that for every death you may rate twenty-eight cases of serious illness. How vast becomes the calculation—the consideration of influences which are here before you, which, if these learned gentlemen are correct, you are to decide for, or against, for or against a standard, a means of protection and a safe-guard; for or against the limit of adulteration without concern, for the profits of this distinguished defendant, or
the liberty which he claims, about which his counsel has been so anxious. The liberty of what? The liberty of pursuing a dishonest trade, the liberty of evil doing. I tell you, gentlemen, that your verdict in this case will establish or condemn the restrictions upon that liberty, for whose establishment and regulation our government is constituted; it is a liberty conformable to law.

Now the history of the litigation in milk cases is important. You have had constantly presented to you the first trial of such a case, when these same learned counsel and these same scientific gentlemen arrayed for the defence appeared. The prosecution, as represented in this case, did not have at that time the opportunity to make the same defence as in subsequent cases. They did not then show that they had arrived at the test which is produced for your judgment in this case. They had to wait until this case was tried, until the instructions of more than a year had been had, in the learned talk, in the learned lectures of how milk may be adulterated to escape the lactometer, and in the frequent defences instituted in prosecutions by the Board of Health, by these learned gentlemen, until the inspections of milk had been tried by the experience gained in these contests. These public officers who now prosecute, come before you to say we have now arrived, by our experience, by this very instruction from the milkmen’s counsel, by the very instruction received from Dr. Doremus, at a test which will stand scrutiny, and we submit it to you. Now, gentlemen, what is this test? In the first place every witness that has been before you, has agreed that a man may know milk; he will be able to test milk and be an expert in milk inspection. You know there are experts of great skill in many trades and in many commodities. In the case of testing milk, a man who has experience will mark defects in it that will pass your eyes and mine. You are able to judge whether these inspectors have experience in judging milk. The witness for the defence, Dr. Vaughan, could distinguish the quality of milk because, as he says, he is “accustomed to handling it.” Could Drs. White and O’Connor not test it? But it will be said by the defence, we presented a bottle containing a fluid which they
did not dare to say was milk. You, gentlemen, have now arrived at a point where you, too, will say it was not milk. There is this thing for which they searched the whole country around New York, and could find no place from which it could be derived, except the famous farm of Mulford, distinguished in the researches of the Doremus family. This article they proposed as a standard by which shall be regulated the milk trade of New York, and you will pronounce it, gentlemen, I am convinced, no milk; that it is not for a standard, and my impression is, that such a sample of their evidence will characterize their whole case. If that is their standard, if that is their evidence of milk which they say is from a fair, healthy cow, "a fair sample of the average milk mixed and taken to New York," I trust, gentlemen, you will leave that sample and that trade to the gentlemen for the defence, give it to "the distinguished defendant," nourish him on it in the seclusion to which I hope he will be devoted, and let us see if he, and his friends and associates, will not wish for a better milk, as they should wish for a better and more honest trade. Gentlemen, your verdict will touch such considerations as these. After the first case was tried, we came to another, where many experts were examined whose testimony you have heard here on this trial, but there was no defence except by the cross-examination of this learned gentleman.

Mr. Lawrence.—I was not present; you are mistaken.

Mr. Prentice.—Your associate, Mr. Waehner, was present; I speak of the Joechter case; there was no appeal in that case. Then we came to the Cox case. In that case there was an appeal, and Cox illustrated by his labors in the penitentiary the dangers and difficulties attending a dishonest trade in the City of New York. Now we have finally come to this case, and they propose, after a year or two of litigation, that this shall be the test case. The issue here, as I stated before, is whether the defendant had for sale watered milk. I shall not spend time in discussing whether there was an error of one, two, or three degrees on any of the lactometers, or in any of the tests. This man watered his milk fifteen degrees. Take the lowest standard offered by the gentlemen of the defense of milk. I do not call the sample
from the "black cow," I do not call the sample with which it was associated, from the "bob-tailed cow," samples of milk. Mr. Charles Doremus told you here that these two samples were similar and alike in their constituents. I call these no samples, except for them; but, even if you propose to admit them, put them in with all the milk, as they wish them put into the milk supply of New York. Remember this "rule of three" which belongs to their model herd. It takes eight cows of theirs to make twelve pints of milk. Now, put their milk into a can of mixed milk of forty quarts, the can of the commercial milk that comes to this city, take these two samples in such a can of milk, determine then its average, and see whether there is a possibility that this defendant, taking all averages and including all errors, had any milk except watered milk. Now one word as to this distinguished gentleman, the prisoner at the bar. He has come before you chivalrously, and glorified by the distinction of representing and defending what some would appear to call a good act, the watering of milk. He has said to you that his milk had been inspected before. He knew the test when the inspector came to his shop, and he read the lactometer; he even discussed with the inspector whether the proper degree on the lactometer was 85 or 90. He said it was 90, so that he knew the test. Now he comes to the stand and says, "I did not do it; my son did not do it;" but, mark it, gentlemen, the defendant does not say he did not know that milk was watered, for he did know that it was watered; there is not a milkman in this city who would not have known that that milk was watered. I do not believe a discussion from books, a discussion of opinions, or any discussion on the lactometer, or the hydrometer, or the other ometers with tediously long names of which we have heard, will withdraw from your observation the fact that this man, by all the evidence in this case, is shown to have had for sale watered milk, and to have known it. But I do not care whether he knew it or not; the question is, did he violate the law? He has been in this business seventeen years. I am not discussing his moral innocence; there is no question of that kind in this case. There is no pretense in this case that
the milk he was offering for sale was "adulterated" with cream. Their witness, Dr. Vaughan, said that, to show a different rate on the lactometer by the addition of cream, we would have to put in an immense amount, and then it would show "viscosity." There is no question of viscosity in this case; it is a question—whether the milk was watered or not. It has been shown that the milk found in the defendant's place looked blue, it ran off the glass, and the inspector tasted it; so that, without even testing it with the lactometer, he could have said that it was watered milk. It was, as the learned professor who has distinguished himself for the defense, upon whom they place their whole reliance, has said, and you will remember the graphic style with which his evidence was given—it was "rich in water." This is a sample as he said which the Court will observe was "rich in water." It occurred to me this morning, as I was taking my milk, that I had read of another sample of milk that was "rich in water." Without detaining you any length of time, I will refer to the incident told by Charles Dickens in presenting to the people of England the enormities of the so-called farming-schools and boarding-schools, where step-sons and orphans were put away in the country at Dotheboy's Hall, ruled over by Mr. Squeers, who exercised there a most vicious tyranny. Mr. Dickens, by this graphic story of Nicholas Nickleby, which burned its moral into the heart of the English people, produced a great reform—such a reform as I trust, in some measure, will follow your verdict in this case. In the story, Mr. Squeers goes to London to get pupils. Mr. Nickleby meets them at an inn. Mr. Squeers calls for breakfast for the boys, while he is having meat and coffee.

"This is two penny'orth of milk is it, waiter?" said Mr. Squeers, looking in the large blue mug, and slanting it gently, so as to get an accurate view of the quantity of liquid contained in it.

"This is two penny'orth, sir," replied the waiter.

"What a rare article milk is to be sure, in London," said Mr. Squeers with a sigh. "Just fill that mug up with luke-warm water, William, will you?"
"To the werry top, sir?" inquired the waiter. "Why the milk will be d rounded."

"Never you mind that," replied Mr. Squeers. "Serve it right for being so dear. You ordered that thick bread and butter for three, did you?"

"Coming directly, Sir."

"You needn't hurry yourself," said Squeers; "there's plenty of time. Conquer your passions, boys, and don't be eager after vittles." As he uttered this moral precept, Mr. Squeers took a large bite out of the cold beef, and recognized Nicholas. "Sit down, Mr. Nickleby," said Squeers, "we are a breakfasting you see." Nicholas did not see that any body was breakfasting except Mr. Squeers; but he bowed with all becoming reverence and looked as cheerful as he could.

"Oh! that is the milk and water, is it William?" said Squeers, "very good, don't forget the bread and butter presently."

At this fresh mention of the bread and butter the five little boys looked very eager, and followed the waiter out with their eyes; meanwhile, Mr. Squeers tasted the milk and water.

"Ah!" said that gentleman, smacking his lips, "here's richness! Think of the many beggars and orphans in the streets that would be glad of this, little boys. A shocking thing hunger is, isn't it, Mr. Nickleby."

"Very shocking, Sir," said Nicholas.

Here is richness, yes! let us think of the widows and orphans in the street who have to suffer by this "richness," by such a standard as is proposed by these learned gentlemen. Now observe how this controversy has been shaped, with what art the particular issue has been concealed. The first point in the trial of such cases, the first point in the movement of public officers to prevent an evil so enormous as this, must depend on some practical mode of detection of fraud. So cumbrous and lengthy a method of detection, involving the necessity of this parade of a whole laboratory, as you saw here, in which, after forty minutes of experiment in the evaporation of milk, the experiment was not concluded, and several parts you had to take upon your im-
agination. Such a method is insufficient. Make it cumbersome, throw difficulties in the way, and you cannot detect one milkman's fraud a day. Perhaps the Milkmen's Association would be willing to offer up the vicarious sacrifice of a "distinguished member" like the prisoner, and the other members would then pursue their trade undetected and unharmed. Therefore, I say the first object of the defence was to get rid of any practical mode of detection. There is in fact but one method of adulteration of milk of which we are really afraid. It is the "iron-tailed cow" that does the damage; it is by water. This is the cheapest and most ordinary way. You are not to consider if there are other adulterations; you have not to say that the Board of Health would necessarily fail in the detection and punishment of other offenses. We have here the most common and the readiest adulteration—that by water. You know that the milkmen themselves are interested in this test, and that they are making it constantly. Doughty has told you, that even on the farms, they are testing the milk, and every man who purchases milk knows whether he is buying a good article or not. Officers Jepson and Gardner were police officers of the Sanitary Squad, and made 10,000 tests each. Drs. O'Connor and White have testified, and you have seen a witness on the stand for the defence who claims that he is no scientific man, and has no scientific experience, but who says that these observations are easily and readily made. It is not necessary to talk to you at length of the detection of so plain and palpable a fraud as there is in this case. Gentlemen, you know that every one of you can take that lactometer and test milk yourselves. Take milk which they say is "adulterated with cream," and milk which is diluted with water, and your own good sense and observation will determine that it is possible to distinguish between them. The first thing, then, that the defense strikes at is the instrument used in this practical test. We were told that the lactometer should be brushed away, "that knowledge and science," excuse me for quoting the words, "damn the lactometer." We have a learned professor, on the part of the defence, who meets this instrument as some noble leader of a bovine herd who,
breaking from his accustomed pastures, crosses a railroad track in the gloom of the evening, and seeing the locomotive coming with its dazzling light plunges at it to brush the locomotive away; but it is the bull and not the locomotive that disappears.

Now I ask you to remember this fact, that not one witness in this case has said that the lactometer will not test specific gravity. They all agree to that. "But it is useless," says the learned professor. I say let us determine the specific gravity in the first place. The public officers in this case do not propose to you the lactometer as a test for anything else but specific gravity, but they say that since you know what the specific gravity of good, sound, commercial milk is, and must be, if the milk tested shall fall below that standard on the lactometer, then it is watered. Now, gentlemen, whether that be a correct conclusion or not, you have heard the evidence of all these learned gentlemen who have testified to the value of this test. I shall not take up your time to attempt to meet the quibbles about mistakes of words when they were under the very sharp fire of the cross-examination of the learned counsel. I shall not ask you to determine whether these scientific men, witnesses for the prosecution, are worthy of the place they have occupied in the scientific world for fifteen or twenty or more years; but I will remind you of the fact that as one distinguished author has said, "books follow thoughts, not thoughts books." You have had the book-makers before you; you have had the men before you who determine scientific questions. You have had their opinion, to the effect that after a consideration of all the authorities, and after a review of the whole subject with careful analysis and reason, such as scientific men have learned to use, their opinion, vouched for by their reputation, is that the lactometer is a sure and practical test of the adulteration of milk by water, when it is properly tested and is accurate. Now they have said further that as a practical test it is just as accurate as analysis. It is not necessary for us to go to that point; I desire to make it plain. It must be admitted on all sides that analysis can only tell you the amount of water in the milk; the lactometer tells you the same thing. How can you tell from analysis whether water has been
added unless you have some standard? You must settle in the
first place how much water ought to be in milk, or analysis will
not tell you what has been added. Here is where the defence
have made their real and their principal issue. Their attack is
not on the lactometer; they can no more meet it than the bull
can meet the locomotive; they can no more meet it than you
can meet any well ascertained fact. The lactometer has been
described to you by the learned witness for the defence, in his
graphic style, as beginning with Archimedes. It is not neces-
sary to prove that; it has been admitted in court that it deter-
mines specific gravity, and analysis will do no more. It is upon
this question of a standard that we have to meet them. This is
the real thing at which they aim. You cannot tell, they say,
but that this was honest milk, because there is no standard.
Then we asked the defence, what is your standard? They answer
it ranges from 80 to 130. We asked, can you fix it no closer?
“No.” How do you know that? “By experience.” Their pro-
fessor made personally twelve observations, and of these seven
were against him, and five for him, and the most distinguished
of those observations was on the now famous quadruped, which
seems to be the peculiar property of the scientific family on the
side of the defense. I think I would be justified in calling that
tribe of milk cows the “Doremus Cows,” and the most distin-
guished of that family is the mother, perhaps, the so-called
“Bob-tailed Cow.” We have found her sister nearly related to
her in this case. Her milk is produced by the youthful knight
errant of the professor’s family, who searches “the County of
Orange, with its creameries and its rich pastures,”—to quote his
own language—and goes straight to the Mulford Farm. You
will remember the learned professor’s description of the golden
crown of Hiero, which Archimedes tested, exclaiming, “Eure-
ka!” “Eureka!” So you will remember how this youthful
scion of that scientific house returned from “the creameries
of Orange” with “the sample of low gravity milk,” that he
had been sent for, and may imagine him exclaiming, “Eureka!
I have found it, the low gravity milk, the black cow.” And
the anxious father says, “Have you heard anything of the
bob-tailed cow?” The youth replies, “It is not necessary, I have the black cow, sample number three. Get the other side to taste it, and the case is done.” I thought we would trace this cow-relationship a little. I thought we would go one step more. So I asked Mr. Charles Doremus, another member of the family, more about this tribe of cows, which has been hitherto unknown in science. There is no description of any such cows anywhere, except in the evidence of the professor’s family. I could read you books without number, but I will take the testimony which you have heard. No such cows were ever known before, therefore I wished to trace them. I said to Charles Doremus, “This sample of milk is very like another we have had?” He was talking about the samples he had in the Kneib case, and about the “bob-tailed cow.” “There is another milk, that of the black cow, like this,” I said. “Yes, it is,” he said, “in whey.” “Is it like it, in other respects?” “Yes, sir, in other respects.” There are no such cows to be found except in this “Doremus tribe.” The black cow and the bob-tailed cow stand together, and when Prof. Doremus goes on to give you a standard of milk, he begins with these. It is from these that he gets his low standard. I will read an extract from Wanklyn, and we shall see if there is not a standard for milk. Wanklyn, page 41, says: “In dealing with milk supply on a large scale, we are little concerned with the possibility of single animals giving abnormal milk, and need only concern ourselves with milk of normal quality, all departures from the standard being looked upon as sophistications.” The fact is claimed by him that the normal standard of milk varies, if I remember right, only two degrees. Now I take up a book, “Du Lait,” by Marchand, and read this: “Every time that we shall meet a milk of which the corrected density shall be inferior to 1.030 at a temperature of 15 [Centigrade], and which shall contain less than 30 gr. of butter, 50 gr. of lactine, we shall affirm with certainty and without fear, that the milk is falsified.” I read from the last edition of Tardieu, the edition of 1862: “In one word, the frauds indicated by the lactodensimeter are certain, but it is far from indicating all frauds.” On page 521, I read that “the lactodensimeter is a useful instrument
for the verification of milk. It can show some frauds, but not all.” I read from this dictionary of Profs. Tardieu and Blythe, in which they say in the article on milk, page 385: “Mr. F. N. McNamara, of Calcutta, published a short time since the interesting analysis of the milk of a little Bengali cow. His results show how constant the composition of milk is, whether obtained from the much prized and well-fed Alderney, or the poor, ill-nourished Bengali cow.” This book I have in my hand, is one that gives a most exhaustive treatment of this whole subject. There are no pet theories in it, such as are to be found in Von Baumhauer, but it reviews the whole subject. Christian Müller’s treatise, on page 43, of the edition of 1872, says: “From more than 6,000 samples from Quevenne and Bouchardat, 1.029 appears as the minimum and 1.033 as the maximum. For the hospitals and public institutions in Paris, the minimum is 1.030. From 1842 to 1856 there was an earnest inquiry if these figures could be taken for Switzerland. A great many instruments were distributed to obtain the greatest possible number of data both on the mountains and in the valleys, and there was a great demand for them; so that in 1856 already several hundreds of instruments were in use. The fear of the new instruments closed the mouths of the guilty, and it soon became the rule to close the prosecution by 1.028. So it was in my laboratory.” On page 51, he says, “the proving of the specific gravity of milk by means of the arameter answers the purpose, and for the greatest proportion of cases is sufficient, and in several localities there is no other test.” On page 69 he says, “besides, I investigated 286 other cases of market milk. As the average of all tests, I had a number which was not much greater than 1.031. I found one gravity only under 1.029. This was from a spayed cow; the milk had a bitter taste.” On page 74 he says: “If we go through all Europe, from land to land, from place to place, from dairy to dairy, from alp to alp, with the lactodensimeter in our hand, and mix constantly the milk of various cows together, we shall find that the milk, which is divided as a trade commodity from the physiological milk, ranges from 1.029 to 1.033.”
This answers in one word this question of milk, this commercial milk, and these pseudo criticisms against our lactometer. The real issue in this case is, Shall the standard be that of the milk of a healthy cow? Shall it be a standard of the milk of the cow as she has been found all over the civilized world? Shall it be the standard of the food supply of milk by which nourishment shall be secured to the infant and the sick in the great cities of the civilized world, or shall it be the standard of this model Mulford or Doremus family of cows? Shall it be the standard of the Doremus cows? I say give us a standard such as is accepted elsewhere, and let the citizens of New York have the protection which is accorded to those who live under every well-regulated government in all the world. But it has been said you have no right to use the lactometer. I say on the contrary that the real issue is the standard for sound milk. On this point I will read one or two extracts from well-known books, and then I will pass by this subject. In a work on food, by Edward Smith, published in 1873, after reviewing all the questions with all the experience gained in England, speaking of the addition of water and the subtraction of part of the cream, etc., etc., the author goes on to say of the tests, "the lactometer effects this with readiness and efficiency." Wilson says: "As it (milk) is frequently adulterated with water, the specific gravity is a most important test of the quality, and hence the value of the lactometer." It is said, in the work by Atcherly that "the addition of water is best detected by its (the milk’s) specific gravity." "This in a sample of milk was lowered when mixed with its own volume of water, from 1.031 to 1.015." Here I have the correspondence of the Holland Association, the most recent publication of all, published in Cologne, in 1876, in which the adulteration of milk is treated of under the title or head of "Public Health," and this approves the use of the lactometer in determining the specific gravity. So I might go through a number of these works I have here before me. In the Annals of agricultural chemistry which have been used in evidence, Fleischman has said that "the areometer, under all circumstances, is of the highest excellence (ganz vortrefflich) in
proving the watering of milk.” The areometer is the lactometer. Gentlemen, I shall not enter upon the discussion of the mechanical operation or construction of this little instrument. You have had the testimony here of very distinguished scientific men, that it was very well made; and it seems to me that one of the most notable failures on the part of the defence was when two of their scientific experts were unable to tell how it should be regulated, and showed upon the stand that they were ignorant of the quotation from the article in Watts’ dictionary, in which it appears that in the construction of the lactometer on so very nice a scale the degrees will appear equal. You have heard the testimony of a man who does know how they are constructed, and he has shown to you that the difference in the size of the degrees is the \( \frac{3}{1000} \) or \( \frac{4}{1000} \) part of an inch. The witnesses for the defence did not know these facts and figures when they testified. They did not know how, in fact, the lactometer was constructed. They did not know what was the test that was prescribed by the very book which they had in their hand. You remember the story of the young lady who entertained company, and was found after a number of evenings to be extremely well posted on a great many subjects; but after a while her conversation lagged, and when an explanation was sought as to the cause of her dullness, she said the fact was that she had been reading the encyclopædia, but had only reached the letter O. These gentlemen got up to the page they quoted about the hydrometer, but they had only read up to a certain point, and not the later pages which we showed to them. It was as conspicuous an example of scientific inaccuracy as was afforded when the learned professor informed you that there was no constant quantity in milk, save the one element, which was sugar. “Examine the serum,” said he, “because sugar is always constant.” I said to him: “Professor, tell me if on your chart there over your head the sugar is always constant.” The reply was: “It varies a little.” “How much?” “Well, it varies 3.” Said I, what is the highest and what is the lowest point?” “It varies from 6 at one limit to \( \frac{3}{10} \) at the other”—above 60 per cent., if I can read correctly. That is all he knows of the
standard for milk and of its accuracy in the experiment. Gentlemen, is such testimony to be opposed to the opinions which you have heard here, such authorities as have been read in your hearing? But I do not ask you to trust to that proof, I do not ask you to consult these books, nor to read one of them. I ask you simply to trust your own observation and your own judgment. You have seen with your own eyes whether or not this instrument will detect the watering of milk. Now, remember that, in opposition to the experiment on the Mulford herd of the bob-tailed and black cow species, that we have made experiments in searching for low gravity cows—not with a particular object, but to find out what the range was here about New York. Our inspectors tested not only commercial milk, but they made 505 tests of cows at the dairy farms, and found that in all cases of sound, healthy cows the milk was above the standard. There were some apparent exceptions. Did we conceal them? No; we told you the whole story; we gave you all the reports. The defence used one or two reports only in evidence on this point. We have given you all the facts in our possession, and you can judge as well as we. The exceptions we have explained, and we say that the tests made here, the practical tests to determine the standard of New York commercial milk, demonstrate with mathematical certainty that 1.029 is a very low standard—that it is a very fair standard for the purity of milk.

Suppose you agree with these learned gentlemen of the defence, in any respect, you must still remember that the question is not of one, two, three, five, nor of ten degrees in this case, but it is of fifteen degrees of water. Think of it? Twenty-five per cent. of water had to be added to the sample you had before you the other day to bring it down to 90, five degrees above this point of Schrumpf's. The testimony we have had in this case has increased the number of practical tests, for it seems that out of forty-seven samples that were investigated by the Messrs. Doremus there was a very small proportion that fell below the standard. Accepting the real milk cows of the Mulford and other herds our tests come up to 540, so that our standard is not lowered but if anything it is increased.
Gentlemen, will you say to the milkmen of New York what standard of milk you will have your children take, and what you will give to the poor, and send to the hospitals. You can fix by your verdict the standard. It is of vast importance that nothing should be done to unsettle the standard of pure milk. It is of vast importance that you do not put us all at the mercy of people who are supplying so important an element of health and strength in this community. Now remember commercial milk is mixed milk, it must have an average, and remember, as I said before, that the evidence is uncontradicted in this case that commercial milk, sold in the city of New York, when pure, stands above 100 on the lactometer. Mr. Doughty says he tested 3,000 samples of this commercial milk we are talking about, and out of those 3,000 of Doughty’s tests, out of the 540 tests of the Board of Health, out of the 6,000 in Paris, out of the hundreds of those which Müller tells you of in Switzerland, and those which Smith speaks of, you get an enormous aggregate, and opposed to them you have Doremus’s five or seven strippers and the twelve observations which Professor Doremus himself made, of which seven were in favor of and five against the lactometer. Do you talk about a doubt in this case upon such evidence? Is it possible to go beyond that? Now I have shown you what the opposing standard is, based upon those samples of milk that you have here before you. I have shown you what the sample test, applied to Schrumpf’s milk, was based upon. I have shown you the accepted standard all over the world, and it has been proved by practical tests, and, I think, also by your own observation during this trial. When, I ask you, gentlemen, when you have been brought in to settle and decide this case and make so important a decision, and when the defence have come in to put their best evidence before you, asking that they shall have an unlicensed liberty of trade, such as is claimed by these distinguished counsel; when you sit here upon your oaths to decide according to the evidence, to do what is fair, honest, true, and right, if the evidence proposed, upon which the defence intends to rely, is a fraud, if it is unfair, if it is a deception in the face of the Court, I ask you, gentlemen, will
you not decide the whole case upon the evidence, and charac-
terize the evidence produced by the other side in support of a
standard and a test fraudulent in its beginning, fraudulent in
its production, and fraudulent in itself, as one upon which they
cannot stand, upon which your righteous judgment will not
permit them to stand, as one which they shall take away with
themselves and go out of Court to the judgment, and to the fair
condemnation of every honest man, of every citizen who desires
to protect the innocent, the defenceless, and the poor children of
this city? Gentlemen, will you approve the fraud of such testi-
mony as that of the defence, or will you condemn it? Am I
using too strong language when I speak in harsh terms of this
sample of milk which you have had analyzed, and which the
learned counsel for the prisoner proposed to-day to withdraw?
He says, "Withdraw the samples that young Doremus brought
from the Mulford farm!" It is too late to withdraw these. It
was on Friday only that we found out where they came from.
We had questioned the source; we had admired the research
of this professor's family, and on Friday we found out where
they had been on the preceding Monday. We had the sample
back in Court on this last Wednesday and demonstrated to you
that it was unsound milk, that it was rotten, that it was not milk
at all. They cannot withdraw it, it is the best thing for justice
which they could have done. They have prepared for months
to try this case. The learned counsel for the prisoner is ex-
hausted with the research he has made, and he has been compli-
mented by the Court on the success which you have witnessed:
"His ingenuity and learning in complicating questions." They
have done their best, and it is the same thing we have had
before. If that is a fair average sample, if that is the best evi-
dence they can produce, if it is presented to you as a fair, aver-
age sample of milk, and you know it is not milk at all, that it is
rotten, disgusting stuff, then I say such is their case. You must
remember that this same Mulford herd of cows were fed on oat
straw, and yet every milker in the Mulford herd—mind you,
"the Doremus cows" are not "milkers," but "strippers"—every
milker in the Mulford herd gave milk above the standard. Yes,
one, though fed on oat straw, did get a little hay. Fortunately, young Doremus visited the place, and he saw her eat hay. You were told by other witnesses how he took hay and gave it to her, and then came into court and swore she fed on hay. Is that fair, is that honest? I need not go back to discuss all this evidence. I think I need not discuss much longer the facts. I say that there are no facts upon which you can find a verdict for the defendant, as I believe. It may be, and I am bound to admit, looking at it from one side of the question, that there may be some things which have escaped my observation, but this thing has not escaped my observation. Where there is a fabrication or falsification of evidence, it is one of the earliest principles instilled into the mind of every professional man, of every man who follows that profession in which I glory, which I believe is of the highest honor, and governed by a rule of honor permitting no deception either by inference or by suggestion, it is one of the earliest principles, I repeat, instilled into the mind of the law student on the subject of evidence, that any falsification of evidence, or any fabrication of it, stamps the whole case. Now, if you should excuse the defendant, if you should find he was not guilty—but I do not see how that is possible—yet if you should so find, you would establish a standard for the city of New York from this fraud, and a standard of milk from this Doremus herd of cows. It comes to just that. The famous "number 3 cow," spoken of by the defence in this case, is the standard of milk for New York which they seek by your verdict. Now the lactometer we have offered you as a test for nothing except the specific gravity, and we have said that commercial milk must stand at 100 on the lactometer. I think it has been proved to you that no possible variation of fifteen degrees could occur even on their hypothesis. You will remember that it was probably 25 per cent. of water which was put into the defendant's milk. It is not the lactometer alone that determines the adulteration, but with it the observation of the expert. He knew that the milk was watered before he tried the lactometer. You have been shown three tests, and they all agreed. Yes, you have had one further test, viz., that of the evidence that the defendant knew
it was watered milk. The distinguished defendant who has appeared here as the champion for all the milk dealers—because this is their preferred case, I did not select it—he knew, he read the scale on the lactometer, and he did not attempt to deny it. His skillful counsel drew from him all that was proper for the case. There was to be no mistake; there was no confusion, no lack of skill or ingenuity in getting all from this gentleman that could be got. Therefore his counsel was careful, and asked questions carefully modified. "Did you put any water in your milk?" "No," "Did your son?" "No." Not a question put such as did you know whether it was watered or not? There has been a singular transformation in this man. I do not know what it is owing to. I presume the man who, on the 25th of August, sold this milk must necessarily be a different man from the distinguished individual that comes here and swears as to the standard of milk and the use of the lactometer. He came here the other day, and plead at the bar, before this case began, and said "not guilty." He said that he was not guilty of knowingly offering for sale adulterated or watered milk. But he changed his tune; he woke up within two or three days, and as he looked in the glass he beheld Schrumpf, no longer a milk dealer, but "the champion representative of the Milk Dealers' Association." "Schrumpf!" he said to himself, "you said you did not know, you who know everything, and to whom these scientific men are but infants; but when you come on the stand can you say you did not know the reading of the lactometer? Have you not seen it before? You know all about it." He talked English then and with the Inspector, but on the stand he could only speak German. When the standard of milk of the black cow and the bob-tailed cow is mentioned and proven, see the effect on him. He is changed. Then he knew both English and German; now he knows only German. A week ago he did not know that his was watered milk; but now he finds that he knew it all the time. From such effects save us.

Now we leave this man to suffer the just consequences of an offence prohibited by law. I think you will say it is a salutary law, as the learned counsel for the defence has already admitted
that it is. This is an offence which touches the important relations of life, to which I have called your attention—one that bears immediately upon this question of the reduction of the rate of mortality among infants. And I may say if this be a test case, it is one that is to increase or diminish the rate of mortality of the one hundred and thirty thousand infants in this great city. Leaving that; I say that upon the evidence which you will have to discuss, these several propositions have been demonstrated: 1st. That there is a standard for New York milk. Place it where you like, gentlemen. If you do not accept this 1.029, still my proposition is that there is a standard, though the defence denies it. 2d. That 1.029 or its equivalent 100 on the lactometer of the Board of Health, is practical, and it is the only safe standard for the city of New York, otherwise you incur great dangers and great risks. 3d. That the lactometer correctly determines the specific gravity, and in determining the specific gravity upon this standard, determines the question of adulteration by water. 4th. That the milk dealers must be presumed and held to know the article they are selling, just as the baker knows his bread, and the butcher knows his meat. So the milkmen ought to know the article they are selling, at so great a profit, to the people. 5th. That Schrumpf's milk on this day in August was watered, and watered far below the safe standard, and far below any possibility of error in his detection. 6th. That the defendant's milk was watered at least 15 per cent., and thus adulterated, offered by him for sale, against the law and ordinance. 7th. That Schrumpf is guilty, and whether we find him guilty knowingly or not, he is guilty of selling adulterated milk.

Now one word, gentlemen, and I will detain you no longer. I ask you to consider the parties to this litigation. On the one side you have public officers charged as I said before upon their oaths to discharge this duty of protecting the health of the city of New York. Upon so important a question, they have given evidence after careful preparation, testimony of distinguished scientific men, and evidence of the methods of detection adopted all over the world where such necessity arises for such tests and such action. They have concealed nothing. You have had the
whole before you; you have seen the very beginning and the whole course and history of this test, and you have had added to it such practical demonstrations as the prosecution have shown. These are public interests which are involved, and it is because they are public officers that they have thought it necessary to show you who represent the community—for you are the people in this case—fully, frankly, thoroughly, and accurately, all that they have been doing, and what their officer did the day that Schrumpf was found offering watered milk for sale. Now the defendant appears here on behalf of private interests. As I told you before, he claims but one thing, and that is to be allowed to go on and sell this milk, to get rid of the standard, to get rid of detection, to get rid of all methods of procedure, to have a liberty unrestricted by law, to pour this poison over the whole city. I have shown you the influence of your verdict. I have directed your attention to the principal points that have been discussed. I have not sought to go into details. I ask you to take the other facts upon the authority of the witnesses whom you have heard examined. I will say in conclusion that we have come into this case to discharge a duty; we have entered into this litigation, and have made this fight because it was necessary. We have not sought it. We have, as I believe, fought a good fight, we have kept the faith. I trust that you will find that we have done our duty. The rest we leave to you.
APPENDIX.

I.—WITNESSES.

1.—Witnesses Examined for the Prosecution, in Favor of the Board of Health Tests.

WILLIAM A. WALL, from the Office of the City Record.
CASPAR GOLDERMAN, from the Office of the Health Department.
DR. JOHN B. WHITE, Sanitary Inspector.
PROF. C. F. CHANDLER, Columbia College.
PROF. G. C. CALDWELL, Cornell University.
H. DOUGHTY, Manager of the Essex County Farmers' Milk Association.

PROF. HENRY MORTON, Stevens' Institute.
PROF. BENJAMIN SILLIMAN, Yale College.
ELWYN WALLER, Ph.D., Chemist to the Health Department.
HERMAN ENDERMAN, Ph.D., Health Department.
JOHN R. YALE, Health Department.
DR. J. T. O'CONNOR, Sanitary Inspector.
HENRY A. MOTT, Ph.D., New York.
JOSEPH A. GARDNER, Sanitary Policeman and Milk Inspector.
JAMES C. JEPSON, Sanitary Policeman and Milk Inspector.

PROF. G. F. BARKER, University of Pennsylvania.

2.—Witnesses Examined for the Defence, Opposed to the Board of Health Tests.

THOMAS C. DOREMUS, New York.
PROF. R. O. DOREMUS, College of the City of New York.
DR. C. A. DOREMUS, New York.
H. W. VAUGHN, Milk Inspector, Providence, R. I.

A. S. CASPER.

JOHN H. COMER, Accountant and Practical Farmer.

DANIEL SCHRUMPF, Defendant, Milk Dealer.

JACOB SCHRUMPF, Son of Defendant.
II.—THE LACTOMETER.

1. The lactometer is a hydrometer which indicates specific gravities between 1.000, the gravity of water, and 1.0348.

2. It is used to determine the specific gravity of the milk.

3. As the specific gravity varies with the temperature, the observations are made at a standard temperature of 60° Fah.

4. The specific gravity of the average milk at a milking of a healthy cow, properly fed and in a normal condition, varies from 1.029 to 1.0348. The former number being the lowest or minimum gravity, 100° is placed at this point on the lactometer; 0° is placed at 1.000, the gravity of water; the intervening space is divided into 100°, and the graduations are continued to 120°, which corresponds to the specific gravity 1.0348.

5. To apply the lactometer, the temperature of the milk is first noted with the aid of the thermometer; the lactometer is then carefully inserted, taking pains to avoid wetting the portion of the stem above the milk, and to free the surface of the milk from foam. The degree to which the instrument sinks is then noted. Bearing in mind the effect of temperature on the gravity, the inspector now decides whether the gravity will probably be below 100° at 60° Fah. If he thinks it will, he carefully cools or warms a sample of the milk, as the case may require, to 60° Fah., and again inserts the lactometer. If it stands below 100°, the gravity is below that of any genuine milk. He carefully notices the
consistence to determine whether he has before him a sample of thin watered milk or a sample of thick cream. The black background of the shot in the lower bulb enables the inspector, as the milk runs off the lactometer, to judge of its consistence. The color is also noted, as well as the odor and taste. Low specific gravity (below $100^\circ = 1.029$) together with abnormal watery consistence, and a watery taste, establish the fact of adulteration by water, which is the most common form of adulteration, because the simplest and most convenient.

If the specific gravity be above $100^\circ$, it does not follow that the milk is pure and unadulterated. Skimming, by removing the lighter cream, increases the gravity of the milk; so skimmed milk is heavy; but it appears at the same time very thin, and the inspector's attention will be at once arrested by the inconsistency of high gravity and a watery character. In this, as in other cases where the inspector suspects adulteration of any kind which cannot be proved by the above-mentioned tests of gravity, consistence, and taste, he is instructed to take a sample for further examination by the cream test, chemical analysis, and the microscope.
### Value of Lactometer Degrees in Specific Gravity.

<table>
<thead>
<tr>
<th>Lactometer</th>
<th>Gravity</th>
<th>Lactometer</th>
<th>Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.00000</td>
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<td>1.01760</td>
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<td>1</td>
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<td>2</td>
<td>1.00058</td>
<td>63</td>
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<tr>
<td>59</td>
<td>1.01740</td>
<td>120</td>
<td>1.03480</td>
</tr>
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</table>
III. REPORT OF DOCTORS WALLER AND O'CONNOR ON THE COWS OF THE MULFORD FARM.

NOTE.—Samples of low gravity milk from this farm were introduced by the defence to prove that genuine, unadulterated milk, from healthy, well-fed cows sometimes shows a specific gravity below 1.029 (100° on the lactometer), the standard used by the Board of Health, and others, as the minimum gravity of pure milk.

W. De F. Day, M.D., Sanitary Superintendent.

SIR:—We have the honor to report that, at the request of the President of the Board of Health, we visited the farm of Mr. Charles Mulford, in the neighborhood of Guymard, Orange Co., N.Y., about 80 miles from New York. We reached there on the afternoon of Saturday, December 23d, 1876, and were present at the evening's milking.

His herd consists of some 22 cows, of which but four were at that time regular milkers; eight were "stripers," or cows that were nearly dried up, and the rest were dry. Only the regular-milkers were milked that evening.

_Evening milking—"milkers;" milked twice a day:_

<table>
<thead>
<tr>
<th>Cow</th>
<th>Age</th>
<th>Time since last calf.</th>
<th>Amount yielded.</th>
<th>Test by Lactometer.</th>
<th>Temperature Fair.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Charley&quot;</td>
<td>12 yrs.</td>
<td>3 weeks.</td>
<td>3½ qts.</td>
<td>105</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Blue&quot;</td>
<td>7 &quot;</td>
<td>2 &quot;</td>
<td>4 &quot;</td>
<td>104</td>
<td>61°</td>
</tr>
<tr>
<td>&quot;Red Heifer&quot;</td>
<td>5 &quot;</td>
<td>5 &quot;</td>
<td>2 &quot;</td>
<td>100</td>
<td>61°</td>
</tr>
<tr>
<td>&quot;Gypsy&quot;</td>
<td>7 &quot;</td>
<td>4 &quot;</td>
<td>4 &quot;</td>
<td>102</td>
<td>59½°</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>13½ qts.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The cow Charley was stated to be half Ayrshire; all the others were of the common breed.

That evening, after all had retired, Mr. T. C. Doremus and his friend, Mr. Root, arrived, and the next morning (Dec. 24th) the cows were milked in our presence, and the milk tested with the lactometer, both by the above-named gentlemen and by ourselves. The results were as follows:
Morning milking—"milkers;" milked twice daily.

<table>
<thead>
<tr>
<th>Cow</th>
<th>Amount yielded</th>
<th>Lactometer</th>
<th>Temperature F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Charley&quot;</td>
<td>6 qts.</td>
<td>108</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Blue&quot;</td>
<td>6 &quot;</td>
<td>112</td>
<td>60¹/₂°</td>
</tr>
<tr>
<td>&quot;Red Heifer&quot;</td>
<td>4 &quot;</td>
<td>104</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Gypsy&quot;</td>
<td>5 &quot;</td>
<td>107</td>
<td>60°</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21 qts.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"Strippers;" milked but once daily.

<table>
<thead>
<tr>
<th>Cow</th>
<th>Amount yielded</th>
<th>Lactometer</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Andrew&quot;</td>
<td>½ pint.</td>
<td>104</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Fanny&quot;</td>
<td>1 &quot;</td>
<td>93</td>
<td>59°</td>
</tr>
<tr>
<td>&quot;Moody&quot;</td>
<td>1 &quot;</td>
<td>99</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Ryder&quot;</td>
<td>3 &quot;</td>
<td>103</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Yellow&quot;</td>
<td>3 &quot;</td>
<td>102</td>
<td>60¹/₂°</td>
</tr>
<tr>
<td>&quot;Spot&quot;</td>
<td>1 &quot;</td>
<td>108</td>
<td>60°</td>
</tr>
<tr>
<td>&quot;Star&quot;</td>
<td>1½ &quot;</td>
<td>104</td>
<td>59¹/₂°</td>
</tr>
<tr>
<td>&quot;Black&quot;</td>
<td>1½ &quot;</td>
<td>78</td>
<td>60°</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12½ pints.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With the exception of the Black cow, all of the strippers were with calf and were expected to be delivered in about 2 or 2½ months. The Black cow had never yielded much milk since her calf was taken from her, and was to be fattened and killed for beef. Her milk looked very thin and watery, and was full of stringy curds which clogged the strainer. Indeed the product from all the strippers was not true milk, and was in no way suitable for domestic use. The product from the pregnant cows was essentially colostrum.

The total yield of the four regular milkers for the evening and morning together, was 34½ quarts, an average of 8½ quarts per day from each cow, which is considered a fair average yield for the winter season.
The total yield from the eight strippers was 12½ pints, or an average of 1½ pints per day.

The food of the cows, so far as we saw, was oat-straw only.

Mr. Mulford stated that after that morning he should not again milk the strippers Fanny, Star, Andrew, Mooly, Spot, or Black, until after calving.

Samples of the milk from Fanny, Mooly, and the Black cow, all whose milk stood below 100 on the lactometer, were taken, and, on reaching New York, they were submitted to examination. The results were as follows:

**Examination of the low gravity Milk (?) from Strippers.**

<table>
<thead>
<tr>
<th></th>
<th>Fanny</th>
<th>Mooly</th>
<th>Black Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction</td>
<td>Strongly alkaline</td>
<td>Strongly alkaline</td>
<td>Strongly alkaline</td>
</tr>
<tr>
<td>Lactometer</td>
<td>93°</td>
<td>99°</td>
<td>78°</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.03697</td>
<td>1.03871</td>
<td>1.02262</td>
</tr>
<tr>
<td>Cream (%)</td>
<td>11.50 per cent.</td>
<td>No distinct layer</td>
<td>10.50 per cent.</td>
</tr>
<tr>
<td>Water</td>
<td>86.97 &quot;</td>
<td>86.66 per cent.</td>
<td>91.52 &quot;</td>
</tr>
<tr>
<td>Fat</td>
<td>4.65 &quot;</td>
<td>3.45 &quot;</td>
<td>1.78 &quot;</td>
</tr>
<tr>
<td>Casein and Albumen</td>
<td>5.14 &quot;</td>
<td>7.58 &quot;</td>
<td>4.30 &quot;</td>
</tr>
<tr>
<td>Sugar</td>
<td>2.40 &quot;</td>
<td>1.03 &quot;</td>
<td>1.42 &quot;</td>
</tr>
<tr>
<td>Salts</td>
<td>0.84 &quot;</td>
<td>1.28 &quot;</td>
<td>0.89 &quot;</td>
</tr>
</tbody>
</table>

Milk from Mooly yielded no well-defined layer of cream. Milk (?) from the Black cow yielded 10.5 per cent. by volume of scum—curdy matter mixed with fat globules. It also deposited a sediment.

Respectfully submitted,

**Elwyn Waller, Ph.D.**

**J. T. O'Connor, M.D.**

**New York, Jan. 12, 1877.**

**Note.**—The sample of milk (?) from the “Black cow” on the “Mulford Farm,” produced in court as “pure milk,” “standing at 78° on the lactometer,” by Mr. T. C. Doremus, before the visit of Doctors Waller and O'Connor, was examined by Prof. Chandler and Dr. O'Connor, who found it after standing a week to exhibit a strong alkaline reaction, which it has not yet lost.
after three weeks' standing up to the time this note was written, to deposit a considerable sediment, and to possess a disagreeable taste. Analysis showed it to contain

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Water</td>
<td>90.64</td>
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<tr>
<td>Fat</td>
<td>2.64</td>
</tr>
<tr>
<td>Casein,</td>
<td></td>
</tr>
<tr>
<td>Albumen,</td>
<td>6.04</td>
</tr>
<tr>
<td>Sugar,</td>
<td></td>
</tr>
<tr>
<td>Salts</td>
<td>0.68</td>
</tr>
</tbody>
</table>

100.

The microscope showed the sediment to contain pus corpuscles. This is an abnormal fluid, which cannot properly be called milk.
since 1850 under existing up to the time this note was written.
Analysis showed it to contain

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>90.64</td>
</tr>
<tr>
<td>Salt</td>
<td>0.68</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.04</td>
</tr>
<tr>
<td>Sulfate</td>
<td>0.04</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

The microscope showed the sediment to contain pse corpuscles. This is an abnormal fluid, which cannot properly be called

milk.
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