Fishiness in evaporated milk

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_Iowa State College_

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FISHINESS IN EVAPORATED MILK

BY B. W. HAMMER

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

Dairy Section

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FISHINESS IN EVAPORATED MILK

By B. W. Hammer

Among the abnormal dairy products brought to the dairy section of the Iowa State College for examination was a can of evaporated milk that had developed a very fishy odor and flavor. Since fishiness is of very great importance in butter, of considerable interest in milk, and in neither product is thoroughly understood, an investigation was undertaken to determine the cause of the abnormality and the results obtained are presented below.

HISTORICAL

The development of a fishy flavor has been observed in milk from time to time and in butter it is a defect that is commonly met with and strongly objected to on a market that is at all critical. The causes to which fishiness has been ascribed are extremely variable; this is due, in part at least, to the fact that the term fishiness does not signify the same thing to all investigators and accordingly different conditions due to different causes are included under it.

Harding, Rogers and Smith (1900) reported a fishy odor and taste in milk brought to the Geneva Agricultural Experiment station by a milk dealer. "The taint was so strong that the milk was of no commercial value altho coming from a dairyman of more than ordinary carefulness in the handling of his herd." The trouble was limited to the milk from one animal that was receiving the same feed and care as the remainder of the herd and that showed no discernible ailment or lesion. The milk from the different quarters of the animal was studied, but the organisms isolated did not produce fishiness either alone or in mixed culture. An organism that was very plentiful in the strippings and that refused to grow in ordinary lactose agar or gelatine unless 5 to 10 per cent of milk was added, was introduced into two quarters of the udder of a healthy cow but the milk subsequently drawn showed no fishy odor. The authors also state that W. E. Griffith observed (1899) a case of fishy odor and taste in the milk of a cow kept for family use; the abnormality was so pronounced that the milk was discarded during the latter part of July and the month of August. The milk had the peculiar odor and taste when drawn and there did not seem to be a further development on standing.

Du Roi² in giving experiences concerning the use of pasteurization.
zation in combating butter defects mentioned fishy butter, which he says appears, e. g., when litter collected from the woods is used in the stable.

O’Callaghan’s (1901) cited experiments which had convinced him that *Oidium lactis* is the cause of fishy butter; his ideas are by no means conclusively proven, however. This author made experimental butter that was fishy even before it was salted.

Piffard’s (1901), in considering the idea that salt is sometimes the cause of fishy butter, mentioned the ability of salt to absorb the odor and flavor of material stored near it. This author states that a fishy flavor in milk is undoubtedly sometimes caused by the objectionable flavor in water to which the cows have access and which is due to the development of diatoms and algae, notably the Oscillaria. The work of O’Callaghan, already reviewed, is mentioned.

Harrison’s (1901), under the heading of defects in butter, states that the peculiar tastes or flavors of “putrid butter”, “lardy butter,” “bitter butter” and “fishy butter” are caused by the presence and growth of undesirable bacteria in the cream.

O’Callaghan’s (1907) reiterated his idea that fishiness in butter is caused by *Oidium lactis* and stated that he found that this organism, when grown in conjunction with *Bacillus acidilactici* in cream, produced fishiness on every occasion. Contrary to the ideas of some, this author says that many consignments of unsalted Australian butter have turned out fishy in London and that fishiness is sometimes detected in unsalted butter before it leaves Australia.

Rogers’ (1909) concluded from his study of fishy butter that fishy flavor in butter is evidently not produced by the action of any one special factor and that the results given “indicate that its immediate cause is a particular substance produced by the oxidization of one of the combinations of the acid developed in the ripening cream”. Rogers found that acid is essential and that a small amount of oxygen favors the development of fishiness; he states that “butter made from pasteurized sweet cream with a starter, but without ripening, seldom if ever becomes fishy”. He reported that all the experimental fishy butter for which the records were complete came from high acid cream, although high acid cream did not uniformly give a fishy flavor to the butter. Overworking the butter made from sour cream produced a fishy flavor with reasonable certainty. Rogers was unable to produce fishy butter by the inoculation of *Oidium*

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*lactis* into the cream altho a number of different cultures of the organism were used; he also states that the fungus has never been found in more than very small numbers in samples of fishy butter examined by him.

Weigmann* considers that fishy milk would be expected especially when fish residues are used as feed. According to this author, it appears that in Schleswig-Holstein the people believe that cows give fishy milk when they are pastured on meadows, especially marshes, that are temporarily overflowed and in which Crustaceae become dried on the grass. Weigmann points out, however, that it has been noticed that with comparatively heavy feeding of fish meals there is, with clean milking, no fishy taste in the milk or in the butter.

Weigmann* considers that fishiness in butter may develop from abnormal working, and sometimes also from the use of salt high in magnesium. The effect of such salt may be simply an intensifying or bring out of a flavor already there.

Reakes, Cuddie and Reid* (1912) were unable to find significant differences between the bacterial flora of fishy butter and the bacterial flora of high grade butter. Moreover, plugs of fishy butter put into high grade butter failed to cause fishiness and plugs of high quality butter inserted into tubs of fishy butter retained their desirable flavor. These investigators consider the view formerly held by O'Callaghan as untenable and concur with Rogers in the belief that "the development of fishy flavors in butter arises as a result of a chemical change inducing a splitting up of some of the constituents into compounds possessing this peculiar character of smell and taste, the factors responsible for such change being apparently a degree of high acidity of the cream and overworking".

Rogers* more recently discussed fishy butter from a practical standpoint. He pointed out that fishiness is usually preceded by an oily or metallic flavor and that fishiness is more common following conditions that produce more than the usual amount of sour cream. He also points out that fishiness is only retarded and not prevented by low temperatures, and that it may develop in butter made from high grade cream. This author considers the evidence against the trouble being bacterial in nature and ascribes it to a chemical change favored by high acid, and the presence of air and certain materials such as salts of iron and salts of copper that may act as catalytic agents. He states also that "fishy flavor is said to occur rarely or not at all in unsalted butter and it is possible that the salt furnishes cer-

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*8. Mykologie der Milch. 124. 1911.*

*9. Ibid. 208. 1911.*


tain conditions which are essential to the development of the flavor”.

Ernst mentions the possible influence of fish meal and inundated pastures, and also states that “Weigmann mentions a case in which, with uniform feeding and care of the animals, the milk of only one cow developed a fishy odor, and to such a marked extent that the milk of the entire herd became fishy (possibly the udder of the cow was diseased)”.

During the experiments on the flavor of milk as affected by feeds carried on at the Beltsville farm by the U. S. Dept. of Agriculture it was found that, “Milk from fish meal, . . . . had an abnormal flavor when fresh, but was preferred by the judges after it was five days old”.

Hunziker (1915) stated that extremely high pasteurization temperatures, such as 185° F. and higher, when used on sour cream, altho efficient in destroying bacteria, may cause a very poor quality of butter; the butter tends to have a disagreeable oily flavor suggesting also fishiness. This is stated to be particularly likely to occur in summer when the cows are on green pasture and the butterfat contains a relatively high percentage of olein, which appears to yield to the oxidizing action of the combination of high acid and high heat.

A fishy flavor in milk is evidently of very little practical importance and may be due to a number of causes. With butter, however, the development of fishiness is a common source of trouble and the cause of considerable loss; the evidence is against bacteria being the direct cause of the defect and indicates that changes in the butter that are favored by high acid and the presence of oxygen are responsible for the off flavor.

RESULTS OBTAINED

The can of fishy evaporated milk was encountered in a home where evaporated milk is bought by the case of 16 oz. tins and used in coffee and for cooking purposes. On adding milk from the abnormal can to coffee a strong odor of fish was noticed and this recalled to the person opening the can that a small amount of gas had escaped when the tin was punctured. Only the one can of abnormal milk was observed, and this was well in from the edge of the case. On arrival at the laboratory, the milk had a very fishy odor which was still more noticeable when the milk was added to hot water. Because the ideas of various people regarding fishiness are undoubtedly somewhat different, it seemed advisable to submit the abnormal milk to a number of people who had had considerable experience in the judging of dairy

14. l. c. 177.
products in order to be absolutely certain that the material had the typical fishy odor. All of the judges reported the milk to be decidedly fishy. The milk showed an acidity of .56% (calculated as lactic acid) while the acidity of the milk from a normal can from the same case was .32%. Except for a number of small lumps of curd, the milk was normal in appearance.

Tubes of sterile milk inoculated with the abnormal milk developed a fishy odor in from 3 to 4 days at room temperature. Agar plates poured from milk in which a fishy odor had developed showed colonies of only one type and when these were inoculated into tubes of sterile milk a fishy odor again resulted. Plates poured from the original material showed several types of colonies, although a colony that was apparently the same as that secured from the tubes inoculated with the original milk predominated; it seems probable that the mixed flora was due to air contamination, as the milk was exposed for some time before it was received at the laboratory.

The organism secured from the plates was inoculated back into normal cans of evaporated milk by flaming a small portion of the tin, punching a hole with a flamed piece of steel, introducing the organism and then soldering the opening. After holding such artificially infected cans at room temperature for a few days there was a slight distention of the cans, and when the tin was punctured a small amount of gas escaped. In such artificially infected evaporated milk there was a distinct fishy odor and usually small lumps of curd were present. Acid was developed in such milk as is evident from Table I, in which are recorded the acidities, calculated as lactic acid, present in cans of evaporated milk artificially infected and held at room temperature.

**TABLE I—THE DEVELOPMENT OF ACID AT ROOM TEMPERATURE IN CANS OF EVAPORATED MILK ARTIFICIALLY INFECTED.**

(ACID Calculated as Lactic.)

<table>
<thead>
<tr>
<th>Age</th>
<th>ACIDITY Culture 1</th>
<th>ACIDITY Culture 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days</td>
<td>.32%</td>
<td>.32%</td>
</tr>
<tr>
<td>3 days</td>
<td>.37%</td>
<td>.39%</td>
</tr>
<tr>
<td>5 days</td>
<td>.48%</td>
<td>.49%</td>
</tr>
<tr>
<td>9 days</td>
<td>.46%</td>
<td>.49%</td>
</tr>
<tr>
<td>13 days</td>
<td>.48%</td>
<td>.49%</td>
</tr>
<tr>
<td>21 days</td>
<td>.50%</td>
<td>.58%</td>
</tr>
<tr>
<td>30 days</td>
<td>.59%</td>
<td>.59%</td>
</tr>
</tbody>
</table>

In artificially infected cans of evaporated milk held at 37° C. the fishiness produced was not as pronounced as that developed at room temperature. At both 37° C. and room temperature, however, variations were observed in the fishy odor developed, the fishiness sometimes resembling most closely one fish product and sometimes another. Altho the odor was largely influenced by the age of the cultures, it seemed that this could not account
for all of the variations and that other factors must be operative. In cultures several weeks old, the fishy odor had largely disappeared and was replaced by an odor resembling, to a certain extent, the odor of ammonia; it seems probable that ammonia was present among the decomposition products existing in old milk cultures. In making titrations it was observed that on adding the alkali the fishy odor apparently was intensified.

The development of a fishy odor in inoculated sterile milk has already been mentioned. Accompanying the development of this odor there was coagulation followed by a very evident digestion of the casein beginning at the top of the tube and progressing downward. The digested material gradually darkened until in old cultures it was a deep brown; in old cultures also there were small masses of a material that had the appearance of tyrosin. The fishy odor developed at 37° C. in sterile milk was not nearly as pronounced as in the same milk held at room temperature. Acid was quite rapidly developed in inoculated milk at both 37° C. and room temperature as is evident from table II.

### TABLE II—THE DEVELOPMENT OF ACID AT 37° C. AND ROOM TEMPERATURE IN MILK ARTIFICIALLY INFECTED.

<table>
<thead>
<tr>
<th>Age</th>
<th>At Room Temperature</th>
<th>At 37° C.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Culture 1</td>
<td>Culture 2</td>
</tr>
<tr>
<td>3 days</td>
<td>.23%</td>
<td>.22%</td>
</tr>
<tr>
<td>5 days</td>
<td>.34%</td>
<td>.33%</td>
</tr>
<tr>
<td>9 days</td>
<td>.34%</td>
<td>.33%</td>
</tr>
<tr>
<td>13 days</td>
<td>.35%</td>
<td>.24%</td>
</tr>
<tr>
<td>21 days</td>
<td>.33%</td>
<td>.24%</td>
</tr>
</tbody>
</table>

Gas was quite constantly evident in inoculated milk containing gas tubes, although always in small amounts; this gas formation occurred in milk sterilized by the continuous method as well as in milk sterilized by the discontinuous method, altho in some cases as low an exposure as 10 pounds for ten minutes was used. The data, to be presented later, on gas formation in various bouillons show that in lactose bouillon no gas was formed. A considerable number of experiments were carried out using neutral lactose bouillons and lactose bouillons with reactions up to +.7% as well as different continuous and discontinuous sterilization exposures but in no case was gas formation secured. Since the organism forms gas from glucose and galactose, the gas formation in milk may be the result of a slight hydrolysis of the lactose, but it seems more likely that it is produced in the rapid and fairly complete protein decomposition.

The influence of flooding inoculated tubes of milk with sterilized cotton-seed oil was studied in a number of cases. At both 37° C. and at room temperature there was a more rapid digestion and a more rapid development of acid in the exposed tubes than in the tubes flooded with oil. Table III gives a portion of the
room temperature data on the comparison of the acid developed in exposed milk and in milk flooded with oil; the increase in acidity in the exposed tubes was followed by a decrease in acidity while in the tubes flooded with oil it was not.

**TABLE III—COMPARISON OF ACID DEVELOPED IN EXPOSED MILK AND IN MILK FLOODED WITH OIL (ROOM TEMPERATURE).**

( **Acid Calculated as Lactic.**)

<table>
<thead>
<tr>
<th>Age of Cultures</th>
<th>Exposed Milk</th>
<th>Milk flooded with Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days</td>
<td>.32%</td>
<td>.26%</td>
</tr>
<tr>
<td>10 days</td>
<td>.18%</td>
<td>.26%</td>
</tr>
</tbody>
</table>

Evaporated milk was transferred to sterile tubes under aseptic conditions and inoculated with the organism isolated. A fishy odor and flavor developed in about two days at room temperature but even after long periods of holding the milk did not have an appearance suggesting digestion. The lessened digestion in ordinary milk, when it was flooded with sterile oil, suggested that the lack of a digested appearance in cans of evaporated milk artificially infected might be due to the lack of air, but the experiments reported above, in which infected evaporated milk was exposed to the air, apparently excludes the air supply as being of importance in this connection. It seems more likely that the high percentage of solids in evaporated milk prevents the digestion that does occur from changing the appearance of the material very much.

The evaporated milk transferred to tubes and inoculated exhibited a fishy odor and flavor for a number of days after which it began to acquire an odor and flavor suggestive of rancidity. It is probable that the organism inoculated was not causally related to the secondary flavor, but that the light was responsible for the change, thru its action on the milk constituents, notably the fat.

When inoculated into sterilized 20% cream, the organism produced a pronounced fishiness and eventually a coagulation which resulted in a wheying off of the material; a digested appearance was never observed presumably for the same reason that a digested appearance was never observed in evaporated milk.

Because of the importance of fishiness in butter a number of experimental lots of butter were made in an attempt to produce fishy butter by the employment of the isolated organism.* These trials were made by inoculating the organism into butter at once after it was removed from the churn or by inoculating it into small lots of cream before churning. In those cases in which the cream was inoculated, various methods were adopted.

*The work done in an attempt to produce fishy butter by the use of the isolated organism was largely done by Mr. Nick Fennema, a graduate student in dairying.
Bac. ichthyomimus 24 hr. agar culture stained with gentian violet

using both sweet and sour cream; in some cases sterilized cream and in others pasteurized cream was used and the isolated organism was inoculated alone and in combination with Bac. lactis acidii. After churning, the butter, which was sometimes salted and sometimes not, was held in a cooler thru which the brine was circulated only a part of each day and which accordingly ranged in temperature from 0° C. up to 10° C. Altho the inoculated butter was held for long periods of time in no instance was a typical fishy flavor developed in the butter altho the flavor of the butter was commonly very disagreeable. Determinations of the numbers of bacteria present per gram of butter showed that with the butter made from sour cream and with the salted butter from sweet cream there was a decrease from the time of the first determination, which was only a few hours after the butter was churned, while with the unsalted butter made from sweet cream there was a considerable increase in the numbers of bacteria for a few days and that then there was a pronounced de-
crease. From the work carried on it seems the isolated organism which can cause a pronounced fishy odor and flavor in milk is unable to produce fishiness in butter. The fact that the organism is unable to grow in butter made from sour cream or in salted butter made from sweet cream is also evidence against it being of direct importance as a cause of fishiness in butter under practical conditions.

DESCRIPTION OF THE ORGANISM

_Bac. ichthyosmius_

The organism isolated from the can of evaporated milk that had developed a fishy odor was studied morphologically, culturally and bio-chemically with the results given below. The name _Bac. ichthyosmius_, suggested by Dr. A. W. Dox, was adopted for it.

MORPHOLOGY.

**Form.** The organisms were definitely rod shaped.

**Size.** Preparations made from young agar cultures and stained with methylene blue showed organisms from 1.0μ to 2.1μ long (average about 1.6μ) and from .6μ to .8μ wide (average about .7μ). Older cultures seemed to show more uniformity in the size of the organisms, the average size being essentially the same as the average for the young cultures.

**Arrangement.** The organisms were practically all isolated in stained preparations made from solid media and also in hanging drop preparations made from bouillon cultures.

**Motility.** In young bouillon cultures the organisms were very actively motile.

**Staining Reactions.** The organisms stained readily with the common stains. There was, however, considerable variation in the intensity of the staining of different organisms particularly in the old cultures and certain cells showed lightly stained areas. The gram stain was negative, _Bact. lactis acidi_ serving as a positive control.

**Spore Formation.** Stained preparations failed to show structures that could definitely be called spores. A number of heat tests made on both young and old agar or milk cultures gave no growth with exposures of 80° C. for 5 or 10 minutes or 70° C. for 5 or 10 minutes.

CULTURAL CHARACTERISTICS

**Agar Streak.** Cultures showed a dirty white, non-viscid, medium heavy, growth in 24 hours at room temperature; with age, the growth increased in amount and became darker in color.

**Agar stab.** There was considerable dirty white, non-viscid, growth at the surface of the medium with a fair amount of growth along the line of puncture after 24 hours at room temperature. In older cultures there was an increased growth. Near the lower end of the line of inoculation there was a heavier growth than just beneath the surface of the medium.

**Agar Plate Colonies.** Colonies were evident after 24 hours at room temperature and were white by reflected light and brown
by transmitted light, the surface colonies being round while the subsurface colonies were irregular with a tendency to an ellipsoidal shape. Both types of colonies had a slightly roughened edge. With age, the colonies became darker and increased in size, the surface colonies having diameters as great as 2 mm, while the subsurface colonies only reached 1 mm.

**Gelatin Stab.** After 24 hours at room temperature there was considerable liquefaction with a turbidity and sediment in the liquefied area. With age, there was an increase in the liquefied area until, after 4 days, liquefaction was almost complete. There was also an increase in the turbidity and sediment with holding.

**Bouillon.** After 24 hours at room temperature, growth was evident as a uniform turbidity. With age, the turbidity increased and soon a sediment developed; there was a greater turbidity and a greater sediment in bouillon to which certain fermentable materials had been added than in plain bouillon. No tendency toward pellicle formation was ever observed.

**Potato.** After 24 hours at room temperature, growth was evident but was very slight in amount; growth increased somewhat with age but was always small in amount. At all stages it was shiny, non-viscid and covered the medium in only a very thin layer.

**Carrot.** The growth on carrot was essentially the same as on potato.

**Dunham's Solution.** After 24 hours at room temperature growth was evident as a turbidity and slight sediment; with an increase in age, there was a slight increase in turbidity and considerable increase in the sediment. In old cultures there was a slightly heavier growth at the surface, although no definite pellicle.

**Uschinsky's Solution.** After 24 hours at room temperature there was a slight sediment and turbidity. Growth increased with age until after several days there was considerable sediment present, and a tendency to a pellicle formation although no definite film was ever found.

**Milk.** The action of the organism on milk and cream has already been described.

**Litmus Milk.** In litmus milk, the color changes consisted of a reddening of the litmus and later of a loss of most of the color. Aside from the color changes, the changes in litmus milk were essentially the same as in plain milk.

### BIO-CHEMICAL FEATURES

**Gas Production.** Gas was produced in bouillons containing glycerol, glucose, fructose, galactose, maltose, sucrose, mannitol, or salicin at room temperature but not in bouillons containing lactose, dulcitol, raffinose or inulin. Where gas was formed there was more produced at room temperature than at 37° C.

**Oxygen Relation.** Growth occurred in both the open and closed arms of fermentation tubes containing plain bouillon or bouillon with glucose or lactose. In all cases growth was somewhat more abundant, however, in the open arm than in the closed arm.

**Indol Production.** Indol was produced at room temperature in a few days.

**Reaction Change.** The reaction changes in various beef extract bouillons held at 37° C. and at room temperature are shown in table IV.
TABLE IV—REACTION CHANGES IN VARIOUS BOUILLONS
(BEEF EXTRACT) HELD AT 37° C. AND ROOM TEMPERATURE FOR SEVEN DAYS.
(Results in per cent Normal Acid.)

<table>
<thead>
<tr>
<th></th>
<th>37° C.</th>
<th>Room Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerol</td>
<td>1.2%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Glucose</td>
<td>1.4%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Fructose</td>
<td>1.4%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Galactose</td>
<td>1.3%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Lactose</td>
<td>a**</td>
<td>a</td>
</tr>
<tr>
<td>Maltose</td>
<td>1.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Sucrose</td>
<td>1.6%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Mannitol</td>
<td>1.4%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Duleitol</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Salicin</td>
<td>a</td>
<td>1.8%</td>
</tr>
<tr>
<td>Raffinose</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Inulosa</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

*a—Alkaline

Ordinarily slightly larger amounts of acid were produced at room temperature than at 37° C. and in the case of salicin bouillon the reaction at 37° C. became alkaline while at room temperature considerable acid was developed. The peculiarity of the results obtained with salicin bouillon led to a considerable number of additional trials in all of which results similar to the original were obtained. Table V shows the acidity in salicin bouillons held at 37° C. and room temperature for various times. Essentially similar results have been obtained in other tests.

TABLE V—ACIDITY IN SALICIN BEEF EXTRACT BOUILLON
AND SALICIN YEAST BOUILLON* HELD AT 37° C.
AND ROOM TEMPERATURE.
(Results in per cent Normal Acid.)

<table>
<thead>
<tr>
<th>Age in Days</th>
<th>37° C.</th>
<th>Room Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beef Extract Bouillon</td>
<td>Yeast Bouillon</td>
</tr>
<tr>
<td>Orig.</td>
<td>.1%</td>
<td>.1%</td>
</tr>
<tr>
<td>2 days</td>
<td>.1%</td>
<td>.1%</td>
</tr>
<tr>
<td>4 days</td>
<td>a**</td>
<td>a**</td>
</tr>
<tr>
<td>7 days</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>21 days</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

The organism isolated is believed to be a species that has not previously been described; its importance from the standpoint of the dairy bacteriologist lies in its ability to produce fishiness in milk, cream, and evaporated milk. The organism is apparently closely related to the Proteus group. A number of species belonging to this group have been inoculated into milk and the cultures examined at various times for the odor developed. With certain of these cultures the odor produced suggests the definite fishiness developed by the organism isolated but it was not so intense and seemed to show more of a tendency to a putrefactive odor.

The name *Bac. ichthyosmius*, which was suggested by Dr. A. W. Dox, has been adopted for the organism isolated.


**a—Alkaline.
The presence of the organism in a living condition in the can of evaporated milk is rather difficult to explain. The failure of this type to resist heat as well as its presence in only one can indicates that it did not survive the sterilization process and suggests that contamination occurred after heating, probably thru some small opening in the metal. It seems rather remarkable, however, that organisms producing more pronounced physical changes in evaporated milk did not gain entrance; this may have been due to a sealing of the opening soon after sterilization, as a result of the firm drying of a small portion of the milk.

**SUMMARY**

From a can of evaporated milk that had developed a fishy odor, an organism was isolated that was capable of producing fishiness in milk, cream or evaporated milk into which it was inoculated. In inoculated milk there was, in addition to the development of a fishy odor, a coagulation and a rapid digestion.

The isolated organism when inoculated into butter, either directly or into sweet or sour cream either pasteurized or sterilized before churning, failed to produce fishiness. In some lots of butter, salt was used while other lots were unsalted. The counts made showed that the numbers of bacteria per gram decreased thruout the holding period with butter made from sour cream and with salted butter made from sweet cream while with unsalted butter made from sweet cream there was an increase which was followed by a decrease.

The organism is apparently a new species which is closely related to the Proteus group and has been named *Bac. ichthyosmius.*