writer has seen cases in which a nasal voice has followed because of laceration of the posterior pillar which was drawn in by the unsevered mucous membrane. There is less hemorrhage in this method than in any other, for the cleavage plane of the capsule is the least vascular. Injury to the pillars and other tissues may cause considerable bleeding.

When the capsule is removed the tonsil can never grow again and tonsillitis will not recur. The writer was shown a patient at the Massachusetts General Hospital who had had one tonsil with its capsule removed one year previously by Dr. Barnes. The operation was stopped at this point because the patient took ether very badly. At this time, one year after operation, patient had a typical follicular tonsillitis of the remaining tonsil, but no inflammation on the opposite side where there was no tonsillar tissue. In the experience of the writer the amount of post-operative pain is less in the operation above described than in any of the other methods of removal. The post-operative pain depends upon different factors. Dr. F. C. Cobb advances the theory that the amount of mucous membrane left on the edge of the posterior pillar is very important. It would seem that this might be only an indication that less injury had been done to the pillar as a whole. Infection is an important factor. This is influenced by the cleanliness of the mouth, resistance of patient and trauma to tissues. A patient weakened by extreme hemorrhage is more susceptible to infection. Therefore, the method causing the least trauma and hemorrhage should be followed by the best results.

Many writers speak of adherent tonsils and adherent pillars. Probably adhesions are never found binding the capsule to the adjacent parts except where there has been inflammation of the peritonsillar tissue, as in peritonsillitis. In these cases it may be necessary to complete the dissection with the scalpel.

Patients vary as to the vascularity of the parts, and at times hemorrhage seems not to be influenced in any way by the technic employed. In like manner, bleeding stops more quickly in some patients than in others.

Mathews, Blackwell, McWhinnie, Groves and others advocate enucleation by finger dissection. By this method a capsule can be preserved, but it means the use of some force, a tearing of the mucous membrane, which is the only troublesome attachment of the tonsil, and, finally, the lower third must be severed by a snare, guillotine or scissors. There is considerable hemorrhage, but this does not interfere as in the dissection by sight. A preliminary incision of the mucous membrane down to the capsule, as above described, makes finger enucleation very simple and easy and saves the possibility of entering the tonsillar tissue, thus leaving a portion of the capsule. The writer compared a series of cases in which finger dissection was employed with a series after enucleation with scalpel and snare and found that patients complained of much subsequent discomfort after digital enucleation.

The operation above described is followed by less hemorrhage than the other methods of tonsillectomy and causes less immediate hemorrhage than the tonsillotome and punch operations. However, we are liable to excessive bleeding in any instance from the severing of some extra large vessel or because of the idiosyncrasy of the patient.

To check a hemorrhage, first press a pledget of gauze on a holder into the tonsillar sinus for at least three minutes. If this does not suffice, the anterior pillar may be retracted and perhaps a bleeding point may be caught with a long hemostat. If these attempts are unsuccessful, the pillars may be sutured together over a pledget of gauze. This should check any ordinary hemorrhage. As a last resort a tonsil clamp may be applied. Astringent applications and adrenalin are not efficient in the presence of much blood, and are not reliable. They render the tissues more susceptible to infection and secondary hemorrhage. The surgeon should see that all hemorrhage has ceased before leaving the patient. Because of the liability to hemorrhage, tonsillectomy is more safely done in a hospital.

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THE THERAPEUTIC VALUE OF LACTIC ACID BACTERIA.*

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INTRODUCTION.

THE lactic acid organism, first described by Pasteur¹ as far back as 1857 with relation to lactic acid fermentation, has come into very great prominence of late years. It owes its high position in the bacterial world to Professor Metchnikoff,² of the Pasteur Institute of Paris, who discovered the beneficial value of this organism in overcoming putrefaction of the intestinal tract, doing away with intestinal auto-intoxication and assisting in the prolongation of life.

* Read at the American Academy of Dental Science, March 1, 1910.

¹ Pasteur: *Ann. de Chim. et Phys.*, s. 3, 1858, lii, p. 404.² Metchnikoff, Elie: *Prolongation of Life*. G. P. Putnam's Sons, New York, 1908.

As previously said, Pasteur was the first to discover the lactic acid organisms; he described it as a small globule or very short rod, occurring singly or in clumps, rarely forming chains, and capable of fermenting lactose, with formation of acid and gas.

In 1884, however, Hueppe³ described a bacillus which he isolated from various samples of soured milk and was the first to name this organism "Bacillus Acidi Lactici." Hueppe's bacillus, recognized as the lactic acid bacillus of the milk, is known now as the *Bacillus (Lactis) Aerogenes*.

More recent observers have described a number of other lactic acid organisms, the more important among them being:

Streptococcus Lacticus, first described by Leishman⁴ in 1896, who named it "Bacillus Lactis Acidi" to differentiate it from Hueppe's "Bacillus Acidi Lactici." (Leishman's organism, which was also described by a number of other observers, does not differ, however, morphologically and culturally from any other streptococcus and is, therefore, known now as *Streptococcus Lacticus*.)

Another lactic acid bacillus, first isolated by Professor Massol,⁵ of Geneva, from Bulgarian yoghurt and also studied by Cohendy and Michelson,⁶ of the Pasteur Institute of Paris, is known now as the Bulgarian Lactic Acid Bacillus (*Bacillus Bulgaricus*) and, according to Metchnikoff, gives most satisfactory results therapeutically. Its chief value lies in the fact that it produces the largest amount of lactic acid as compared with other lactic acid organisms. This advantage, however, becomes a marked disadvantage when it is found that the highly acid taste is not tolerated by most patients.

The *Bacillus Bulgaricus* is a long, slender rod occurring singly or in chains, rarely forming spores. It does not grow readily on artificial culture media, excepting, as described by North,⁷ upon dextrose bouillon containing pieces of calcium carbonate (marble). It grows very readily in milk at body temperature; not so at room temperature.

While there are a great number of lactic acid bacteria, several scores at least, yet those described above represent the three most important and distinct groups. All these bacteria are capable of fermenting carbohydrates or sugar solutions with the formation of lactic acid, varying one from another in the amount of lactic acid they produce and their ability to overcome other bacteria with which they come in contact; or to be overcome by others.

What happens to the milk when the lactic acid bacillus is introduced is this: In milk the casein is in a state of partial solution, but as soon as there is formed from 0.7% to 0.9% of acid by lactic acid bacteria, the casein precipitates. This phenomenon is commonly known as the curdling of milk.

³ Hueppe, Ferdinand: Mitt. a. d. Kaiserl. Gesundh. Amt., 1884, ii, p. 309.

⁴ Leishman, G.: Centralbl. für Bacteriol., abt. 2, 1904, ii, pp. 600 and 733. *Ibid.*, v, 1899, p. 344.

⁵ Massol, M.: Rev. Méd. de la Suisse Rom., 1905, p. 716.

⁶ Cohendy and Michelson: Compt. rend. de la Soc. Biol., March 17, 1906.

⁷ North, Chas. E.: Med. Rec., N. Y., March 27, 1909.

The precipitate is fine, readily emulsified by the fat present upon the slightest shaking, and then gives rise to a smooth, creamy beverage.

PERSONAL EXPERIENCE.

My own experience with the lactic acid bacillus and soured milk dates back to September, 1905, when one of the most reliable local pharmacists approached me on the subject. This firm was then preparing and dispensing "koumiss," while Metchnikoff, they thought, was advocating the use of "kefir" (a Bulgarian soured milk). I was asked to examine the koumiss prepared by them and find out how it differed from the kefir recommended by Metchnikoff.

Examination showed the kefir to contain various forms of lactic acid bacteria and yeasts, but when carefully prepared with sterilized milk it made a good tasting beverage.

The koumiss prepared by the drug store people contained, beside the lactic acid bacteria and yeasts, a variety of other extraneous bacteria.

The method of production of this koumiss may be of interest.

The manufacturers would get an eight-gallon can of milk, into which they would introduce one or more yeast cakes previously broken up with the fingers. This milk would be allowed to stand in a warm place for twenty-four hours or longer and then poured into bottles, beautifully labeled, and sold as koumiss.

Now, the milk was probably not of the best quality to begin with, and then it was allowed to stand without sterilization or pasteurization for twenty-four hours in a warm place. This in itself is harmful or even dangerous. And this was only supplemented by the effect of yeast cakes handled in a non-bacteriological way.

I made the report upon my findings, offered my services to teach them how to prepare the kefir properly and watched their procedure for a short time. I have since lost track of this firm.

Quite recently the buttermilk epidemic broke out again. This time Metchnikoff was advocating the use of soured milk prepared with a pure culture of the Bulgarian lactic acid bacillus. I began a fresh investigation of the subject because the *Bacillus Bulgaricus*, as we know, produced too much acid and was not tolerated by patients.

I examined various prepared soured milks, lactic acid milks or buttermilks in the market and found most of them to contain different kinds of organisms and yeasts which did not belong there. The many kinds of lactic acid tablets so widely advertised by commercial houses and found in the market under fancy names contained other organisms and yeasts not mentioned in the advertisements. Besides, under the best of circumstances the tablets contained no more active lactic acid bacteria than are found in an equal volume of soured milk. A whole box of tablets, retailing at \$1.50, is equivalent in live organisms to not more than a glass of lactic acid milk. This makes

it rather a costly beverage, even as an "elixir of life."⁸

Recognizing the value of properly soured milk as a food and to a certain degree as a combating agent for putrefactive and gas-producing changes of the intestinal tract in the proper cases, I began investigations aiming to obtain a good-tasting and wholesome buttermilk, or rather, lactic acid milk which could be prepared at home by a practical yet strictly sanitary method.

I isolated several strains of lactic acid bacteria from various prepared lactic acid milks and buttermilks. These organisms in pure culture were tested as to their ability to produce a palatable lactic acid milk.

After many tests I decided upon a bacillus which I isolated from among a variety of organisms. This bacillus (one of the paralactic group of bacteria) in pure culture, when implanted in sterilized milk, produced a good-tasting, smooth lactic acid milk. Later, the results obtained clinically with this organism fully justified its use.

The next step was to find a practical way by means of which the patients could prepare at home a clean and wholesome buttermilk along bacteriological lines. The following method was found most satisfactory:

DIRECTIONS.

1. Take one quart of ordinary milk daily. (If the fat is not desired, order one quart of *fat-free* milk from your milkman.)
2. Pour off one half cupful from quart bottle (to make room for starter).
3. Replace lid or cork (not tight).
4. Put the quart bottle containing milk in a saucepan of cold water.
5. Bring water round bottle of milk to a boil and keep it boiling for one half to one hour (to sterilize the milk). *Do not boil milk.*
6. Remove bottle of milk from boiling water and let it stand in cold place until it COOLS.
7. When milk is cold, shake up starter (in little bottle) and introduce it carefully into the milk.
8. Put on cork or lid tight and shake it.
9. Place bottle in warm place (even temperature) on kitchen shelf (not any warmer than body temperature) for twenty-four hours.
10. At end of twenty-four hours the milk is fermented and should be of same consistency and smoothness as that of cream.
11. The next morning take your second quart of milk and repeat process exactly as you did with the first quart of milk (pouring off one half a cupful, sterilizing the remainder, cooling it).
12. Pour in a little less than one half a cupful (about as much as you had in little bottle) of the first quart of the already fermented milk in order to start the second, instead of starting your second quart with a "starter" as described.

After you have started your second quart from the first, the latter is ready for use and should be kept in ice-chest.

Thus you start your second quart from the first, and your third with part of the second, etc.

Use this lactic acid milk as food either *with* your

⁸ A very careful study of the various tablets and preparations in the market was published by Heinemann in the *Journal of the American Medical Association*, Jan. 30, 1909. His investigations agree with mine in reference to the many lactic acid products in the market.

meals (replacing tea or coffee), or as a last dish, or between meals, using a cracker or toast with it. *Do not drink it like water.*

(To cleanse bottle, pour in a weak solution of household ammonia and let it stand for ten minutes or so. This will remove the adhering particles readily.)

Lactic acid milk prepared in this way is preferable for these reasons: It insures a bacteriologically clean milk, free from extraneous germs. It contains a lactic acid bacillus in pure culture which gives rise to a palatable buttermilk. The heating of the milk in the prescribed way sterilizes it, killing off all the germs present in the raw milk without changing the taste or the consistency, as in the case of boiling. This buttermilk contains all the nourishing elements of milk, in which respect it differs from the dairy buttermilk and is much more tolerated by people who cannot take ordinary milk.

The chief requisites in my opinion, therefore, are a clean, sterilized milk fermented into lactic acid soured milk by any one or more of the various lactic acid bacilli in pure culture. The latter, when implanted in sterile milk, should give rise to a smooth and palatable soured milk.

The things to avoid are unclean milk, not sterilized milk, and uncleanly method of starting or preparing the soured milk. Several harmful germs that may be present in the raw milk, or introduced when starting the milk, may develop alongside of the harmless lactic acid organism while the milk is allowed to be fermented. There is nothing dirtier than a dirty milk; the opalescence will hide everything; sometimes the dirtiness will be detected in taste, but as a rule it will not.

THERAPEUTIC APPLICATIONS.

The lactic acid group of bacteria is of greatest therapeutic value when administered in the form of soured milk, probably because of its ability to ferment milk, with the production of lactic acid. The latter substance in its nascent state, as well as the bacteria themselves when introduced into the intestinal tract, seem to help overcome putrefaction. Active lactic acid organisms introduced into the digestive system will keep on producing lactic acid as long as there is present enough convertible food supply (which, as a rule, is never lacking). The putrefactive wild germs present in the intestinal tract, which only grow in an alkaline medium, are replaced by the lactic acid organisms, which change the alkaline into an acid medium and thus arrest putrefaction. At least this is the theoretical explanation of this method of fighting putrefaction, although there is as yet no scientific evidence that this is really what happens. However, it is reasonable to believe that this is the case.

Another claim made for the lactic acid bacillus and its products is that it will retard the natural hardening of the blood vessels (arteriosclerosis) of old age and will thus give rise to longevity, as the old saying is that "one is as old as his blood vessels are."

My personal experience with the lactic acid

milk, however, from the clinical standpoint, has led me to the belief that while one is taking a quart of lactic acid milk a day with crackers or toast there is sufficient nourishment in that itself, so that one can discard meats, particularly red meats, and other food articles, some of which may be responsible for the introduction into the intestinal tract of putrefactive organisms which keep up putrefactive changes there. These harmful foods, also alcoholic and aerated beverages, are responsible, in a measure at least, for putrefaction and ultimately for arteriosclerosis. So that the change in diet and the elimination of harmful agents of food is one of the chief phenomena in arresting the progress of old age, while the lactic acid milk is not only a good substitute in the change, but also by virtue of the lactic acid organism it contains is capable of overcoming putrefactive bacteria already present there.

In my practice the lactic acid bacteria in the form of soured milk has proven quite efficient, in some cases, in counteracting intestinal flatulency, which in itself was sufficient to give rise to pain and marked discomfort. One or two illustrative cases will not be out of order here.

Dr. H. M. C., fifty-one, while on his vacation last August, noticed suddenly excessive gas and flatulency, both gastric and intestinal; precordial pain, intermittent heart, unable to do much of anything, appetite diminished, general malaise. The excessive pain from flatulency was present all the time; the precordial pain, "simulating angina pectoris," was intermittent. This condition continued for about two months without relief under ordinary methods of treatment (intestinal antiseptics, beta naphthol, etc.). I advised him to take one pint to a quart of the lactic acid milk prepared according to directions previously described. The abundant gas production and the distressing precordial pains in the intestinal tract disappeared within a week. At end of a few weeks he felt so well that he thought of giving up the lactic acid milk. This he did, only to resume it at end of three to four days on account of the return of the symptoms. He now continues to use about one pint daily of the lactic acid milk, which he considers a good, palatable food. He is practically well ever since. Appearance of stool, normal. Odor, which was very foul, is now normal, and no gas whatsoever. Has gained some in weight.

This case illustrates the effectiveness of lactic acid milk to combat the gas production in the intestinal tract. Similar results have been obtained by other observers and by myself in other cases. (The beneficial results observed in some cases of so-called "rheumatoid arthritis" by the use of lactic acid milk are probably due to the counteracting of the gas, which, if excessive, is claimed by some to cause displacement of abdominal viscera, with subsequent rheumatic pains.)

CASE II. Dr. E. L. T., physician, middle age, in a state of general malaise, has always been very thin, always losing rather than gaining in weight. The first time I was called in to see him he was in bed, too weak to get up. The only abnormality found was a subacute infection of the throat. Cultures showed the infection to be a pneumo-staphylo, from which a vac-

cine was made up and with which he was treated. Besides, he was advised to take daily a quart of home-prepared lactic acid milk. Within two weeks the infection was practically cured and the patient gained steadily in weight, weighing now more than he ever did before. His general condition "excellent," feels like "really doing things." He still continues the buttermilk, which he enjoys taking—a glass after each meal. His own story follows:

"Mean for two weeks, no temperature. Bed Nov. 3, temperature 102, pulse 90. Nov. 4, first injection of vaccine, Dr. Medalia, injected every other day. Nov. 16, first time out. Dec. 2, began to do work like myself and gained steadily—from 134 to 150 lbs."

This case illustrates the value of soured milk as a good nutritive food. The nourishing element of the lactic acid milk has also proven in my experience to be of great value in consumptives. The patients who would get bilious and sick of ordinary milk in the forced feeding treatment have taken milk in this form with relish.

So much for the therapeutic value of the lactic acid bacteria in the form of soured milk.

As to the therapeutic value of the *b. Bulgaricus* (Massol) in pure culture in bouillon when applied directly to infected cavities and wounds of the body, nothing definite could be said as yet. Although of some help in leucorrhoeal discharges of the vagina, infection of the bladder, also in cases of ozena and chronic middle ear infections, etc., in all these cases when applied it does no more, if as much, than the applications in those cases of any mild antiseptic, such as dilute Lugol's solution or argyrol, etc. I could not see in it the general panacea claimed for it by the various manufacturers of the lactic acid products. We may hope to counteract by it putrefactive organisms as such wherever found and which are probably responsible for the bad odor in ozena. According to Goodale,⁹ a distinct effect is produced by the cultures in some cases of ozena characterized by general crust formation. He compares the results to those produced by argyrol, and it remains to be seen, he says, whether more than a temporary effect is produced; while in localized chronic suppurative sinusitis with polyp formation he noticed no effect. North's conclusions are not much stronger than Goodale's; where he says in part that the use of the cultures as a spray on inflamed surfaces or cavities often diminishes the discharge, it often diminishes the odor caused by putrefaction, it *sometimes* reduces swelling, especially of the erectile tissue of the nose. He further says that acute and chronic inflammations due to infection, whose seat may be reached by the cultures, may *sometimes* be checked and that the use of these cultures seems to be accompanied by no special danger and cause no irritation.

These cultures are used, then, as nothing more than a local application. If this does no more than any other local *antiseptic* application, it is inferior to the latter, because the antiseptic is supposed to be not only bacteria-free, but should kill any bacteria which may be introduced by

⁹ Goodale, J. L.: BOSTON MED. AND SURG. JOUR., July 15, 1909, vol. clxi, no. 3, p. 83.

handling, etc., while the lactic acid culture is supposed to contain live bacteria and the culture medium itself is favorable to any bacterium with which it will be contaminated by handling, etc., and as such is, one might say, a sort of double-edged sword. It may contain harmful organisms as well as the harmless ones. Although the acidity in the culture may overcome certain kinds of bacteria, yet it cannot always be depended upon to overcome all kinds of bacteria. I could not cite any cases here as treated with the cultures because in no case where I used it have I depended upon the cultures alone, but have at the same time treated the patients with vaccines.

In the mouth the presence of the lactic acid organisms is not to be looked upon with such favor as when present in the milk and introduced into the intestinal tract, for, according to Miller¹⁰ this lactic acid group of bacteria is capable of producing all the essential phenomena of caries of the teeth (out of 22 mouth bacteria, 16 were found by him to produce lactic acid in sugar solutions). The carbohydrate food collecting in favorable places on the teeth undergoes acid fermentation, with decalcification of the enamel, after which the bacteria penetrate the tubules, giving rise to caries. For this reason I caution my patients to wash their teeth with a weak Lugol's solution (1 part to 10 of water) after taking the buttermilk. I do not consider it wise to apply cultures of lactic acid bacteria in the neighborhood of the teeth, as it is recommended, for instance, in pyorrhea, because they are just as likely to destroy the enamel of the teeth and produce caries as they are capable of removing and softening the tartar.

Before concluding, I cannot too strenuously recommend the thorough inspection by the board of health of the many buttermilks and lactic acid milks in the market on the same principle as the inspection is carried on for ordinary milk. It seems strange that the public should be so thoroughly protected against impurities of ordinary milk while any old or spoiled milk may be turned into "buttermilk" and no pure food law nor inspection will reach it, leaving the public unguarded against this impurity. There ought to be a definite law laid down as to what is meant by the various fancy names, such as koumiss, kefir, yoghurt, etc.; what they are to contain in the way of bacteria and what not, and whether or not they really are what they are supposed or advertised to be; also some definite understanding and inspection of the various "buttermilks" sold in every corner of the city.

Surely there must be some way of protecting the people against the impurities of this new article of food, and the Commissioners of the Pure Food Law and the boards of health have another duty to perform for the public.

CONCLUSIONS.

My investigations, therefore, lead me to the following conclusions:

¹⁰ Miller, W. D.: *The Micro-Organisms of the Human Mouth*. The S. S. White Dental Mfg. Co., 1890, Philadelphia, p. 105.

1. Lactic acid milk when prepared at home from tablets is unreliable as to taste and bacterial contents.

2. The objection to the use of the tablets in their dry state is their unreliable bacterial content, the loss of viability of organisms in their dry form, and the high price.

3. Buttermilk, pure and simple, when obtained from the dairyman, varies considerably as to taste (at times very sour, sometimes bitter) and bacterial content and is, therefore, unreliable. It is also deprived of the principal nourishing elements of milk. (The buttermilk as obtained from the dairyman is a side product with him, is the watery fluid left after churning the butter and as such probably not much attention is paid to its keeping, handling, etc.)

4. The Bulgarian lactic acid bacillus (*b. Bulgaricus*) so highly recommended by Metchnikoff produces too much acid, which taste is not tolerated by most patients. For this reason Metchnikoff is advocating now the use of the paralaetic organism mixed with the *b. Bulgaricus* in order to obtain a better tasting soured milk. Which of these two organisms is responsible for the good results cannot be definitely determined, as the *b. Bulgaricus* does not grow readily at room temperature and is, therefore, outgrown by the paralaeticus, which grows most readily at room temperature. It might be safe to say that the beneficial results are apparently due to the latter.

5. A good, clean, soured milk can be obtained by means of any lactic acid organism in *pure culture* implanted in sterilized but not boiled milk. The palatability, however, being an important factor, makes it necessary to choose the organism best suited for this purpose.

6. The therapeutic value of soured milk depends chiefly upon the lactic acid organisms it contains as well as upon the fact of its being a good food article, and *not* upon any particular kind or variety of the lactic acid organism. Any *clean*, palatable milk properly soured would answer the purpose.

7. A good tasting buttermilk can be prepared at home from sterilized milk with a "starter" of lactic acid organisms. One starter will last for several weeks or months if the directions for the preparation described in the article are carefully followed. A new starter should be obtained upon the first sign of contamination detected in taste or in change in the manner of curdling.

8. The *b. Bulgaricus* in pure culture in dextrose bouillon as a therapeutic application in infectious processes, although of benefit in certain conditions as a good local antiseptic, is not a cure-all and must be used with caution. In the oral cavity it should be used with great care, if at all, because the action of the lactic acid upon the enamel may give rise to caries.

9. Public safety demands that the various buttermilks or soured milks in the market should be thoroughly inspected by the health and pure food authorities.