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Milking Cows.

The milk of cows soon after they have calved contains more butter, and is much more easily churned, than it is afterwards. About five months after calving the milk undergoes a change, and the cream is not only less in quantity, but the butter globules are smaller. The reason why milk froths in churns is that, when it sours, alcohol is formed by the decomposition of the sugar of milk, and this causes the milk, when shaken or beaten, to foam or froth. If this froth exists to a large extent, butter will not come, and the milk is useless for churning purposes. The longer a cow is milked after calving, the less is the yield of butter, and the less nourishment is there contained in her milk.—*Land and Water.*

A BIT OF ANCIENT TRAVEL.

In our description of the Oera Linda alphabet (page 195 of our last issue), mention was made of the circumstance that among the many internal evidences of the genuineness of the Oera Linda manuscript was an account of a visit to the pile dwellers of the Alpine lakes, which could not have been written by any one in recent times. It is certain that the manuscript has been in the Oera Linda family for several generations, and equally certain that previous to 1853, when the first remains of pile dwellings were accidentally discovered, the existence of a people living in that way had been forgotten for a period of two thousand years. It rests with those who question the antiquity of the record to show how the following narrative, not to mention others, could have been invented at any time since the extermination of the lake men and the destruction of their remarkable settlements, of which the historians of Southern Europe make no mention.

The first and most ancient account of the pile dwellers is also the most complete and circumstantial. It occurs in the story of Apollonia, chief priestess or burgtmaagd of a place called Lindasburgt, which she describes at length, furnishing a remarkable picture of a civilization in Europe more ancient than that of Greece. Her visit to the pile dwellers was made about the middle of the sixth century before the birth of Christ. It was the rule among the ancient Frisians that, before a burgtmaagd could enter upon the duties of the office to which she had been elected, she must travel for a year. Upon her devolved the responsibility of teaching the maidens how to set to work when they went among the people, and naturally it was essential that she should be well acquainted with the country. It was during her tour of observation that Apollonia visited the pile dwellers.

"My journey," she writes, "was along the Rhine, on this side going up and on the other down. The higher I went, the poorer the people seemed to be. Everywhere about the Rhine the people dug holes, and the sand that was got out was poured with water over fleeces to get the gold; but the girls did not wear golden crowns of it. Formerly they were more numerous; but since we lost Schoonland (Scandinavia) they have gone up the mountains. There they dig ore and make iron. Above the Rhine, among the mountains, I have seen Marsaten. The Marsaten are people who live on the lakes. Their houses are built upon piles, for protection from the wild beasts and wicked people. There are wolves, bears, and horrible lions. Then come the Swetsar (Swiss), the nearest to the frontiers of the distant Krekalanders (Italian and Greeks), the followers of Kalta (Kelts), and the savage Twiskar (Germans), all greedy for robbery and booty. The Marsaten gain their livelihood by fishing and hunting. The skins are sewn together by the women, and prepared with birch bark. The small skins are as soft as a woman's skin. The burgtmaagd at Fryasburgt (Freiburg) told us that they were good, simple people; but if I had not heard her speak of them first, I should have thought they were not Frya's people (that is, white men), they looked so impudent. Their wool and herbs are bought by the Rhine people and taken to foreign countries by the ship captains. Along the other side of the Rhine, it was just the same as at Lydasburgt (Leyden). There was a great river or lake, and upon this lake also there were people living upon piles. But they were not Frya's people: they were black and brown men who had been employed as rowers to bring home the men who had been making foreign voyages, and they had to stay there till the fleet came home."

About two centuries and a half after Apollonia's visit, her descendant, Konerêd, added to the family record a history of Friso and his son Adel, in which another visit to the pile dwellers is mentioned. Hitherto Friso has been supposed to have been the founder of the Frisian race; but it appears that he only brought back to the ancient home of his family a colony of Frieslanders whose ancestors had traveled to the Far East about sixteen centuries before Christ, at a time when there was unbroken water communication between the Mediterranean and the Red Seas. The subsequent closing of the channel by an uplifting of the present isthmus during an earthquake is graphically described in the writings of Adela. Friso had been in the service of Alexander the Great, having built the conqueror's fleet on the Indus and brought it, under Nearchus, by way of the Red Sea to the Isthmus of Suez, over which the ships were drawn to the Mediterranean. He afterwards returned to Friesland with his followers, and was elected grevetman of the districts round Staveren.

When Friso's son Adel had finished his studies at the citadel of Texland, he was sent to travel through the States, accompanied by his wife Ifkja, a clever Frisian: this some time about the middle of the third century B. C., at which time the pile dwellers still inhabited the lakes among the mountains. Adel and his wife spent some time among them, not without great apprehension, for the plundering Twisklanders (Germans) were pressing hard upon them. On the return toward the lowlands, four servants of the party, who had loitered a little, were set upon and murdered by Twisklanders, who are described as banished and fugitive whites who had taken wives from among the Tartars, so called because they made war on everybody. They were all horsemen and bloodthirsty robbers, calling themselves Frijen or Franken. Hitherto the settlements on the Alpine lakes have been known only through their remains. The Paeonians, who inhabited Lake Prasias, as described by Herodotus (book V., chapter 16), were undoubtedly a branch of the same race; and his account tallies well not only with those of Adel and Konerêd Oera Linda, but also with the deductions of archæology. Herodotus, however, knew nothing of the existence of such a people so far to the west; consequently these descriptions, by contemporary writers so many centuries ago, are as valuable as they are interesting.

We may add that tribes living in a similar manner have been discovered in New Guinea, and very recently (by Lieutenant Cameron) in Central Africa.

THE NAVAL ENGINEER CORPS.

Many of our readers may not be aware that the usefulness of the United States Naval Academy at Annapolis has within the past few years been greatly extended by the addition of a thoroughly scientific and practical course of mechanical and marine engineering, and that the engineer corps of the navy is now mainly recruited from the graduates of the institution. The course of study for the cadet engineers comprises four academic years, during which time they are thoroughly instructed in designing, drawing, fabricating, and operating steam machinery, in mathematics, natural philosophy, and the English branches. Their physical culture is carefully attended to, the studies being varied by gymnastic exercises and infantry and artillery drills. The rank, pay, and position of the cadet engineers is the same as that of the cadet midshipmen, their courses of study being parallel. They are, however, appointed in a different manner. The cadet midshipmen, as is well known, are appointed on the nomination of senators and members of Congress. The cadet engineers are appointed from those passing the best competitive examinations. The positions are thus thrown open to those who can show themselves to be the best qualified to fill them, which is just as it should be.

Twenty-five appointments are allowed by law each year, and they are made in September, at the commencement of the academic year. The examination for entrance begins on September 5 next; and those wishing permits to be examined should apply soon to the Secretary of the Navy or the engineer in chief, by mail, for blank applications and pamphlets, containing full particulars as to the qualifications of candidates and the nature of the examination they are required to pass. Candidates must be from 16 to 20 years of age, and must have a fair education. They must send to the navy department, with their applications, certificates as to their good health and character, the dates of their birth, and information as to the educational advantages hitherto enjoyed. Candidates who receive permission must go to Annapolis at their own expense, and, if successful, must furnish themselves with an outfit of uniforms, clothing, and books, at a cost of $230. After admission to the Academy, the salary of the cadet is sufficient for all his necessary expenses, and he will receive from the government a thorough education at an institution which the last report of the Secretary of the Navy declares to be a "school of mechanical and marine engineering second to none in the world;" and on finally graduating he will be commissioned an assistant engineer in the navy.

THE SCIENCE OF CURRENCY.

A proposition has been sent to the Committee on Banking and Currency of the House of Representatives, suggesting that a committee of scientific experts be appointed, to enquire whether there is any science of money and currency, and if they find there is, to express the laws briefly and clearly; but if it shall appear that no such science is known, they shall endeavor to "evolve, discover, or create" such a science. Probably this plan will excite a general smile, for it is very hard to find a person who does not think that he knows all about such matters, and is only surprised that there are so many foolish people who will not agree with him. In spite of all this, however, it is impossible to resist the conviction that we are continually approaching the time when the affairs of this world will be conducted on scientific, that is, on common sense, principles. A good many persons are accustomed to think of scientists as theoretical dreamers, whose labors are of little or no practical importance; but no idea could be farther from the truth. A scientific man is one who is endeavoring to discover Nature's laws, and publish them for the guidance of mankind. The scientists hows us how to make the most of the resources placed at our disposal, how to increase the yield of our land, to reclaim deserts, to harness the physical forces, to avoid disease, to live more comfortably and securely.

In this country, we find ourselves at the present time in the hight of a conflict relating to the currency, and it seems to be entirely overlooked that the elaborate argumenst *pro* and *con* lack even the merit of originality, as they have been uttered scores of times in bygone years, and can be exhumed from the literature and official records of foreign countries. This sort of repetition becomes monotonous, after a while, to say nothing of the disastrous effects of an unsettled policy on the business interests of a country. Now that demagogues have had their say, it is time to call for the views of Science; and we hope the proposition will receive due consideration.

MILK AND ITS ADULTERATION.

When doctors disagree, who shall decide? New York city has been greatly exercised lately by a renewal of the discussion about the methods of detecting the fraudulent adulteration of milk. It was long since settled that water was the only substance employed for adulterating milk, and the question is narrowed down to the determination of the quantity of water added to this popular beverage. Dr. C. F. Chandler has appeared as the champion of the much abused lactometer, and Dr. R. O. Doremus as its chief opponent. The courts lean first one way and then the other, and the public are left as much in the fog as ever.

The question excites much interest, although, aside from its moral and economical aspect, it really does not deserve much attention Of course such a systematic course of

fraud as that which takes $4,000,000 per annum from honest citizens to pay for water mixed with milk, should not be tolerated. Yet if the milkmen will put clean pure water in their milk, we suffer no injury except to our pockets. In truth the excess of water is the least disagreeable distinction between the milk delivered at our doors and that enjoyed by the rural swain. The hot jolt over stony roads, exposed to the sun's direct rays, as it wends its way to the station, where it waits a few hours for the night milk train, to say nothing of the trip on the rail, enable it to reach us just before it begins to sour, but in a fit state to undergo that change at once on taking it from the ice box. It has spent from 12 to 18 hours in a can none too clean at the start, and soon begins to reproduce for us the well known odor of a dirty milk can. The empty can is returned unwashed on the following day to the honest farmer, whose industrious wife finds it impossible, by careful scalding and scouring, to make it perfectly clean and sweet before it must start off again, and probably consolos herself with the thought that it is "good enough for New Yorkers." To our minds and palates, the filth and stench introduced into it in other ways, including the food of the cow, etc., are far more objectionable and dangerous than the water about which so much stir is being made just now. There is a simple mode of escape from all these by the practice of a little self-denial, by learning to drink black coffee and clear tea. Or, if this task prove too difficult, three or four condensed milk companies stand ready to furnish us and our babies with a pure article of acknowledged healthfulness.

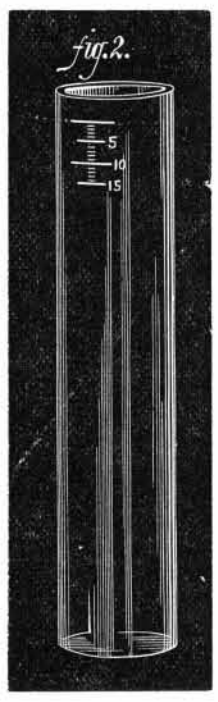
But what are the difficulties in the way of detecting watered milk? Milk is itself a dilute aqueous solution of milk sugar, caseine, and small quantities of mineral salts, and holds in suspension a quantity of fat in a fine state of division. Its composition, when taken from the cow, varies considerably, being richer in the morning than at night, that which is drawn last from the udder, called strippings, being richer than that drawn previously. The same cow yields richer milk when well fed than when poorly fed; and town-fed milk differs from country-fed milk. It is likewise affected by the age of the calf, breed of the cow, etc. The amount of water in unadulterated milk varies from 81·47 to 90·7 per cent, the average according to Letheby being 86·0 per cent. The amount of fat or butter globules varies even more, ranging from 1·79 to 9·88 per cent, both of these figures representing extreme and very uncommon cases. Caseine varies less, from 2·43 to 5·37; sugar, from 3·29 to 6·56; salts, 0·50 to 1·15. Two of the leading English chemists put the average composition of pure milk as follows:

	Letheby.	Wanklyn. Town.	Wanklyn. Country.
Water	86·00	85.94	87·55
Fat	3·90	4·00	3·08
Caseine	4·10	5·02	4·04
Milk sugar	5·20	4·31	4·62
Ash	0·80	0·73	0·71
	100·00	100·00	100·00

It will be evident that, if a complete analysis of a given sample of milk be made, it will tell us neither how much water has been added nor how much cream has been removed. The dairyman must have the benefit of the doubt, and the law should permit him to furnish as poor milk as the poorest cows will give on fair food, and hence he is permitted and encouraged to dilute his best milk down to this standard, no matter what method of testing be employed.

A word about testing milk may not be out of place here. The most satisfactory test is, of course, complete chemical analysis; but unfortunately, the time required precludes its use, except to prove a point already indicated by some more rapid method. If it were possible to erect a huge chemical laboratory at every railroad depot, and employ an army of skilled chemists to analyze a specimen from every can of milk, the time required would be such that most of the milk would sour before it reached the consumers' hands. Beside, it is probably not the farmers but the middlemen who dilute it. The course of analysis is briefly this: A weighed quantity of milk is evaporated to dryness on a water bath, dried at 212°, and weighed; the loss represents the water, and should not exceed 88 per cent. This residue is treated with ether (which dissolves out the fat), is filtered, the filtrate evaporated to dryness, and weighed; the result equals the butter. The total residue, *minus* the butter, is a tolerably constant quantity, and should be about 9 per cent. The caseine in cow's milk (not in breast milk) may be coagulated and determined thus, and the salts are determined by burning off the combustible portion of the solid residue after extracting the butter.

The lactometer, about which we hear so much said, is simply a very delicate hydrometer (Fig. 1), so arranged that it floats in pure water at the zero point of the scale. The depth to which it sinks in milk or other liquid having a specific gravity of 1·029 at 60° Fah. is marked 100°. It is not claimed for this instrument that it is able to do more than show the specific gravity of the liquid. This form of instrument was devised by Dinocourt, and was employed for a long time in Paris and London, where its imperfections and careless use brought severe censure upon it. The difficulty in judging of the quality of milk when we know its density consists in this: Milk contains two different kinds of ingredients, salt and sugar, each of which increases its specific gravity; and butter or cream, which lowers its specific gravity. Hence the apparent paradox that you may lower the specific gravity of the milk by adding either water or cream, and increase its density by removing the cream. Although cream is lighter than milk, it is heavier than water; and hence the addition of cream has much less effect than an equal amount of water; so that although this lactometer does not detect skimmed milk, it does detect the admixture of any considerable amount of water. It was necessary to put the standard of pure milk as low as that of the poorest pure milk to avoid injustice to honest dealers; and for this purpose many hundred samples of pure milk, direct from the cow, were tested, and none being found lower than 1·029, this was taken as the 100° mark for pure milk. Milk that has a greater density may have been skimmed or even slightly watered; if the density is less than that, it is due to one of two things, either water or cream has been added; as no man will add the latter, it is a safe supposition that it is due to the former. Granting the possibility of a farmer or dairyman owning one cow, whose milk is so unusually rich that it falls below 100° on account of cream, he is not likely to send her milk to market or if he does, when mixed, as it must be, with other milk, it will be lifted to the standard at least. So that while the lactometer does not decide the absolute value of the milk, it serves to indicate any considerable amount of dilution; and whether followed up by a complete analysis or not, it will not injure the seller, although affording partial protection to the buyer. The fact that its use by the Board of Health has seriously interfered with the dishonest profits of the milkmen is quite evident from their vigorous efforts to prevent its use. It is not, however, true, as many seem to think, that all milk which stands above 100° is allowed to pass by the sanitary police. Should the milk be wanting in cream, as is easily told by the appearance of the lactometer when it is lifted from the milk, a sample is taken and carefully analyzed to determine the amount of cream removed, a point which, as we have seen, the lactometer does not settle. Several other tests have been suggested for determining the relative value of milk. Each of these is open to one of two objections: they either require delicate balances and skilled fingers, or give very rough approximations. A very simple instrument, which may be used in connection with a lactometer, is known as the creamometer, Fig. 2. It is a straight tube, closed at the bottom and graduated



in hundredths, although the graduation need extend but a little way from the top down. The milk is poured in and allowed to stand and throw up its cream; the volume is then read. Pure milk yields about 10 per cent of cream, but is subject to great variation, so that, while this instrument determines the richness of the milk with some accuracy, and would at once detect skimmed milk, it is unable to decide how much water has been added, because unwatered milk may still be poor in cream, and watered milk throws up its cream more rapidly than pure. John Horsley, F.C.S., modifies this test as follows: One tablespoonful or half an ounce of milk is poured into a tube 11 inches long and ¾ of an inch in diameter, graduated from 10 inches down into hundredths. An equal bulk of ether is next poured in, and the tube closed and shaken for five minutes. An equal measure of alcohol is then added, and again shaken for another five minutes. On placing it upright, the oily matter rises to the surface. Each line of oil corresponds to 4·15 grains of solid butter, and milk with 10 per cent of cream will show two lines of oil, or 8·3 grains for 250 grains of milk.

Sacc's method, which is similar to Horsley's, consists in mixing the milk with an equal volume of alcohol (70° Tr.), and shaking. In good milk the coagulum should occupy the same volume as the milk did. If the coagulum remains suspended in the liquid instead of rising quickly to the surface, it is a proof that water has been added.

Still another method has been devised, depending on the opacity imparted by the butter globules, but space forbids our entering into a minute description of it.

The butter and caseine may best be determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the caseine pure. On evaporating the ether, the butter extracted by it is left and may also be weighed. No chemist would, of course, attempt to deduce the weight of this coagulum from its bulk, which depends entirely on its compactness, and, although apparently simple, is actually a very fallacious test.

Boussingault has shown (Dingler's *Polytechnisches Journal*, CCV., 65) that the microscope readily distinguishes good milk from skimmed or watered milk; but the microscope, like the balance, is a costly piece of apparatus and reliable only in skilled hands.

TO THE FRIENDS AND PATRONS OF THE SCIENTIFIC AMERICAN.

At no period since the commencement of the publication of this paper—thirty years ago—has its regular weekly circulation been so great as it is at present. This fact is gratifying to us, and not less so, we are sure, to our advertising patrons. Notwithstanding the hard times, scarcity of money, and depression in most kinds of manufacturing business, our old subscribers have never renewed their subscriptions more promptly; and never before have so many new names been enrolled in our subscription books as have come in since the commencement of the new volume. The success of the SCIENTIFIC AMERICAN SUPPLEMENT has exceeded our expectations; and, although but three months old, it has obtained, we believe, a larger circulation than that of any similar publication in this country or Europe, while that of the regular edition of the SCIENTIFIC AMERICAN is undoubtedly greater than the *combined* circulation of all the papers of its kind published both in this country and Europe.

These papers go into most of the manufacturing establishments and machine and workshops of this country, and are on file in the principal libraries and reading rooms in the United States and Europe, thereby affording an unequaled medium for manufacturers of all kinds of machinery, and vendors of any new mechanical articles, new inventions, patents, etc., to advertise their wares. Through no other source can they reach the class of persons most likely to become their patrons.

Every established business firm knows the necessity of advertising; therefore a hint to them is not needed. But upon persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or to find a manufacturer to work it—upon this class we would impress the importance of advertising; and we believe there is no other source from which the advertiser can get as speedy returns as from the columns of the SCIENTIFIC AMERICAN and its SUPPLEMENT.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business. All who advertise persistently, and through such mediums as have the largest circulation among the class of persons most likely to be interested in the articles offered, advertise judiciously. That the SCIENTIFIC AMERICAN and the SUPPLEMENT go into the manufacturing establishments, and are taken by persons interested in all kinds of engineering and mechanical enterprises, no one will deny; but what the extent of circulation necessary to reach all these classes of persons is, few stop to realize, and none but the publishers and their advertising patrons, we suppose, care much about it. But the latter are interested in this matter; and for their information we would state that 47,500 copies of the SCIENTIFIC AMERICAN and 15,000 of the SCIENTIFIC AMERICAN SUPPLEMENT are printed every week, making a total aggregate on both editions of 62,500 copies of each issue. Of this large edition, in no single week since the 1st of March have we failed to distribute a less quantity than 60,000 copies to our regular subscribers in this country and abroad, through the mails and newsdealers; and we are happy to say that the demand increases each successive week.

We thank our friends and patrons for their liberal encouragement; and we shall strive to render to all classes of them—subscribers, advertisers, and inventors—a full equivalent for their money.

THE FATHER OF WATERS.

Under this head we recently called attention to the remarkable paper of J. B. Eads, C.E., published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 11, reviewing the labors of the United States Levee Commission, pointing out a number of most serious errors, as he conceives, in the conclusions reached by the Commission. The area of reclamation was given by us at 70,000 square miles, but should have been given at 30,000 square miles. The area of the valley drained by the Mississippi is estimated to contain an aggregate of 1,200,000 square miles, and to be capable of supporting a population of over 300,000,000. In our SUPPLEMENT for the present week (No. 14) Brevet Brigadier General Abbot criticises Engineer Eads' review, giving diagrams of the soundings of the river, showing the accumulation of sediment on the bottom, resulting from increased river volume, with other facts that look difficult of explanation on the theory of Captain Eads. The discussion is one of interest and importance.

Jay Gould Defeated.

About a year ago, the then Commissioner of Patents ordered a patent to issue to T. A. Edison and G. B. Prescott, for quadruplex telegraph instruments, the latter individual being part assignee. Edison sought, by appeal to the Secretary of Interior, Delano, to set aside the Commissioner's decision and prevent Prescott from obtaining his share in the patent, on the pretence that, before selling to Prescott, he had sold the invention to certain other parties, who were known to be in the interest of the notorious Jay Gould. Delano entertained the appeal, held the papers, and refused to decide the case; subsequently he resigned the office. The new Secretary of the Interior, the Honorable Z. Chandler, has recently decided the matter by dismissing the appeal, which he thinks was unauthorized by law; and he sustains the Patent Office in issuing the patent jointly to Messrs. Prescott and Edison,