

ISSN:0273-2866
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August 1985
Vol. 5, No. 8
Pages 289-328
\$6.00

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Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Kathy Hathaway, PO Box 701, Ames, IA 50010-0701. 515-232-6699.

"Instructions to Contributors" can be obtained from the editor.

Orders for Reprints: All orders should be sent to IAMFES, Inc., PO Box 701, Ames, IA 50010-

0701. Note: Single copies of reprints are not available from this address; address reprint requests to principal author.

Business Matters: Correspondence regarding business matters should be addressed to Kathy R. Hathaway, IAMFES, PO Box 701, Ames, IA 50010-0701.

Subscription Rates: \$60.00 per volume, one volume per year, January through December. Single copies \$6.00 each. No cancellations accepted.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of \$300 per year, which includes \$100 credit toward an ad in the "annual meeting issue" of the Journal, the July issue. For more information, contact IAMFES, PO Box 701, Ames, IA 50010-

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Membership Dues: Membership in the Association is available to individuals only. Direct dues are \$28.00 per year and include a subscription to **Dairy and Food Sanitation**. Direct dues and both journals are \$50.00. Affiliate and International Membership include both journals for \$50, plus affiliate dues. Student membership is \$14.00 per year, with verification of student status, and includes **Dairy and Food Sanitation**. No cancellations accepted.

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Public Health and Regulatory Concerns of The Foodservice Industry

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Millions of Americans daily consume one or more meals provided by the foodservice industry. Although such foods generally are safe, sometimes mistakes are made in their handling, particularly foods of animal origin, which result in the presence and sometimes growth of certain pathogenic bacteria. Consumption of such food can cause illness. Most common causes of foodborne illness associated with the foodservice industry are Staphylococcus aureus, Salmonella spp., and Clostridium perfringens. Problems also may be caused by other pathogenic bacteria, viruses, parasites and certain chemicals.

The U.S. foodservice industry, both the institutional and commercial segments, provides millions of Americans with one or more meals per day. This activity resulted in sales of more than \$145 billion in 1983 and in forecasted sales of more than \$158 billion in 1984 (2).

Although consumers served by the foodservice industry sometimes may complain about the quantity, appearance, taste or nutritional composition of a meal, their experience with this industry generally is positive. In fact, consumers assume that, regardless of other attributes of the meal, the food will not cause illness. This assumption usually is true, and it is a credit to the combined efforts of regulatory agencies, the foodservice industry

and those segments of the food processing industry that provide products to the foodservice industry. It is particularly noteworthy because of the large size and extreme fragmentation of this industry.

In spite of this generally excellent record, there are instances in which the health of a segment of the public was at considerable risk because of what was done in a foodservice establishment. The regular occurrence, on an annual basis, of these events suggests the ongoing necessity for regulatory intervention to encourage the foodservice industry to further minimize health problems that might be encountered by the public as it uses the goods and services provided by this industry.

The discussion to follow will (a) provide recent information on reported outbreaks of foodborne illness in the U.S. that were attributable to the foodservice industry, (b) mention the types of foods that were associated with these problems, (c) summarize information on the general kinds of mistakes that were made so that problems resulted, (d) provide pertinent information about several of the bacteria involved in these problems and thereby illustrate the need for food control and (e) indicate some causes of foodborne illness that may be of concern to the foodservice industry in the future.

Causes of foodborne illness

The numbers of reported outbreaks of foodborne illness in the U.S. caused by different bacteria are listed in Table 1. The three principle causes of illness related to mistakes made in the foodservice industry in 1981 were *Clostridium perfringens*, *Salmonella* spp. and *Staphylococcus aureus*, with *Salmonella* spp. causing as many outbreaks as the other two organisms combined. Although this pattern was true for 1981, the number and proportion of outbreaks caused by these three organisms varies from year-to-year. However, what tends to remain constant over the years is that most foodservice-associated illnesses are caused by these same three microorganisms.

Of the 185 reported outbreaks of foodborne illness in 1981, approximately 24% were associated with the foodservice industry. This is somewhat lower than the value of 30-35%, which is more typical for this industry. The data (Table 1) also indicate that about 31% of the outbreaks in 1981 resulted from mistakes made in the home, whereas mistakes made in handling food in locations other than foodservice operations and homes accounted for 45% of the outbreaks. It is important to note this last value includes outbreaks caused by mishandling of

TABLE 1. Foodborne illnesses in the U.S., 1981, listed by cause and place food was eaten,^a

Cause	Foodservice	Home	Other ^b
<i>B. cereus</i>	5	2	1
<i>C. jejuni</i>	1	5	4
<i>C. botulinum</i>	0	10	1
<i>C. perfringens</i>	11	4	13
<i>Salmonella</i>	15	18	33
<i>S. aureus</i>	6	17	21
Other	3 ^c	1	5

^aFrom: Foodborne Disease, Annual Summary, 1981 (1).

^bIncludes school, picnic, church, camp, etc.

^cIncludes *Streptococcus* Group A, *V. parahaemolyticus* and others.

foods in schools and churches and at picnics and camps. Many of these outbreaks could justifiably be classified as foodservice-related.

Several additional points need to be made about the data in Table 1. First, the numbers in the table refer to outbreaks and not people who were ill. The number of people per outbreak who were ill varied from 1 to 1000 or more. Second, the numbers refer to reported rather than total outbreaks, which suggests the real numbers of outbreaks are likely to be larger, but how much larger is unknown. If it is true that we do not know the real number of outbreaks, it follows that we do not know how many people in the U.S. suffer from foodborne illness in a year. However, persons knowledgeable about these matters have estimated that annually 740,000 to 5,300,000 U.S. citizens suffer from salmonellosis (17). If we assume that salmonellosis accounts for one-third of the foodborne illness, then it follows that from about 2,200,000 to 16,000,000 of our citizens may suffer from some type of foodborne illness in a year. Although it is not known how many of this group of people could have become ill from food mishandled in the foodservice industry, one can speculate by using the rather conservative value of 24% as experienced in 1981. This suggests the number could range from about 530,000 to 3,800,000. If one were to use the value of 41%, which prevailed for the foodservice industry during the years 1972-1976 (17), then obviously the number of people would be larger. Whatever it is, the true number is likely to be substantial.

Food associated with outbreaks of illness

Table 2 lists the foods associated with illnesses attributable to mistakes made in the foodservice industry during 1981. Included are foods that caused illnesses in schools and at camps and picnics. It is evident from the list that foods of animal origin were the almost exclusive cause of the three major foodservice-associated forms of foodborne illness. This, of course, suggests where the emphasis should be by regulatory agencies and the industry to minimize the problem.

Food handling practices leading to illness

Deficiencies in the handling of foods which caused illness in 1981 are given in Table 3. Although the practices listed here are not specifically related to outbreaks associated with the foodservice industry, an examination of the information can direct us to potentially hazardous practices that need to be changed.

TABLE 2. Foods associated with several types of foodborne illness attributable to mistakes made in the foodservice industry, U.S.A., 1981^a.

Perfringens poisoning	Salmonellosis	Staphylococcal poisoning
Beef	Beef	Baked foods
Chicken	Mexican food	Beef
Mexican foods	Shellfish	Cheese
Turkey	Turkey	Ham
		Milk
		Pork
		Salad, egg
		Salad, other
		Turkey

^aFrom: Foodborne Disease, Annual Summary, 1981 (1).

Holding food at a temperature that allowed bacterial growth was the single greatest factor contributing to outbreaks of illness. This is of particular importance to the foodservice industry because in some instances both inadequate refrigeration and frequent refrigerated storage of foods in deep rather than shallow containers occur. Another factor that may be overlooked is the reduction in cooling rate as cooling proceeds because of physical changes that occur in the product as the temperature is reduced.

Other major factors that contributed to outbreaks of illness in 1981 were inadequate cooking, use of contaminated equipment, use of food from an unsafe source, and poor personal hygiene. These four factors were of greater importance in outbreaks of salmonellosis than in outbreaks of staphylococcal or perfringens poisoning (Table 3).

Another major factor not listed in the table, but which is directly related to all the factors in the table, is training of foodservice workers. Several years ago Schafer (14) said of the foodservice industry, "It's been said that we are a billion dollar industry, and in not so many years may become the largest industry in America, and we are run by teenagers." He goes on to say, "A turnover rate of 200% a year is not uncommon." Schafer (14) was talking about commercial foodservice, but the situation is much the same in institutional foodservice. Several years ago researchers at the University of Wisconsin surveyed personnel in in-

TABLE 3. Factors contributing to outbreaks of foodborne illness, U.S.A., 1981^a.

Factor	No. of outbreaks	<i>C. perfringens</i>	<i>Salmonella</i>	<i>S. aureus</i>
Improper holding temp.	79	21	17	28
Inadequate cooking	32	6	19	1
Contam. equipment	21	2	12	1
Food source unsafe	14	1	5	4
Poor personal hygiene	42	1	15	6
Other	19	0	11	4

^aFrom: Foodborne Disease, Annual Summary, 1981 (1).

stitutional foodservice and found the average worker was less than 25 years old and remained on the job for less than 1 year (8). Hence, it is evident that most workers in the foodservice industry have not had training in safe food-handling procedures before they are employed and then often do not remain on the job long enough to be trained while they are working. Under such circumstances it is amazing that the record of the foodservice industry, in terms of outbreaks of foodborne illnesses, is as good as it is.

Characteristics of bacteria causing illness

We will briefly review some of the characteristics of the bacteria that are the three major causes of foodborne illness associated with the foodservice industry, namely *C. perfringens*, *S. aureus* and *Salmonella* spp. An appreciation of these characteristics will help us to understand why the factors given in Table 3 are so important in causing outbreaks of foodborne illness, and why regulatory control must address itself to these factors.

Information about *C. perfringens* appears in Table 4. Because this organism is widespread in the environment, including soil (11), it is not surprising to find it associated with animals when they are slaughtered and with meat from such animals. Tests by various investigators have shown that the organism occurred in 1.5 to 82% of samples of raw pork, beef, veal, mutton and lamb (11). Because the organism forms spores, any method of cooking that does not give temperatures above 100°C in the product will allow survival of *C. perfringens*. This is particularly true

when roasting rolled roasts or turkeys. Subsequent slow cooling allows for development of vegetative cells, which if the product is not reheated or is inadequately reheated, are consumed. These cells sporulate in the intestine, and release of spores by cells is accompanied by release of enterotoxin, which causes illness. Note that this organism can grow very rapidly near its maximum growth temperature, a fact which makes control of temperature of heated meats particularly important.

Salmonellae (Table 5) are widely distributed among food-type animals such as cattle, calves, pigs, chickens, geese, ducks, turkeys and pigeons. They also have appeared in a variety of foods of animal origin (11). Because of the widespread distribution of these bacteria in meats, factors such as improper holding temperature, inadequate cooking and use of contaminated equipment are of importance in causing outbreaks of salmonellosis. Sometimes persons who have recovered from salmonellosis

continue to shed the organism in their stools for an indefinite time. If such persons are food-handlers, personal hygiene is of special importance in causing or preventing an outbreak of salmonellosis. Although salmonellae are easily killed by heat, sanitizing agents and food-type acids, their widespread occurrence in foods of animal origin often seems to be ignored and so improper food-handling practices continue to cause outbreaks of salmonellosis.

From 30-50% of healthy adults carry *S. aureus* in their nasal passages and from 30-40% of healthy food-handlers carry them on the skin of their hands (10). A staphylococcal lesion on the skin can provide a further important source of staphylococci for contamination of foods. Food-type animals also may harbor *S. aureus*; the organism is a major cause of mastitis, which can lead to contaminated raw milk. Characteristics of the organism (Table 6) that are of particular importance for its control in the foodservice industry

TABLE 4. *Perfringens* food illness - The organism^a.

1. Sporeforming anaerobic rod, *Clostridium perfringens*.
2. Grows at 15 to 50°C, but best at 45°C (Generation time of 10 minutes).
3. Grows at pH values of 5 to 9.
4. Grows in 8 but not 10% salt.
5. Enterotoxin commonly produced in the intestine when ingested vegetative cells sporulate.
6. Enterotoxin (protein, MW ca. 36,000) (heat labile) produced when cells sporulate and is released when spores are released from sporangia.
7. Toxin can be produced in foods if cells sporulate.

^aFrom Marth (9).

TABLE 5. *Salmonellosis* - The organism^a.

1. Asporogenous short rods, *Salmonella* spp.
2. Grows best at 37°C, but can grow at 5.5 to 45°C.
3. Is inhibited or inactivated by food-type acids.
4. Is inactivated by pasteurization and common sanitizing agents.
5. Hundreds of serotypes, all considered pathogenic to humans.

^aFrom Marth (9).

are its carriage by humans (personal hygiene), occurrence in some raw foods (unsafe foods), temperatures of growth (need for prompt and adequate refrigeration to preclude growth and enterotoxin production).

This brief review of major characteristics of *C. perfringens*, *Salmonella* spp. and *S. aureus* has indicated why the factors given in Table 3 are so important in causing outbreaks of foodborne illness. Since they are so important, the need for their control is self-evident if the foodservice industry is to further reduce the risk of illness for the consumer.

Other causes of foodborne illness

Although the forms of foodborne illness we have just discussed constitute the main concerns of the foodservice industry, there are some other forms that need attention. These are listed in Table 7.

Enteropathogenic strains of *Escherichia coli* can cause human illness characterized by diarrhea. Some strains invade the epithelium of the intestinal tract and others produce an enterotoxin, either heat-stable or heat-labile, to cause illness (7). Imported French soft-cheese, in 1971 and again in 1983, was responsible for outbreaks of illness in the U.S. caused by *E. coli*. Had such cheese

been served in a restaurant, this would have been a foodservice problem. However, another situation developed recently in which *E. coli* caused a problem for the foodservice industry. Hamburger sandwiches sold several years ago by fast-food restaurants in Michigan and Oregon caused rather severe diarrhea characterized by presence of blood in the stools of some consumers. Eventually a strain of *E. coli* able to cause the severe symptoms was isolated from the raw ground beef used in one of the restaurants. Had the meat been cooked sufficiently, this problem would not have occurred. At this time we do not know if this strain of *E. coli* is widespread in raw foods. If it is, we may hear about it again.

Yersinia enterocolitica is associated with many food-type animals and causes gastroenteritis in man. This organism is one of the few foodborne pathogens that grows at refrigeration temperatures. The organism has caused outbreaks of illness associated with chocolate milk (12) and, more recently, with pasteurized milk which presumably was contaminated with the organism after pasteurization (16). Again, if these dairy products had been served by a foodservice operation, the industry would have had a problem.

Generally, we associate outbreaks of botulism with foods that were improperly canned in the home. How-

ever, recently *Clostridium botulinum* caused two problems in the foodservice industry because foods were handled improperly. The first involved potato salad made from left-over baked potatoes that became toxic because they were held too long at ambient temperature before they were used to make the salad. Sauteed onions were involved in the second problem, and again the cooked onions were held too long under conditions that allowed growth and toxin production by *C. botulinum*. Spores of *C. botulinum* commonly occur in soil and so their presence on crops such as potatoes and onions is not surprising. Foodservice workers in both instances either knew nothing about the characteristics of *C. botulinum* or if they did, they ignored the information. Regardless of which situation prevailed, the outcome is a matter of record.

Today *Campylobacter jejuni* is recognized as a common cause of acute bacterial gastroenteritis in humans (5). There have been outbreaks of illness caused by this organism that, in the broad sense, were foodservice-associated. In several instances, barbecued chicken that apparently was recontaminated after cooking was responsible for illness. A rather large outbreak in which 800 of 2500 school children became ill apparently was caused by contaminated vinegared pork with vegetables (5). Time will tell if this organism will cause more problems for the foodservice industry.

Although shigellosis is usually thought of as a waterborne rather than a foodborne illness, some outbreaks associated with foods have been reported. Often such foods were salads that probably were contaminated by a human carrier with poor personal hygiene (3). A recent report from The Netherlands indicates that an outbreak of shigellosis occurred in a home for the elderly. Of 208 residents, 28 became ill and of those 28, 14 died. Frozen shrimp imported from the Far East were suspected as being the source of the shigella. This, however, could not be confirmed by laboratory analysis (6).

TABLE 6. *Staphylococcal food poisoning - organism and toxin*^a.

1. Spherical asporogenous cells of *Staphylococcus aureus*.
2. Grows aerobically and anaerobically.
3. Tolerates salt.
4. Grows at 10 to 45°C, but best at 35-37°C.
5. Commonly carried by humans and animals.
6. Produces an enterotoxin (A-E), which is a protein (MW ca. 27,000 to 34,000) that is heat-stable.
7. Enterotoxin affects intestinal tract and circulatory system.

^aFrom Marth (9).

TABLE 7. *Other causes of foodborne illness that may be of greater concern in the future.*

Hemorrhagic *Escherichia coli*
Yersinia enterocolitica
Campylobacter jejuni
Clostridium botulinum
Shigella
Vibrio parahaemolyticus
Listeria monocytogenes

In 1978, *Vibrio cholera* was isolated from the stools of 11 cholera victims who had consumed boiled or steamed crabs. The organism also was isolated from left-over crab meat (4). Tests showed that 20, 39, 19, 22 and 8% of shellfish harvested from Galveston Bay, Mississippi River Delta, Mississippi Sound, Mobile Sound, and Panama City contained *V. cholera* (4). Perhaps this is another good reason for not serving or eating raw shellfish.

Vibrio parahaemolyticus occurs in the marine environment, especially in coastal and estuarine waters and hence is often associated with fish. In humans, the organism causes enteritis characterized by severe abdominal pain, diarrhea, nausea and vomiting (13). *V. parahaemolyticus* is a major cause of foodborne illness in Japan because raw and semiprocessed fish products are frequently consumed. Will this organism cause more problems in the U.S. as the trend to eating raw fish increases? Time will tell.

Finally we come to *Listeria monocytogenes*, an organism which is widely distributed in nature, particularly in soil. It can cause infections of food-type animals, including mastitis of dairy cattle. In humans, the organism can cause death of infants and meningitis or meningoencephalitis of adults, particularly if they are immunocompromised. For a non-sporeforming bacterium, the organism is rather hardy in the environment (11).

Several years ago, in Canada, coleslaw contaminated with *L. monocytogenes* caused a major outbreak of illness that involved 41 persons. Cabbage from which the coleslaw was made was harvested from a field that had been fertilized with manure from sheep ill with listeriosis (15). It is presumed that the cabbage became contaminated from the soil and that *L. monocytogenes*, since it is a psychrotroph, may have grown on the cabbage during refrigerated storage before it was processed into coleslaw. In 1983, an outbreak of human listeriosis in Massachusetts involved 49 persons and was associated

with consumption of pasteurized milk. Although neither of these events involved foodservice operations, the potential exists for dissemination of *L. monocytogenes* through such operations.

This is a brief discussion of some of the uncommon, at least for the foodservice industry, forms of foodborne illness whose importance may increase as ways of handling food are changed. The effects of such changes on the microbiology of products, unfortunately, are not always determined before the changes are made.

Other public health concerns

Listed in Table 8 are some other concerns of a public health nature. This is not an exhaustive list, but each of these items has been or could be a problem for foodservice industry.

TABLE 8. Other public health concerns.

Chemical poisoning

Ciguatoxin
Heavy metals
Monosodium glutamate
Scombrototoxin

Parasites

Trichinella spiralis
Others

Viruses: Hepatitis A
Sodium
Nutrients

Ciguatoxin or ciguatera fish poisoning is associated with eating fish that contain a toxin produced by a marine dinoflagellate. Concern with heavy metals centers around lead, mercury and arsenic, although other elements (e.g. copper) can cause problems. Monosodium glutamate causes the "Chinese restaurant syndrome" in susceptible individuals. This is characterized by the sudden onset of a feeling of numbness over the neck and back, weakness and palpitation, lasting for 2 hours but leaving no after-effects. Scombrototoxin occurs in certain scombroid fishes when bacteria convert histidine to histamine.

Parasites can be a problem when some foods are inadequately cooked. Included are trichinae, the beef and pork tapeworms, and the anasakine nematode in fish. Shellfish can become contaminated with the hepatitis virus if the shellfish grow in polluted waters. Consumption of such raw shellfish has caused hepatitis in some persons.

Recently I visited a chain-type restaurant in Madison and ordered soup. When the soup came, it was little more than colored and flavored salty water, in fact, excessively salty water. Needless to say, I have not gone back to the restaurant, but this points up the problem of use of salt in restaurants. Does the foodservice industry concern itself with the needs of that segment of the population that either must or should control its intake of sodium? Many processed retail foods have labels giving the consumer information about the sodium content of these products. Is it too much to expect the foodservice industry to provide the consumer with similar information?

The final concern to mention is that of providing an adequate balance of nutrients to consumers. This, of course, is taken for granted by the consumer, but does it always happen?

ACKNOWLEDGMENT

A contribution from the College of Agricultural and Life Sciences, University of Wisconsin, Madison, Wisconsin 53706. Presented in a symposium on "Regulations in the Foodservice Industry: Benefits and Burdens" at the 44th Annual Meeting of the Institute of Food Technologists, Anaheim, CA, June 10-13, 1984.

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DNA Comparison Of Molds

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Comparing DNA in molds grown to produce food with DNA in wild molds that produce toxin shows that they are as related as blue-eyed and brown-eyed persons, says a U.S. Department of Agriculture microbiologist.

Cletus P. Kurtzman, head of the Agricultural Research Service collection of molds, yeasts and other microorganisms, says cultivated and wild molds in a group called the yellow-green *Aspergilli* have essentially matching DNA. He says the DNA comparisons support an ecological hypothesis that the food producers evolved from the toxin producers.

Donald T. Wicklow, mold ecologist, says the toxin producers adapted to man-made environments and lost survival characteristics including the defensive toxin-producing ability. The cultivated *Aspergillus oryzae* and *A. sojae* evolved from the wild *A. flavus* and *A. parasiticus*, he says.

The cultivated molds are used to produce Oriental fermented foods and beverages in Japan, China and an increasing number of other countries including the U.S., says Clifford W. Hesseltine, chief of fermentation research at the Northern Regional Research Center. The wild molds can produce the carcinogen, aflatoxin, in cereal grains, peanuts, cottonseed and products made from them all over the world.

Wicklow says Charles Thom and Margaret Church, USDA microbiologists, formed the foundation in the 1920's for identifying the yellow-green cultivated molds and their wild relatives. The scientists concluded that a series of molds could be found to bridge gaps between cultivated and wild strains. In 1945, Thom and Kenneth B. Raper, then Northern Laboratory microbiologist, wrote, "Any variant between the dwarf and deep green *A. parasiticus* and the longest stalked and palest greenish yellow *A. oryzae* may be found if we look for it."

Wicklow says variability among these strains remains a distinguishing feature. Variation is most apparent in

strains isolated from Oriental fermentation products and in strains repeatedly cultured in the laboratory. Strains isolated from cereals at harvest are readily distinguished as the wild molds.

In the man-made environments of fermentation processes and laboratory cultures, artificial pressures replace natural selection, Wicklow points out and poses the question: "Can studies of the cultivated, yellow-green strains tell us anything about the adaptive value of different characteristics of the wild strains?" He evaluated the adaptive value of some mold characteristics used in traditional taxonomy: form, structure, color and chemical products.

Cultivated strains produce fewer spores on test media than wild strains, Wicklow says. Spores of wild strains have rough or spiny surfaces, which aid in attaching to insect vectors. Cultivated strains produce no sclerotia, structures designed to endure adverse conditions, and the strains produce no aflatoxin, which Wicklow considers chemical defense against predators. He points out that the cultivated strains save metabolic energy by not producing the same characteristics in man-made environments that the wild strains need to survive in nature.

Saving energy should give the cultivated molds a growth advantage in their man-made environments, Wicklow says, extrapolating from a theory advanced by ecologists studying higher plants. In spore germination studies, he found that *A. oryzae* and *A. sojae* germinate about 3 hours sooner than *A. flavus* and *A. parasiticus*.

He concludes that the cultivated molds are varieties of the wild molds, and the DNA comparisons support the conclusion.

Extracting deoxyribonucleic acid, DNA, from nuclei of cultivated and wild molds, Kurtzman, Millie J. Smiley, Christie J. Robnett and Wicklow unzipped the DNA twin strands and allowed single strands from cultivated molds to reassociate, or "rezip," to single strands from wild molds. The extent of matching in the "DNA mating" determined the degree of relatedness within a possible 5 percent error. (The molds have no sexual stages, probably cannot mate naturally and have not mated conventionally in research.)

Kurtzman says *A. oryzae* and *A. flavus* showed 100 percent relatedness in the DNA mating, about as related as blue-eyed and brown-eyed persons. The cultivated *A. sojae* and wild *A. parasiticus* showed 91 percent relatedness. The four molds "actually represent only one species," Kurtzman says.

"The species is the primary unit of taxonomy," he states. "Defined in terms of genetics, the species is the product of nature rather than the creation of the taxonomist." Taking into account "industrial, commercial and regulatory practicalities" as well as the rules of taxonomy, he proposes that the four molds be designated as varieties of *A. flavus*. The term "aflatoxin" derives from "*Aspergillus flavus*," he points out, and using *A. flavus* to identify molds used to produce food would be confusing.

Both cultivated and wild Aspergilli have increasing significance in international food industry and commerce, Hesseltine says. The wild molds grow in soil, insects, animals and plant products, including cereal grains and peanuts. They can produce aflatoxin in food and feed crops.

Soon after the 1960 discovery of aflatoxin in peanuts fed to turkeys in England, Hesseltine says, world industries and governments initiated programs to monitor crops and protect foods against aflatoxin contamination. He serves as U. S. chairman of a joint U.S. - Japanese panel organized for this purpose.

The cultivated molds are grown on grains to produce a mixture of enzymes used in making Oriental foods and beverages, including soy sauce and miso from soybeans and sake from rice. Hesseltine and Japanese scientists examined more than 600 strains of cultivated Aspergilli for toxin production. "As far as I know," Hesseltine says, "no authentic strains of *A. oryzae* or *A. sojae* have ever been found to produce aflatoxin." He was decorated on behalf of the Emperor of Japan for research that helped the Japanese establish the safety of their fermented foods.

The cultivated molds have never been isolated "from the wild," Wicklow says. *A. oryzae* was isolated in 1883 from the "starter" used for making sake. *A. sojae* was isolated later.

If the food producers were found and identified no more than 100 years ago, when did their ancestors, the wild molds, "come in from the cold?" Neither molds nor man left a record of the evolution, Hesseltine says.

Man was using "starters" called "koji" in Japan and "chu" in China, in Oriental industries before he identified the organism involved, Hesseltine says. "Starters," "koji," or "chu" are masses of rice, soybeans or other seed sources of starch and protein from fermentations "giving satisfactory results" that are used in subsequent fermentations. Fermentation starters are commercially distributed in the Orient, the same as bread-making yeast is sold in the U.S.

Humans probably discovered chu as naturally molded seeds, says Hwa L. Wang, Northern Center chemist. With S. F. Fang of Academia Sinica, Beijing, Peoples

Republic of China, she recently traced the history of Chinese fermented foods. She says the first documentation of chu is in a book written during the Chou dynasty, 1121-220 B.C., which says that "chu is essential for making chiu," an alcoholic beverage.

"Chu serves as the source of enzymes to convert complex plant constituents into simple products," Wang says. Malt was seldom used as it is in the West to convert starch to glucose sugar.

Raw and cooked grains are vulnerable to mold growth in hot, humid weather, Wang points out. "It must be this naturally molded grain that they (the Chou dynasty writers) referred to as chu," she says. "If we speculate, humans could have discovered chu 6,000 to 7,000 years ago.

"When chu, or molded grain, was soaked in water, early humans noticed the fermented mixture turned into a delightful drink. Perhaps this delightful drink inspired them to imitate nature and resulted in the flourishing development of mold fermentations."

As early as the Chou dynasty, Wang says, the Chinese evidently had enough experience in fermentation to prepare desirable chu with pure quality. "The most popular one was yellow," she says. "Perhaps *A. oryzae* had been cultured at that time. The yellow color was said to be so lovely that the Emperor's yellow robes were known as chu-yi."



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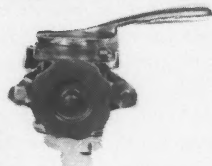
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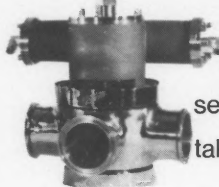
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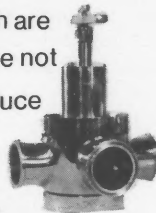
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California To Host 1985 ACDPI Mini-Clinic

The American Cultured Dairy Products Institute has scheduled its fourth mini-clinic for September 24-26 in Fresno, California, according to Institute Board Chairman Bill Ezell of Purity Dairies. This two and one-half day session dealing with the "basics" of cultured dairy food manufacture is especially geared for processing plant supervisors, quality control personnel, foremen, and on-line production staff.

Clinic delegates will receive instruction in microbiology, sanitation principles, product formulations, culture programs, equipment operation, and be given "hands on" experience in recognizing defects in buttermilk, sour cream, yogurt and cottage cheese - PLUS MUCH MORE! Additionally, those in attendance will observe cultured food processing operations at the Dairymen's Cooperative Creamery Association facility in Tulare.

Featured clinic instructors, relates Ezell, will include: Dr. Ron Richter, Texas A & M University; Professor Ed Custer, Mississippi State University; Dr. Charles White, Louisiana State University; Earl Connolly, Fantasy Flavors, Inc.; Fran Lavicky, Nordica International; Bill Born, Dean Foods Co.; Dr. C. Bronson Lane, Dairy and Food Nutrition Council of Florida. Commencing comments will be given by Dr. John Bruhn, University of California.

Further information pertaining to the "nuts and bolts" workshop may be obtained from Dr. C. B. Lane, ACDPI Vice President, P. O. Box 7813, Orlando, FL 32854. 305-628-1266.

Food Safety Manual Now Available

The Retail Food Protection Branch announces the availability of the Program Information Manual (PIM). The PIM is the definitive FDA desk reference of information concerning food safety and sanitation in the food service, food vending and retail food store industries. It is intended for use by local, State and Federal regulatory officials, but is germane to corporate sanitarians and sanitation consultants as well.

The PIM contains:

- organizational charts, directories, lists and bibliographies;
- the 3 model codes (cross referenced to subsequent interpretations);
- all current code interpretations (bulk food, sulfites, dishwasher conversion, etc.);
- manager training and certification information;

- a guide to the FDA's automated data processing system - SPIF;
- Agency procedures for conducting investigations and evaluating food chains; and
- a complete course on facility planning and plan review.

The PIM is available *only on microfiche* from: National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161. 703-487-4650.

For more information contact: Retail Food Protection Branch, HFF-342, 200 C St. SW, Washington, DC 20204. 202-485-0140.



Participants in the University of Wisconsin-River Falls Food Microbiology Symposium (from left) Dean Berry, Dave Robinson, P. C. Vasavada, Nelson Cox, Dianna Wiggins, Kristav Childress, Barbara Savitsky, Phil Kinningham and Richard Gunter.

Fifth Annual Symposium Held At University of Wisconsin

A symposium on Rapid and Automated Methods in Food Microbiology was recently held at the University of Wisconsin-River Falls. It was the fifth annual symposium sponsored by the Animal and Food Science Department as part of an ongoing effort by the department to provide updated information on current issues to the students in Food Science and related majors and offer continuing education opportunity to the food industry personnel.

The symposium was organized by Dr. P. C. Vasavada, and included several speakers presenting information on various systems. Two automated methods discussed at the symposium were the Rapid Impedance measurement (the Bactomatic system) and the Automated Microbiology System (AMBIS beta scanning and electrophoresis systems). Professor George Nelson, University of Wisconsin-Stout, discussed principles of empidometric measurements and

described the use of the Bactometer in Food quality assurance. Mr. Richard Gunter of AMBIS Systems, Inc. discussed the automated system for identifying *Clostridium* species. Several representatives from companies manufacturing and marketing rapid and miniaturized systems for microbial identification made presentations describing their products. These included Mr. Gregg Schaefer, Roche Diagnostics, "Enterotube II & Oxyferm Tubes"; Ms. Barbara Savitsky, Analytab Products, Inc., "API-20E, API Staphase II and DMS Systems"; Professor Dean Berry, SW Bioclinical Labs, "Spectrum-10 System"; and Robert Zuleger, General Diagnostics, "Micro-ID Systems". Finally, Mr. Kristav Childress of the CEM Corporation demonstrated the Hypoberic Grid Membrane Filter (HGMF) technology of the QA Labs and discussed its application in detecting *Salmonella* and coliforms in foods.

A panel discussion featuring all speakers followed the presentations and was moderated by Dr. Nelson Cox, USDA, Athens, Georgia and Dr. P. C. Vasavada, UW-River Falls.

Dr. Nelson Cox also addressed a dinner meeting of the Wisconsin Laboratory Association. He discussed advantages and limitations of various diagnostic systems and gave practical advice regarding the application of such systems in food microbiology and quality assurance laboratories in the food and dairy industry.

The symposium was attended by about 70 people from the food and dairy industry, public health and regulatory agencies, universities and private consulting laboratories. Among the companies represented at the symposium were Ridgeview Foods, Inc., Larson Company, Beatrice (Hunt-Wesson Sanna, Inc.), CTS Fiber-Tek, Nelson-Jameson, Inc., Tolibia Cheese, Inc., Merrick Foods, Green Bay Foods, The Food and Drug Administration, UW-Stout, Commercial Testing Lab, and Food and Dairy Quality Management, Inc.

Nation's First Animal Poison Control Center Established

The emergency telephone service has a veterinary toxicologist available at all times, 365 days a year. Whether the caller has a poisoned animal, a suspected poisoning, an exposure to a poison or just needs information on a potential poison, the NAPCC can provide assistance.

The toxicologists at the center have a constantly updated file on chemicals, feed additives, human and veterinary drugs, pesticides, environmental contaminants and plant and mold toxins. This comprehensive file of information contains comparative species toxicity data, product ingredients

and recommended therapeutic and decontamination measures. We are currently developing a computer database containing 200,000 entries to facilitate quick and accurate responses to all types of poisoning/contamination incidents and inquires.

Since 1983, all calls received by the center have been recorded on computer. This practice provides a means of rapidly retrieving various information on animal poisonings and noninfectious problems across North America. This resource is very valuable in identifying problems involving a specific geographic area or product.

For more information contact: University of Illinois at Urbana-Champaign, National Animal Poison Control Center, 2001 S. Lincoln Ave., Urbana, IL 61801. 217-333-3611.

Wisconsin Joint Educational Conference Announced

The Sixth Annual Joint Educational Conference of the Wisconsin Association of Milk and Food Sanitarians, the Wisconsin Environmental Health Association, the Wisconsin Dairy Technology Society and the Wisconsin Association of Dairy Plant Field Representatives will be held on Wednesday, September 25 and Thursday, September 26, 1985.

The site of this year's conference will be the Valley Inn, Wisconsin Avenue & Walnut Street, Neenah, Wisconsin 54956-0795.

For additional information about the conference contact Ron Buege, West Allis Health Department, 7120 West National Avenue, West Allis, Wisconsin 53214. The telephone number is 414-476-3770.

Food Science Program Appoints 6 USDA Ph.D. Fellowships

After a national search, the Kansas State University Food Science Graduate Program has selected 6 outstanding graduate students to receive the 6 U.S.D.A. Ph.D. fellowships awarded to the university by the U.S. Department of Agriculture. The stipend for 1985-1986 is \$15,000 per fellow. The fellows are Mark Buono (Manhattan, KS), James Claus (Salem, OH), Dean Creighton (Euless, TX), Laura Hansen (Manhattan, KS), Margaret Kolenkiewicz (Bowie, MD), and Normand Lecomte (Orono, ME).

They will be doing applied and basic research in

developing scientific expertise in characterizing and processing cereal and animal products. The departments involved in this renewable grant are Agricultural Engineering, Animal Sciences and Industry, Biochemistry, Chemical Engineering, Foods and Nutrition, and Grain Science and Industry.

The co-directors of the grant are Daniel Y. C. Fung, Chairman of the Food Science Graduate Program and Larry E. Erickson, Secretary of the program.



Tom Gilmore, DFISA Technical Director

DFISA Names New Technical Director

Thomas M. Gilmore, Ph.D., has joined Dairy and Food Industries Supply Association (DFISA) as Technical Director, succeeding Harold E. Thompson who retired June 30. Gilmore will manage all technical affairs of the Association and serve as secretariat to the 3-A Sanitary Standards Committees.

Before joining DFISA, Gilmore was a Senior Food Technologist for Hershey Foods Corporation. Prior to joining Hershey, Gilmore's positions included: Assistant Professor, South Dakota State University; Instructor, Delaware Technical and Community College; and Instructor, University of Delaware.

Gilmore received his doctorate's degree in Food Science from Penn State University in 1976; his master's degree in Organic Chemistry from the University of Delaware in 1970; and his bachelor's degree in Chemistry/Math from Lock Haven University, Lock Haven, Pennsylvania.

Ex-Cell-O Presented Public Service Award

Eye charts specially-designed for printing on Pure-Pak® milk cartons were the focus of attention during the presentation of a public service award to Ex-Cell-O Corporation by the National Children's Eye Care Foundation (NCECF). Ex-Cell-O's Packaging Systems Division, a major packaging supplier based in Walled Lake, Michigan, prepared and distributed the artwork to Pure-Pak carton manufacturers. Dairies were also notified that the artwork was available.

Vito G. Castiglione, President of the Packaging Systems Division, accepted the public service award from Marvin A. Address, President of the NCECF.

"Specially-designed eye charts were made available to dairies nationwide as part of the Foundation's efforts to help detect vision disorders which affect more than 50,000 children each year," Address said. "Ex-Cell-O has helped launch an intensive public effort towards safeguarding eyesight in children."

According to Address, quart and half-gallon milk cartons feature an eye chart that can be used for in-home testing.

The milk carton eye charts are a fun and simple way to detect several common eyesight problems in children according to Marshall M. Parks, M.D., a leading pediatric ophthalmologist and Chairman of the Board of the NCECF.

Dr. Parks stressed that, although the milk carton eye charts are an easy way to detect possible vision problems in children, they do not replace formal vision screening by a trained professional.

New Food Protection Newsletter Will Begin Publication in September

The initial issue of a monthly newsletter reporting comprehensively on all aspects of food protection will appear in September, according to Charles Felix Associates, publisher of the new publication.

Aimed at organizations and institutions that are professionally or commercially involved with food protection matters, the newsletter, *Food Protection Report*, will provide its readers with timely information and special features on a wide range of food protection subjects, gathered with the help of 10 regional editors throughout the country.

"We feel that *Food Protection Report* will fill a critical need of public health professionals and others who are actively involved with ensuring effective food protection in their communities," said Charles W. Felix, Director of Charles Felix Associates, in announcing the new publication. "Right now there is no single, reliable source of information on food

protection available to people in the field, and we want the newsletter to fill this information gap." Felix is editor of Environment News Digest, a bi-monthly publication of the Environment and Health Committee of the Single Service Institute, and served as Chairman of the Second National Conference for Food Protection, held last May in Washington, D.C.

The eight-page newsletter will be organized in two main sections. One will be devoted to current news about food protection developments and timely information of interest to people who are professionally and commercially involved with the field. The second section, in the form of a detachable four-page insert, will provide special features, guest editorials, analysis and commentary, profiles of key people in the news, and occasional cartoons and other light material relating to food protection.

Felix noted that the newsletter would highlight innovations and experimental programs in food protection, and would cover the experiences of various jurisdictions in adjusting to budget cuts while seeking to maintain the integrity of food protection programs. One area to be tracked will be the Hazard Analysis Critical Control Point (HACCP) approach to inspections, already in force in a number of jurisdictions. Other subjects include whether and how to assess fees for food protection services and the computerization of food protection operations.

"We hope that the *Food Protection Report* will serve as a clearinghouse of information about food protection and a way of enabling people in the field to share their experiences and ideas," Felix commented. "We invite suggestions for making the newsletter the most effective and useful vehicle it can be."

More information about the newsletter and details concerning subscription and costs can be obtained from Charles Felix Associates, P.O. Box 1581, Leesburg, Virginia 22075. 703-777-7448.

Cheese You Can Freeze

Recent tests on freezing cheese should be good news for those who would like the convenience of having a stock of their favorite cheeses on hand.

Ten different varieties of cheese proved successful for home freezing in tests reported by the Minnesota Experiment Station, says nutritionist Dr. Dymple Cooksey.

But the success depends on rapid freezing as well as the composition of the cheese, explains Cooksey, a specialist with the Texas A&M University Agricultural Extension Service.

"The temperature in the freezer should be zero degrees F or lower, and the pieces or packages of

cheese should weigh no more than one pound," she advises.

The varieties of cheese that were successfully frozen and kept in freezer storage for six months in the Minnesota tests were: Cheddar, Brick, Port du Salut, Swiss, Provoloni, Mozzarella, Liederkrantz, Camembert, Parmesan and Romano.

"The three brands of Blue cheese tested all became crumbly and mealy after freezing," notes the specialist. "But if Blue cheese is to be used for salad or dressings, this would not be a disadvantage and might make the cheese handier to use."

Since the cream cheese in the tests became watery and mealy, it is not recommended for freezing, Cooksey says.

To freeze cheese, the specialist advises cutting it in pieces no larger than one-pound or using packaged cheese weighing no more than a pound. Small-size cheeses like Camembert and Liederkrantz may be left in their original package or you can use an overwrap for extra protection.

Any cut cheese, such as wedges of Cheddar, should be closely wrapped in freezer-foil. Press the foil tight with the hands to keep out air. Freeze at zero F or lower, and thaw in the refrigerator.



Mr. Ray Rottero, Quality Assurance Supv., Purity Dairies, Lorie Welker, and Dr. J. T. Miles, Head, Department of Food Technology and Science, UTK.

Winner of Purity Dairies Scholarship Announced

Miss Lorie Welker was named the 1985 winner of the Purity Dairies Scholarship at the University of Tennessee. The award was presented during the annual Dairy Institute at the University, on February 26.

Purity Dairies, a leading producer of fresh dairy products in Middle Tennessee, awards the \$700 scholarship annually to an outstanding student in Food Technology and Science who has a career

interest in the dairy industry. Purity also donates \$500 each year to support the Dairy Products Judging Team at the University of Tennessee.

Miss Welker comes from Clarksville, Tennessee where she was active in high school 4-H work. At the University of Tennessee, she worked in the Food Tech Club, Ag Student Council, and Ag Communicators of Tomorrow. She was also elected to Alpha Zeta, Mortar Board, Gamma Beta Phi, and was named the Outstanding Junior in the College of Agriculture, 1985. She was also a member of the University of Tennessee Dairy Products Judging Team and placed second overall in the Southern Regional contest.



William T. Papineau

Alfa-Laval, Inc. Announces Vice President of Farm Supply Division

Alfa-Laval, Inc. Agri-Group, Kansas City, Missouri, announces the appointment of William T. Papineau as Vice President and General Manager of the Farm Supply Division.

The Farm Supply Division manufactures and markets the West Agro and De Laval brands of specialty chemicals for dairy farms. De Laval products are marketed through De Laval dairy equipment dealers. West Agro products are marketed through independent farm supply distributors.

Mr. Papineau joined Alfa-Laval in 1981 as Vice President Finance/Administration Agri-Group. He previously was Director of Corporate Compliance of Jos. Schlitz Brewing Company, Milwaukee, Wisconsin. More recently he served as Vice President Finance and Administration for Alfa-Laval, Inc. in the company's corporate office in Fort Lee, New Jersey.

For more information contact Alfa-Laval, Inc., 11100 N. Congress Ave., Kansas City, Missouri 64153. 816-891-7700.

Schwartzberg Receives Food Engineering Award

Dr. Henry G. Schwartzberg, Professor of Food Engineering at the University of Massachusetts' Departments of Food Engineering and Food Science/Nutrition was selected by Dairy and Food Industries Supply Association (DFISA) and American Society of Agricultural Engineers (ASAE) as recipient of the 1985 Food Engineering Award. The honor is given in recognition for outstanding original research, development, design and management of food processing equipment or processes.

Dr. Schwartzberg was awarded a \$2,000 stipend, a gold medal and a commendation certificate on April 15, 1985 by DFISA president Robert Nissen, Ladish Co., Tri-Clover Division, at the Association's Annual Conference at Marco Island, Florida.

According to Nissen, "Dr. Schwartzberg has made outstanding contributions to food engineering throughout his professional career in industry, academe and consulting. His technical accomplishments, inspirational leadership and boundless enthusiasm are recognized throughout the food engineering profession."

Dr. Schwartzberg is most noted for his significant contributions to the first accredited food engineering curriculum in the U.S. Other academic contributions include frequent guest lectures, consulting and reviewing of chemical and food engineering programs around the world. In addition to his academic accomplishments, Dr. Schwartzberg is active as a Food Industry Consultant, developing innovative new approaches to food engineering problems and stimulating ideas which advance the state-of-the-art. Outstanding original contributions to the industry include several areas of separation technology documented by extensive technical research, more than 80 publications and papers, and several patents.

Cow Nutrient Requirements

The only way to know if your dairy cows are getting the required amount of nutrients is to know how much they are eating, says James G. Linn, dairy specialist with the University of Minnesota's Agricultural Extension Service.

"Weigh forages and grains once per month and use feed test dry matter information to determine dry matter intakes," he says. "Changes in moisture contents of grain can have a significant impact on dry matter amounts supposedly being fed."

Nutrient requirements of cows are expressed in two ways: as a percentage of the total ration or as absolute amounts. "However, cows require absolute amounts of nutrients per day, and not percentages,"

Linn says. "Rations may look balanced from a percentage standpoint but if cows are not eating enough of the ration to satisfy their absolute requirements, production will drop to the level of absolute nutrient intake."

Take, for example, two cows fed a 16 percent crude protein ration. If cow A consumes 40 pounds of dry matter, she will consume enough protein to support 60 pounds of milk; whereas if cow B consumes 45 pounds of dry matter, she will consume enough crude protein to support 70 pounds of milk, Linn explains.

Linn says, "The key factor with high-producing cows is they all have good appetites. Encourage high dry matter intake by feeding a balanced ration containing high-quality forages and grains. Know how much cows are consuming and balance rations accordingly."

More information on dairy nutrition and how to maintain a competitive edge in dairying is available in the 1984-1985 Minnesota Dairy Report, AG-BU-2235, published by the Minnesota Agricultural Extension Service. Copies are available for \$1.50 from the Distribution Center, 3 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108, or contact your local county extension office.

New Health Series Features "Slim Goodbody"

"You're the best person in the world to take care of yourself, because you're always there."

That's what Slim Goodbody tells children in a new classroom video series on health and wellness for children in kindergarten through third grade. The energetic star of the award-winning series "The Inside Story with Slim Goodbody" again sings and dances along the path to health in "Well, Well, Well with Slim Goodbody." The new series is available on broadcast videotape, film and all videocassette formats from the Agency for Instructional Technology.

The 15 15-minute programs on health and wellness challenge children to take an active part in protecting, maintaining and improving their own good health. Being well, says Slim, means more than just not being sick.

Puppets and new characters portrayed by John Burstein, the creator of Slim Goodbody, help the man whose bones, muscles and body systems are illustrated on his unique human-body suit show children how to be their best. General Health issues orders to his young troopers, Professor U.B. Schmart lectures from his research center and, when Slim's away, Hairy T. Sludge sneaks in to give viewers outrageous hints. Doctors, a dentist, a pharmacist and other "body buddies" model their helping roles.

In the program "Food Power," General Health demonstrates the Famous Food Group Plan and exhorts his troopers to choose foods from each group every day to get all the nutrients their bodies need. After Sludge recommends his rival S.O.S. plan (eating only sugar, oil and salt), Slim and Book Puppet sing about nutritious snacks. They visit a pizza parlor to see how a good-tasting snack can be made healthful.

Each "Well, Well, Well with Slim Goodbody" program can be purchased for audiovisual use on film or any videocassette format. The price for each program on film is \$250. The price for each program on videocassette is \$125. Previews will be provided to prospective purchasers in the United States at no charge except for return postage. Conditions for international preview are available from AIT or your AIT representative.

The programs can be leased for broadcast, cable and video duplication by schools, public television stations and other education agencies. Rates are also available for non-educational agencies upon request. International prices for video materials in the PAL or SECAM standards are available from AIT or your AIT representative.

For more information contact: The Agency for Instructional Technology, Box A, Bloomington, Ind. 47402. 800-457-4509 or 812-339-2203.







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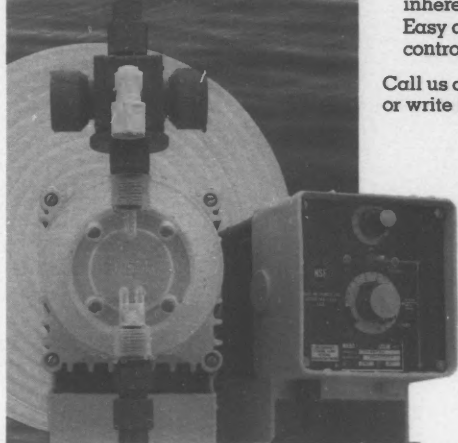
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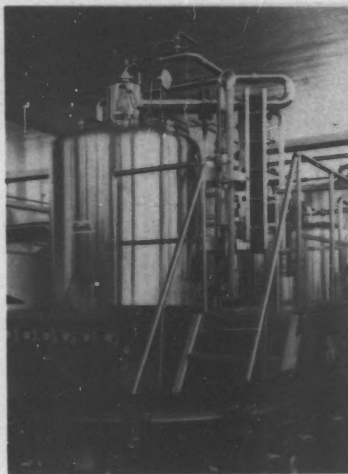


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New Product News

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.



Schmidt-Bretten Food Deaeration System

Schmidt-Bretten Introduces New Food Deaeration System

• Schmidt-Bretten, Inc., Bohemia, Long Island manufacturer of Food Processing and Heat Recovery Equipment has announced the availability of the SigmaVac Deaeration System for extended shelf life of canned, bottled and aseptic cold pack products.

The system eliminates product quality impairment by providing maximum deaeration with no evaporation. The deaeration units are available as stand-alone packages or installed as part of the Schmidt-SigmaTherm thermal treatment system. The SigmaVac allows condensable vapours and aromas to be returned to the product. For more information contact: Schmidt-Bretten, Inc., 1612D Locust Ave., Bohemia, New York, 11716; or call 516-589-2112.

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Dayco EZ-Flo Brochure



Dyna-Dish Disposable Dishes

"Dyna-Dish" - The First Generic Disposable

• Dyna-Dish, a generic, aluminum weighing dish, is now available exclusively from Dyn-A-Med Products.

The Dyna-Dish is an inexpensive, disposable aluminum foil type dish which features crimped sides, a flat bottom, and a finger-tab handle on the rim. It is ideal for use in routine weighing, moisture determination testing, as an evaporating dish, or as a dust protector during testing procedures. Each dish is manufactured of premium quality .0035 gauge thickness aluminum. The dish weight is approximately 1.4 grams and measures 57mm O.D. by 18mm deep. Volume capacity is approximately 42ml.

Dyna-Dish is packaged in poly-sleeves of 100 dishes (1000 per case). With today's cost containment in mind, Dyn-A-Med is offering this premium quality product at generic prices. For more information contact: Randall J. Huster, Director of Marketing, 255 Bluff Court, Barrington, IL 60010. 312-382-5195.

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Dayco EZ-Flo Food Handling Brochure Is Available

• A totally integrated system consisting of hose, fittings and adapters, engineered to improve contamination control and cost-efficiency in food and beverage processing, is graphically illustrated in Dayco's EZ-Flo System brochure.

EZ-Flo excels in the handling of any product which is subject to strict sanitation and code requirements such as FDA and Public Health Grade A pasteurized milk ordinance. It is used for trouble-free handling of food, beverage, chemical or pharmaceutical products made for human consumption.

For more information contact: Sales Promotion Manager, Dayco Rubber Products Company, 333 W. First Street, Dayton, OH 45402. Request Brochure #103408.

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Protein Supplement Introduced By Provesta Corporation

• Provesteen T, a dried yeast protein which fortifies processed food while enhancing flavor and reducing salt content, was introduced by the Provesta Corporation in three tasty and nutritious foods at the Institute of Food Technologists 45th Annual Meeting and Food Expo in Atlanta June 9-12.

A highly digestible protein supplement which contains essential vitamins and minerals, Provesteen is featured as an ingredient in noodles, cookies and "protato" puffs, available for sampling at the Provesta booth. Provesteen replaced 15 percent of the flour used to make the noodles and cookies, and 10 percent of the dried potato flakes in the protato puffs.

Nutrition specialists at Oklahoma State University are conducting research to determine additional food products which can be supplemented by the high-protein yeast powder. All-natural Provesteen is produced in a proprietary fermentation process of an FDA-permitted food-grade yeast.

In addition to fortifying foods nutritionally, Provesteen enhances flavor and reduces salt by 75 percent and in some cases eliminates it. Initial tests indicate Provesteen blends well with corn flavor, chocolate, spice foods and meat flavoring.

"This product has enormous promise as a supplement both in foods already developed and in others under development," said Dr. Sue Knight, assistant professor of food, nutrition and institution administration at OSU, who is directing the research program. "Provesteen can be used to fortify snack and convenience foods as well as food prepared in hospitals or nursing homes for persons who need nutrient-dense supplements," she said. "We also see many applications in the vegetarian industry where Provesteen can be used in cereal and grain based products to produce non-meat food containing high quality protein."

Dr. John Norell, Provesta president, said, "Foods that can be advertised as nutritionally superior, especially snack and convenience foods, have a marketing advantage. In the past decade, American eating habits have changed. Consumers want wholesome foods. There are trends toward reducing salt intake and replacing meat as a protein source."

Dr. Norell added that Provesta would consider joint research and development projects with food companies that are interested in determining specific Provesteen applications in their products.

For more information contact: Provesta Corp., 14C-4 Phillips Bldg., Bartlesville, OK 74004. 918-661-5457.

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Aqua-Flo Water System

Contaminated Water: Today's Silent Killer

• Time and again reports have warned of the dangers of contaminated tap water. These dangers are very real to everyone in America. Many rural homes rely on underground wells as their only source of drinking water.

Recent studies by the Environmental Protection Agency have shown that most of the nation's 50,000 city and town water supplies are slightly or greatly contaminated by such cancer-causing substances as asbestos, pesticides, nitrates, lead and arsenic. 63% of all rural Americans now drink contaminated water. 38% of all community water systems contain poisonous chemicals.

In Duluth, Minnesota, traces of allegedly carcinogenic asbestos fibers were found in the water supply. The asbestos was what remained of an iron waste dumping that was done by a steel company more than 19 years ago.

Traditionally, home owners have used water softeners to filter out hardness minerals in water. However, water softeners do not eliminate chlorine or filter out harmful chemicals. Not only are they expensive and illegal in some areas, but they also add sodium to the water. Sodium is commonly linked to high blood pressure or hypertension. Water softeners remove the valuable trace minerals; calcium and magnesium.

Bottled water is inconvenient and expensive, as is distilled water.

An alternative for the home owner to consider is AGUA-FLO, INC.'s "Water System I." The System combines the benefits of both soft and hard water. Like a water softener system, AQUA-FLO water gives better suds and shampoo while bathing. It also reduces the buildup of limescale and spotting. But unlike a water softener, it does not add sodium to the drinking water. Also, no energy, wasted water on back washes, or chemicals of any sort are required. The Point of Use filter portion of the system eliminates bacteria, removes chlorine and 106 other toxic waste pollutants. AQUA-FLO's unique, non-chemical approach to water conditioning and purification is considered by many in the industry to be the

New Biotechnology Venture Formed By Flow Industries

• Flow Industries, Kent, Washington, and a group of founders announced they have formed BioControl Systems, Inc. as a new biotechnology venture to be located in Kent, WA. BioControl Systems is the first biotechnology company to focus exclusively on developing and marketing products to serve the food, water and milk industries. Specifically, the Company will produce rapid, easy to perform tests to insure the purity and safety of products sold for human consumption.

Flow Industries will provide the initial capitalization for BioControl Systems as well as research and administrative support. In addition, Flow Industries will begin building a substantial biotechnology research component within its own organization. "We are making a major commitment to biotechnology, both in a research and a commercial sense," states Dr. John Cheung, President of Flow Industries.

BioControl Systems' scientists have already developed three test systems for bacterial contamination of food, water and milk and plan market introductions within the first year of operation.

One of these products will be an advanced test for Salmonella that reduces testing time from four days to less than one day, is less expensive and is much easier to perform. A recent major outbreak of Salmonella in the Midwest has created increased demand for better detection methods. "The markets for these products are very large, we plan to get there early and establish a strong market position," comments Max Lyon, Executive Vice President and a founder of BioControl Systems.

For more information contact: Max Lyon, Executive Vice President, BioControl Systems, 21414 68th Avenue South, Kent, WA 98032. 206-872-8500.

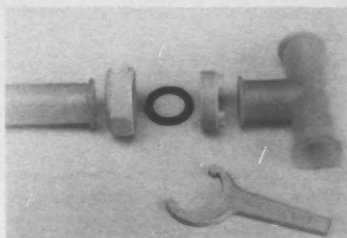
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finest technology available, regardless of price.

AQUA-FLO developed its product line specifically for use in homes, apartments and motor homes. "In looking at the market, we saw that there was not a cost effective product to fit the needs of home owners," said Alden Coke, president. "Home owners on residential well water generally don't want water softeners because they backwash and add salt right back to their fresh water supply. It ruins their drain fields as well as their underground fresh water supply. So, we developed a non-chemical water conditioning and purification system."

For complete facts on this new product and the location of your nearest representative, write or call AQUA-FLO, INC., 6244 Frankford Avenue, Baltimore, Maryland 21206. 1-800-368-2513. In Maryland, 301-485-7600.

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Sanitary Tubing from Sani Tech

Sani Tech Offers Sanitary Tubing of Kynar®

• A complete line of high-purity sanitary tubing made of Pennwalt's KYNAR® fluoropolymer is now being offered by Sani-Tech, Inc.

The new Sani-Pro® K system, as it is called, represents the first wedding of a USDA and FDA approved steam cleanable plastic with a proven system of quick-connect sanitary fittings and connectors, according to Bob Du Pont, president of Sani-Tech.

The result is a high performance, elevated temperature ethical fluid handling system that should provide substantial energy savings and permit significant advances in processing in such industries as food, dairy, pharmaceutical, biotech/genetic and semiconductor manufacturing.

The initial application for the Sani-Pro K tubing made of Kynar fluoroplastic is in a critical electrophoresis system being supplied by McDonnell Douglas for the space shuttle program.

Sani-Tech expects its Sani-Pro K to replace stainless steel, Monel™ and Hastelloy™ tubing normally used in critical arterial systems. Likely uses include the handling of DI water in semiconductor and pharmaceutical industry processing, and tubing for the new ultra-high temperature (UHT) flash processing of long-shelf-life milk products and fruit-based drinks.

Pennwalt's Kynar polyvinylidene fluoride is highly resistant to corrosion and radiation and retains excellent mechanical properties at elevated temperatures. Kynar fluoroplastic has high chemical resistance to virtually all cleaning and sanitizing agents (both alkaline and acidic) as well as to most fats and acids in food, dairy and pharmaceutical products.

For more information on Sani-Pro K sanitary tubing made using Kynar resin, contact Sani-Tech, Inc., Box 104, Gillette, N.J. 07933. 201-647-7600.

For more information on Kynar fluoropolymer, contact Pennwalt Corporation, Plastics Department, Three Parkway, Philadelphia, Pa., 19102.

Pennwalt Corporation, with headquarters in Philadelphia, is a worldwide manufacturer of chemicals, health products and precision equipment.

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The All New "Solar Calf Cabana"

• The "Solar Calf Cabana" is designed to give added control for calf health, comfort and safety. It features a reversible reinforced vinyl cover that is dark on one side and white on the other side. When the dark side is turned out it helps to absorb the sun's heat. The white side out reflects heat for better summer comfort.

An optional, but very important feature is an inner cover (liner) that forms a dead air space (insulation effect) for winter use. In the summer, with the vents in the outer cover opened, it forms a chimney action between the covers to help carry away any unreflected heat.

The frame is galvanized steel tubing of rigid construction, but light and easily moved. Both outer and inner covers have their own multiple vents to give the ventilation control needed for changing climate and weather conditions.

For more information contact: Area Supply Company, 30 Cedar Park Blvd. S.W., Pata-skala, Ohio 43062. 800-848-4296. In Ohio 614-927-9760.

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Viatran Pressure Sensors

New Pressure Sensors Introduced

• A series of four new pressure sensors has been introduced by Viatran Corporation, Grand Island, New York. Models 050, 150, 250 and 350 have been designed and engineered to meet the requirements of 3A Sanitary Standards Nos. 09-07, Instrument Fittings and Connections, and 37-00, Pressure and Level Sensing Devices.

Features of the series include a flush diaphragm integrally machined into the sensor body to expose a flat contact surface to the media. Corners and cavities are eliminated for ease of cleaning in place and reducing potential areas of bacterial propagation.

The industry accepted quick disconnect clamping surfaces, also integrally machined into the sensor body, are designed for a minimum zero offset when the units are clamped

Salt Testing As Fast And Easy As "1-2-3"

• Quantab chloride dip-strip tritators, developed by Miles Environmental Test Systems, provide the food-processing industry with convenient, accurate and on-site chloride detection measurement in as fast as 12 minutes. The plastic Quantab dip-strips are specially designed for attaining precise salt counts in food products including prepared meats, dairy foods, canned and frozen seafoods, canned vegetables, breads, cereals, dry mixes, flavorings, seasonings and much more. A company spokesperson reports that the unique dip-strip method of chloride testing is "virtually as easy as 1-2-3."

The first step in detecting and calculating chloride levels is to place the lower end of a Quantab strip into a fluid test sample until the strip's automatic signal line converts in color, signifying the test completion. This color conversion usually takes about 12 minutes. Second, the chloride reading is recorded by noting the reaction level as indicated on the dip-strip numerical column. Finally, ppm chloride is determined by simply converting the numerical count using the calibration chart included with every bottle of Quantab. The dip-strip can then be filed and stored as a permanent record of the chloride test.

The easy-to-follow instructions enable all on-site personnel to perform and evaluate the tests without advanced training, costly equipment or lab facilities.

For more information contact: Miles Environmental Test Systems, Miles Laboratories, Inc., P.O. Box 40, Elkhart, Indiana 46515.

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in place. Standard clamping configuration is the 2" Tri-Clover type with additional sizes and variations available.

A comprehensive variety of excitation voltages and signals are offered through state-of-the-art solid state electronics. Full scale output signals are directly proportionate to changes in pressure and include 3mVDC, 10mVDC, 0-5 VDC, 0-10VDC and 4-20maDC. Pressure ranges from 0-5 psi through 0-1000 psi are offered in gage, absolute, differential, sealed gage and vacuum design variations. Materials are high quality stainless steel, sealed and welded to provide environmental protection. The units are submersible and offer RFI/EMI protection. Also available, factory set damping.

For complete information and catalog product bulletins, contact Viatran Corporation, 300 Industrial Drive, Grand Island, NY 14072. 716-773-1700.

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Kill Salmonella With Kutol's HSC

• Kutol Products Company's HSC, an E-2 listed bacteria controlling, hand-sanitizing cleaner, kills salmonella, staph, gram positive and gram negative bacteria as well as mold and yeast strains.

HSC is effective even in hard water areas. Its variety of emollients soften and protect the skin as it sanitizes. It can even be used on open cuts as its powerful microbiological properties will continue to destroy any bacteria which comes into contact with the wound. HSC is completely safe and is not absorbed into the skin. There is no need to be concerned with precutaneous absorption, toxicity or hypersensitive reactions.

These outstanding qualities make Kutol's HSC an extremely effective sanitizing and protective cleaner for food plant personnel prior to handling either food or food processing equipment.

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1984 Dry Milk Census Now Available

• The American Dry Milk Institute, national trade association of the dry milk industry, is pleased to announce the availability of its "Census of 1984 Dry Milk Distribution and Production Trends," a yearly publication compiled by the Institute. This publication contains comprehensive industry data and reliably reflects domestic sales and specific markets of utilization for nonfat dry milk, dry whole milk, and dry buttermilk.

This industry-wide survey of the end-use of dry milks distributed in 1984 is intended to serve as a guide in directing promotional efforts to continue the expansion of commercial markets for dry milks. Continued research and development of new uses for the various dry milks are necessary for full expansion of this segment of the dairy industry and represents a program objective of the Institute.

This publication is available for purchase at \$4.00 per copy. For more information contact: American Dry Milk Institute, Inc., 130 North Franklin Street, Chicago, IL 60606. 312-782-4888.

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Food Science Facts

For The Sanitarian



Robert B. Gravani
Cornell University
Ithaca, NY

FOOD DETERIORATION AND SPOILAGE BY MOISTURE AND DRYNESS

Water is one of the most common substances on earth and it is an essential component of all foods. Although the role of water in foods appears easy to understand, it is a very complex topic that requires a great deal of study. An overview of this important subject will be covered in this Food Science Facts.

The water content of a food influences the appearance, texture and flavor of that product. This can be easily understood by thinking of the many foods we consume each day including milk, chicken, macaroni, raisins, apples and many more. All living substances as well as foods contain water in varying amounts. Water makes up about 70% or more of the weight of most natural food products and fruits and vegetables may contain 90-95% water. Even foods that seem dry like beans, flour and cereals contain water.

The moisture content of some common foods are shown in the table below.

Moisture Content of Some Common Foods
Percent (%)

FOOD	%	FOOD	%
Apples	84	Lettuce	96
Bread	32-37	Mayonnaise	15
Butter	16	Milk	88
Corn Flakes	4	Peaches	89
Green Beans	92	Peanut Butter	2
Flour	12	Raisins	18
Jams, Jellies, Preserves	29	Strawberries	90
		Sugar	0.5

Although the water content of a food is expressed as a percent, this number does not reflect how the water exists in the product. Water in food is classified according to its availability, or biological activity, and is either "free" or "bound". Free water is not bound to any components in a food; it can be used by microorganisms for

growth and is also available for chemical reactions. Bound water is physically bound to large (molecules) components in the food. It is not available to microorganisms for their growth and it cannot participate in chemical reactions.

Water exists in foods in many ways. It can be present in:

- Solutions (orange juice, fruit drinks)
- Emulsions (butter, mayonnaise)
- Colloidal dispersions (gelatin desserts)
- Suspensions (starch in puddings)

Water or moisture greatly affects the keeping qualities of food. Excessive moisture pickup can result in product deterioration and spoilage by:

- Microorganisms - microorganisms need water to dissolve the food they use. Water allows the food to get into bacterial, yeast and mold cells where it is used for energy and growth. Water also allows waste products to escape from the cells.
- Chemical Reactions - the moisture in food also functions to allow chemical reactions to occur between components in the product.

Food deterioration and spoilage can occur when there are slight changes in relative humidity. Moisture can condense on the surface of a product and this can result in many common food defects. The molding of grain, soggy cereals, and the caking and lumping of dry products like powders and cake mixes can result from excessive moisture. Other defects such as mottling, crystallization and stickiness have also been observed. Moisture condensing on the surface of a food can also provide an environment for bacteria and molds to grow and multiply.

Physical defects such as cracking, splitting and crumbling occur when excessive moisture is lost from foods.

Since water greatly affects the shelf life of many products, food processors are interested in controlling the final water content of foods they produce. The control of water can be effectively used in preserving foods and this is done with a variety of techniques such as:

- Drying (dehydration), concentration and evaporation - by removing water to a certain level, deteriorative reac-

tions can be reduced or prevented. Examples of products preserved by these drying techniques include dry milk, potato flakes, drink mixes, evaporated milk, orange juice and many other foods.

- Freezing - the freezing of foods changes water from liquid to solid form and renders it unavailable to microorganisms and chemical reactions. Meat, vegetables, and many other products are frozen for this purpose.

- Food Additives - salt and sugar are used in many products to bind water and thereby making it less available for microbial growth and biochemical reactions. Jams, jellies and cured hams are examples of these products.

Not only is control of the final water content of a food important, but the type of packaging material(s) used is also vital in maintaining product quality. The package must protect and preserve the product and retard spoilage as it is moved through the food chain.

Through proper process control, the selection of suitable packaging materials and controlled storage studies, the effects of moisture and dryness of specific foods can be determined.

Employees in the food industry need to be aware of how moisture and dryness affect foods and why it is important to process, package and store foods properly.

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Dairy Quality

by Darrell Bigalke, Food & Dairy Quality Mgmt., Inc., St. Paul, MN

GUIDELINES FOR IDENTIFYING CAUSES OF FLUID MILK PRODUCT DEFECTS

Last month's *Dairy Quality* suggested a product evaluation policy and specifications for fluid milk products. The Newsletter pointed out that effective product evaluation should be based on organoleptic analysis coupled with microbiological analysis. The intent of this month's article is to point out how effective product evaluation (both organoleptic and microbiological) can be useful in identifying causes of product defects.

Identification of sources of contamination or other causes of product quality defects in fluid milk products can be frustrating, requiring considerable time and effort. The only real solution to this problem is to implement an effective control system that will "head-off" problems before they get out of control. However, there are times when control systems are neglected or not implemented properly and, as a result, are not effective in identifying the causes of quality defects. When this condition exists there are a few steps that can be taken to help identify the cause of the product defect.

The first step requires having personnel trained in flavor evaluation that can accurately identify the type of defect. Previous newsletters pointed out that there are several types of defects that may occur in fluid milk including microbial off-flavors, oxidized off-flavors, light induced off-flavors, and others. Table 1, below, shows microbial and non-microbial defects that may occur in fluid milk products.

If fruity, unclean, putrid, bitter, acid, or possibly malty flavors are present, the defects are no doubt microbiological in origin. If this is the case, there are three possible

causes of the defects: (1) post-process contamination, (2) growth of psychrotrophic thermophilic microorganisms, (3) the presence of microbial heat-stable enzymes (assuming these off-flavors were not present in the raw milk). If these off-flavors are present in the milk sample, the next step would be to conduct a Standard Plate Count on that sample. If the count is less than 1,000,000/ml, it might be assumed that heat-stable enzymes are the cause of the product defect. If the counts are greater than 1,000,000/ml, the next step would be to microscopically examine, by the Gram Stain Technique, the organisms from colonies present on the Plate Count Agar. If, after Gram staining several of the colonies from the Petri Plate, it is determined that gram-positive organisms are present (especially gram-positive rods), it is likely that thermophilic psychrotrophic organisms are responsible for the defect. However, if gram-negative organisms are present, the most likely cause of the product defect is post-pasteurization contamination.

If psychrotrophic thermophilic organisms are found, or if heat stable enzymes are determined to be the cause of the product defect, effort should be initiated to upgrade the raw milk supply. If gram-negative organisms are found in the majority of the samples examined, efforts should be made to identify the source of post-pasteurization contamination. This is accomplished through a sanitation review, engineering review, and effective line analysis to identify the source of post-pasteurization contamination.

As a general rule, when consumer complaints are frequent and shelf life is short with fruity, bitter, unclean, and putrid off-flavors present; post-pasteurization contamination with gram-negative bacteria is the cause of the product defect. When speculating that post-pasteurization contamination with gram-negative bacteria is the cause of the product defect, the following facts may support your speculation.

1. Gram-negative bacteria are very heat sensitive and will not survive pasteurization.
2. Gram-negative microbial off-flavors usually occur at a population of 1,000,000/ml to 10,000,000/ml.
3. The contamination rate may be extremely low (as

TABLE 1.

Common Fluid Milk Product Quality Defects	
Microbial	Non-Microbial
Fruity, unclean, putrid	Oxidized, light induced
Acid, bitter, malty	Rancid or lipolized
Ripeness and sweet curdle	Absorbed, transmitted

low as one organism per contaminer). However, because of the psychrotrophic nature of these organisms, defects may occur in as little as seven to ten days.

4. Effective line analysis is the only method to identify the source of contamination.

If non-microbial off-flavors are present, steps should be taken to determine if the off-flavor is an oxidized, rancid, light induced, or absorbed off-flavor. For the most part, if oxidized, rancid, or absorbed flavors are present they may be from the raw milk supply, in which case intense efforts should be conducted for screening raw milk supplies. If light induced off-flavors are present, efforts to minimize light exposure of products need to be initiated.

The intent of this month's *Dairy Quality* was to point out the necessity for effective product evaluation for determining fluid milk product quality and to assist in troubleshooting product defect. Any fluid milk processor who is serious about producing quality products needs to have four to six people effectively trained in product evaluation. When personnel are effectively trained in product evaluation and determining fluid milk quality, troubleshooting causes of product defects is made much easier.

Effective identification and understanding of the defects present can, at minimum, help enable the fluid milk processor to identify whether his product defects are ingredients orientated (raw milk) or caused by a lack of process control (post process contamination).

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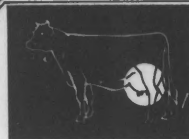
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N.M.C.

NATIONAL MASTITIS COUNCIL

In large herds, dry cow treatment, as well as treating cows that have clinical mastitis, is done most practically by dairy personnel. Since effective treatment needs to be done immediately, early detection by milkers is crucial. Also, a routine for identifying and handling these cows must be followed so that proper treatment can be given.

Tom Fuhrmann, an Arizona veterinarian who recently joined the management team of United Dairymen of Arizona, offered these tips on treatment at the annual meeting of the National Mastitis Council.

There are a couple of ways to evaluate whether or not milkers are detecting mastitis cows correctly. The first is by examining the milk filter at the end of each milking shift. Evidence of clots or flakes suggests that cows with mastitis have been milked into the tank and remain untreated.

Comparing somatic cell counts after test day with mastitis cow treatment records is another monitor. Those cows that have somatic cell counts in excess of 700,000 most probably exhibit signs of clinical mastitis when examined closely. If cows with elevated somatic cell counts have no recent record of treatment nor currently are being treated, you must suspect that milkers are failing to detect mastitis.

Prompt treatment should be done only by designated personnel who have been trained properly. Veterinary input is essential. The one or two people assigned to treat cows must be taught basic concepts of infection, antibiotic use and drug withholding times.

An example of a sound treatment program separates cows with clinical mastitis into one of three categories based on the severity of the infection:

1. Quarter infection only and no evidence of systemic involvement - no temperature: such cows would be given intramammary therapy only.

2. Quarter infection and a moderately elevated temperature (102 to 103°): such cows may initially have been treated in category 1 but this time would be treated intramammary, as well as systemically.

3. Acute severe infection: such cows would receive intravenous antibiotics, as well as supportive therapy; cows are treated twice daily for a minimum of three days.

Selection of treatment products should be done in concert with the veterinarian and be based on observation of effectiveness of treatment at cowside and culture and sensitivity testing.

Dry cow therapy is used to eliminate existing subclinical infections and to prevent new infections during the dry period. Treatment of every cow in every quarter still is most practical and cost effective in large herds. Selection of a product is based on effectiveness and cost. The treatment procedure should be to dip the teats immediately after machine removal for the last milking, treat each quarter with a single-dose disposable dry cow tube through the teat dip film and redip all teats.

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MEMBERSHIP HALL OF FAME

A recent membership drive for new IAMFES members promoted current members to bring in new members to the association.

A big THANK YOU to those whose motivation, support and drive brought in many new members.

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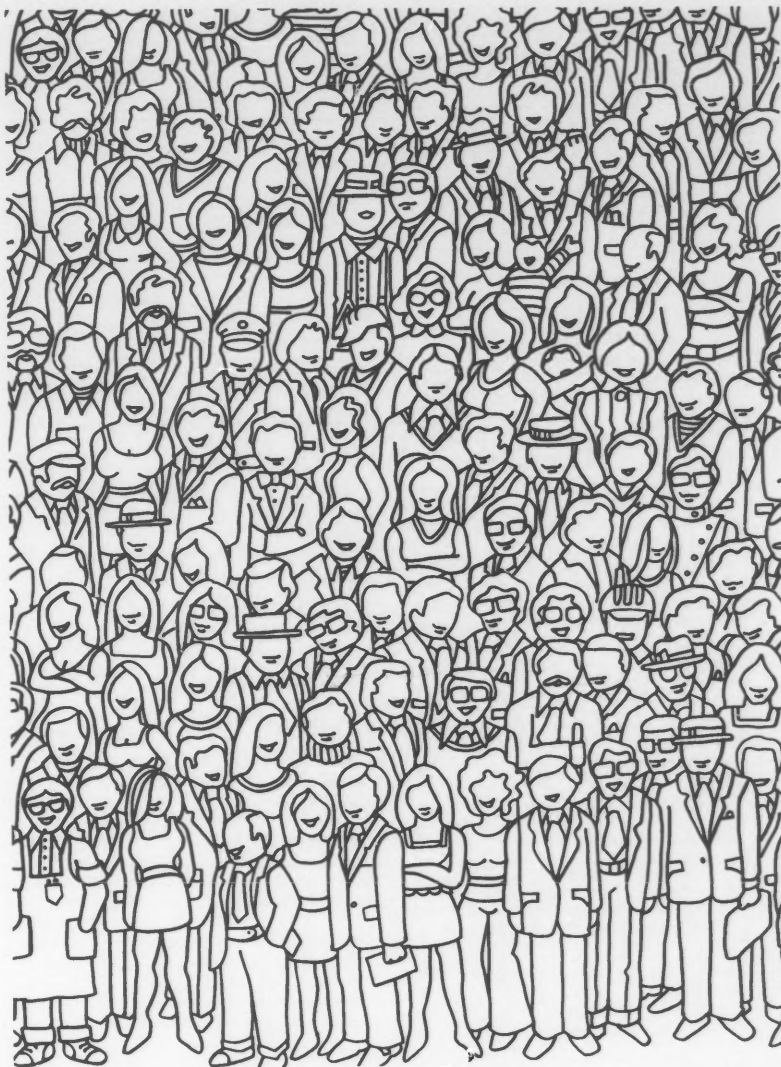
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Larry Hemmingsen will receive \$10.00 off his 1986 membership for recruitment of more than 5 new members.

Look for the 1985-86 MEMBERSHIP DRIVE which will appear in the next upcoming issue of DAIRY AND FOOD SANITATION.

This year, you'll have until June of 1986 to recruit new members! So start NOW!



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Developments in Dairy Chemistry - 2
Edited by P. F. Fox

Elsevier Science Publishing Co., New York, New York

As with the first book in the series, this book *Developments in Dairy Chemistry-2* edited by P. F. Fox has only one major shortcoming, the title. While the first volume deals with proteins, the main topic of this book is dairy lipids. Once this is discovered the reader can settle in for very informative reading on the present state of knowledge concerning milk lipids. The editor has assembled a very impressive group of contributors who discuss in a clear manner their areas of expertise.

The first three chapters deal with composition and physical arrangement of the lipid materials in milk. Chapter one details the various lipid materials found in milk such as fatty acids, vitamins, etc. Also, the structure of these lipids is discussed, from the fatty acid composition of the triglycerides to the various isomers of the individual compounds. How the amounts of the various lipids can be altered is the subject of chapter two. Special attention is devoted to synthesis of the lipids and how changes in the diet of the animal can alter the lipids found in the milk. Chapter three initially examines the origin of the fat globule in the mammary gland. Following this the composition and molecular makeup of the fat globule membrane is detailed. Chapters four and five deal extensively with the properties and chemistry of lipid materials. The first of these chapters discusses the behavior of the fat globules. Items such as size distribution, aggregation and homogenization are addressed. In the following chapter, crystallization and rheological properties along with means to modify these properties are discussed. Chemical reactions which can alter the lipid materials of milk are the subject matter of the next chapters. Hydrolytic rancidity is dealt with in chapter six. The authors first discuss the enzymes which mediate the reaction and then summarize conditions which will result in the occurrence of the reaction. The chapter concludes with a detailing of the effects this reaction can have on product quality. The seventh chapter is really two chapters in one. The first part of the chapter details the mechanism of lipid oxidation in general. Included are the effects of oxygen and pro-oxidants on the reaction. In the second part of the chapter the oxidation of milk in particular is the subject. The final chapter reviews the nutritional aspects of lipids. While addressed from the perspective of lipids in general, the significance of milk derived lipids is quite apparent.

In general this book would be of benefit to anyone interested in dairy chemistry. One of the outstanding features of the book is the extensive referencing found in each chapter which gives the more serious reader a starting point from which to delve more deeply into a particular topic. The editor is to be commended for putting this timely update of dairy lipid chemistry together.

David E. Smith
Assistant Professor

Sanitation, Safety and Environmental Standards. Lewis J. Minor. AVI Publishing Company, Inc., Westport, Connecticut. 1983.

Lewis J. Minor provides the reader a simple, but comprehensive, overview of sanitation, safety and standards to the foodservice industry. In the preface, the author states that his book provides guidelines that should help foodservice managers maintain high quality standards in quantity food production at reasonable costs.

Each chapter includes certain aspects of foodservice standards. Chapter 1, Standards for Foodservices, provides an overview of foodservice quality standards. Chapter 2, Sanitation Standards, indicates how to control microbial and other food hazards by recognizing criteria established for individual foods. Prevention of other food hazards is covered in Chapter 3. Proper food handling, vector control and sanitation procedures are discussed in Chapter 4. Food Definitions, Grades and Labeling (Chapter 5) can be helpful in purchasing. The chapter (Chapter 6) on Warewashing and Environmental Standards provides systems information useful in kitchen planning and operation. Chapter 7, Occupational Health and Safety Standards, is essential for management training of employees. Kitchen Safety and Maintenance (Chapter 8) and Food Waste Control Standards (Chapter 9) give suggestions on how to control foodservice operations by improving environmental safety and controlling menu portions.

The entire book is written in very simple terminology. However, three chapters are worth highlighting. Chapter 2 discusses the microbiological safety of foods. The author describes all the factors that play a role in food borne disease in foodservice establishment. Bacteria, viruses, fungi and parasites are discussed. This is an excellent chapter. Chapter 6 was written with the help of Dr. W.G. Mizuno, W.M. Podas and T.E. Brunnelle. This is an indepth chapter on operational planning, water quality and warewashing. Chapter 7 was excerpted from the Health and Safety Guide for Hotel and Motels, DHEW Publ. No. (NIOSH) 76-112. This chapter provides the basis for a health and safety program in a foodservice operation. The theme throughout the entire book is protection of health of the consumer.

This book is directly focused to hotel, restaurant and institutional management students, managers, chefs, dietitians, foodservice distributors and operators who strive to achieve high quality foodservice standards by developing and marketing very modern lines that provide relevance to the foodservice industry. With the size and complexity of the foodservice industry today, standards are very important in order to provide consumers an abundant, safe supply of nutritious, wholesome and economical food.

Ricardo J. Alvarez, Ph.D
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Abstracts of papers in the August Journal of Food Protection

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Effectiveness of Organic Acids to Solubilize Iron From a Wheat-Soy Drink, S. W. Rizk and F. M. Clydesdale, Department of Food Science and Nutrition, Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts 01003

J. Food Prot. 48:648-652

Changes in the chemical iron profile of a wheat protein concentrate-soy (WPC-Soy) drink resulting from organic acid (ligand) and iron fortification were examined. The ability of each ligand to enhance iron solubility in a WPC-Soy blend was dependent upon both pH and iron source added. Using an 8:1 molar ratio of ligand:iron, the greatest increases in percent soluble iron occurred with ascorbic acid and cysteine at pH 2, ascorbic acid at pH 4, and citric acid at pH 6. Electrolytic reduced iron (ERFe) was considered to be the most suitable iron fortificant (1:1 ratio of exogenous:endogenous iron) for this food on the basis of both iron solubility and technological feasibility. Supplementation of the WPC-Soy blend with ERFe and ascorbic or citric acid was shown to provide the greatest potential for improving iron availability in man as measured by chemical means.

Effects of Antioxidants of Rancidity Development and Palatability of Frozen Bacon, L. E. Jeremiah, Meat Science Section, Agriculture Canada, Research Station, Lacombe, Alberta, Canada T0C 1S0

J. Food Prot. 48:653-658

The efficacy of four antioxidants for retarding rancidity development and maintaining the palatability of frozen bacon slices were examined. The antioxidants (ascorbic acid, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT) and propyl gallate) were incorporated into a dry sugar bacon cure alone or in combination. Results indicated that the incorporation of these antioxidants alone or in combination generally reduced rancidity development in bacon slices during prolonged frozen storage. However, the combination of BHA, BHT and propyl gallate was the only antioxidant treatment which was effective for extending the frozen storability of bacon slices from the standpoint of flavor desirability and overall palatability. Bacon slices cured in the presence of this antioxidant combination remained acceptable for ca. 84 d longer during frozen storage than bacon cured in the absence of antioxidants.

Thermal Resistance of Paralytic Shellfish Poison in Soft-Shell Clams, T. A. Gill, J. W. Thompson and S. Gould, Canadian Institute of Fisheries Technology, Technical University of Nova Scotia, P.O. Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada

J. Food Prot. 48:659-662

Toxic soft-shell clams (*Mya arenaria*) were collected and the meats homogenized and tested for toxicity by the A.O.A.C. mouse bioassay procedure. The homogenate was incubated at temperatures ranging from 220 to 269.5°F and toxicities measured in samples heated for various time intervals. The relationships between toxicity and the time of heating were semi-logarithmic for each of the six incubation temperatures. Decimal reduction times were calculated for each heat treatment and were plotted (log scale) against heating temperature. The thermal-destruction-time (TDT) curve was linear ($r^2=0.97$), indicating that the kinetics of paralytic shellfish poison destruction are similar to those of most microorganisms. The toxin levels were also analyzed by high performance liquid chromatography for 110 samples and although results compared favorably with the bioassay data, its reliability for routine assessment of toxicity was not clearly established.

Estimation of Potential Shelf-life of Pasteurized Fluid Milk Utilizing Bacterial Numbers and Metabolites, J. R. Bishop and C. H. White, Department of Dairy Science, Louisiana Agricultural Experiment Station, LSU Agricultural Center, Baton Rouge, Louisiana 70803

J. Food Prot. 48:663-667

A study was conducted on use of bacterial numbers and their metabolites, and any possible interaction thereof, as estimators of the potential shelf-life of pasteurized fluid milk. Whole and skim milk samples were obtained on the day of processing. Samples of each milk were inoculated in duplicate with 0, 1,000, or 100,000 bacteria/ml with a pure strain of *Pseudomonas fluorescens* P27. Samples, stored at 7°C, were analyzed for microbiological and biochemical parameters every 5 d for up to 20 d, with organoleptic evaluations conducted on a daily basis. On days of analysis, each sample was subjected to various preliminary incubations. Bacterial enumerations conducted were psychrotrophic bacteria count, standard plate count, gram-negative bacteria count, and modified psychrotrophic bacteria count. Lipopolysaccharide (endotoxin) concentrations, degree of proteolysis and impedance detection were also determined. All bacterial enumerations and proteolysis were significantly related to potential shelf-life of pasteurized fluid milk (whole, skim, and combined) but were of little predictive value. Endotoxin concentration and impedance detection were highly significantly related to shelf-life, and provided predictive regression equations. Using combined data from whole and skim milk, impedance detection resulted in the preferred prediction equation suitable for pasteurized fluid milks.

Nisin Sensitivity of Lactic Acid Bacteria Isolated from Cured and Fermented Meat Products, D. L. Collins-Thompson, C. Calderon and W. R. Osborne, Departments of Environmental Biology and Food Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1

J. Food Prot. 48:668-670

Thirty strains of lactic acid bacteria from different meat sources (bologna, summer sausage, thurlinger sausage, chicken loaf and bacon) were tested for nisin sensitivity. The maximum concentration of nisin permitting growth for 20 strains was 50 IU/ml. Lactobacilli classified as atypical were sensitive to <5 IU nisin/ml. These strains could not be induced to increase resistance by five transfers to media with increased nisin concentrations. The ten strains with the higher resistance to nisin were checked for nisinase activity. One strain, *Lactobacillus brevis*, showed weak nisinase activity and the rest were negative.

Detection of Mold in Processed Foods by High Performance Liquid Chromatography, H. H. Lin and M. A. Cousin, Food Science Department, Purdue University, West Lafayette, Indiana 47907

J. Food Prot. 48:671-678

A high-performance liquid chromatographic (HPLC) method was developed to analyze for the degree of mold contamination in processed fruit and vegetable products. The method is based on detection of glucosamine, a breakdown product of chitin which is one of the major constituents of fungal cell walls. Food samples were hydrolyzed at 121°C for 2 h to release glucosamine from fungal chitin. The hydrolysates were partially purified by passing them through a Dowex-50 cation exchanger. Effluents were derivatized by o-phthalaldehyde and the fluorogenic reaction products were separated by reversed-phase HPLC and detected by a spectrofluorometer. Six species of mold, *Alternaria alternata*, *Alternaria solani*, *Colletotrichum coccodes*, *Fusarium oxysporum*, *Geotrichum candidum* and *Rhizopus stolonifer*, which are commonly associated with fruit and vegetable products, were used in this study and different levels (0.1 to 2.5 mg/g of sample) of mold mycelium were added to rot-free tomato products. A linear relationship between concentration and glucosamine was observed. However, different species of mold gave different amounts of glucosamine. The effect of insect contamination on the assay was negligible unless high levels were present. Results obtained by the HPLC method were compared with those obtained with an amino acid analyzer and reasonable correlation between the two methods was evident.

Plant Trials of Bacon Made with Lactic Acid Bacteria, Sucrose and Lowered Sodium Nitrite, Nobumasa Tanaka, Louise Meske, Michael P. Doyle, Edwin Traisman, Donald W. Thayer and Ralph W. Johnston, Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706; Eastern Regional Research Center, U.S. Department of Agriculture, Philadelphia, Pennsylvania 19118; and Food Safety and Inspection Service, Science, U.S. Department of Agriculture, Washington, D.C. 20250

J. Food Prot. 48:679-686

Bacon prepared with 40 and 80 mg/kg (ppm) sodium nitrite, 0.7% sucrose and a culture of *Pediococcus acidilactici* (Wisconsin Process), and control bacon prepared with 120 ppm sodium nitrite and no added sucrose or bacterial culture were produced at three commercial bacon production plants. Sodium chloride, phosphate and sodium ascorbate (or sodium erythorbate) levels, as well as other processing conditions such as pumping rate, smokehouse temperature and time, forming and slicing conditions, were those normally used by each plant. Randomly selected samples of each lot were used for a challenge experiment with *Clostridium botulinum* (types A and B), with ca. 1,000 heat-shocked spores/g of bacon inoculated on each slice, vacuum packaged and incubated at 27°C. Samples were taken periodically up to 56 d of incubation and examined for the presence of botulin toxin. The challenge experiment revealed that test bacon was substantially greater in antibotulin properties than the control bacon. Residual nitrite levels of test bacon were lower than those of the control bacon, as were nitrosamines formed upon frying. Average N-nitrosopyrrolidine level was 8.6 µg/kg (ppb) in the control, <2.7 ppb in the 80-ppm nitrite product, and <1.6 ppb in the 40-ppm nitrite product. This study indicates that bacon commercially prepared by the Wisconsin Process with 40 or 80 ppm sodium nitrite has a lesser risk of nitrosamine and botulin toxin formation than bacon prepared with 120 ppm sodium nitrite and no added sucrose and lactic acid bacteria.

Sensory Characteristics of Reduced Nitrite Bacon Manufactured by the Wisconsin Process, Nobumasa Tanaka, Nadine M. Gordon, Robert C. Lindsay, Luise M. Meske, Michael P. Doyle and Edwin Traisman, Food Research Institute and Department of Food Science, University of Wisconsin, Madison, Wisconsin 53706

J. Food Prot. 48:687-692

Bacon with a culture of lactic acid-forming bacteria, *Pediococcus acidilactici*, plus 0.7% sucrose and 40 or 80 mg sodium nitrite/kg (Wisconsin Process), and control bacon with 120 mg sodium nitrite/kg but no lactic acid bacteria and sucrose, were produced at three commercial bacon plants under production conditions. The bacon was stored under refrigeration for 5 to 8 wk, then subjected to sensory analyses by an experienced sensory panel. Quantitative descriptive visual analysis was performed on uncooked as well as cooked samples, and the cooked samples were served for quantitative descriptive sensory analysis. Results indicated that the test bacon with reduced amounts of sodium nitrite was as acceptable as the control bacon with no sugar and lactics, with the 80 mg/kg nitrite-bacon being the most preferred of all. These results and the results of botulin challenge and nitrosamine tests indicate that the test process can be a satisfactory alternative to processing bacon by the conventional procedure with 120 mg sodium nitrite/kg.

Influence of Minimal Change in pH on Germination of *Clostridium botulinum* 52A in Media Containing Sodium Acid Pyrophosphate and Potassium Sorbate, M. K. Wagner and F. F. Busta, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

J. Food Prot. 48:693-696

The influence of 0.4% sodium acid pyrophosphate (SAPP) or 0.26% potassium sorbate (PS) on *Clostridium botulinum* 52A growth and toxicity from spores was studied at two pH levels 5.55 and 5.85. Absorbance measurements at 630 nm were used in combination with microscopic evaluations and toxin analysis to compare effects of additives on normal cell development. Treatment cultures containing 0.4% SAPP and 0.26% PS at a higher pH of 5.85 showed no increase in absorbance and no sign of toxicity, but elongated vegetative cells ($\geq 9 \mu\text{m}$) were observed using phase contrast microscopy rather than scanning electron microscopy. The SAPP-PS treatment culture at a lower pH of 5.55 displayed no signs of growth spectrophotometrically or microscopically, as well as no toxicity. These data suggest that a SAPP-PS combination in a laboratory medium at pH 5.85 does not halt germination and outgrowth, yet may prevent cell division; whereas, the same treatment at pH 5.55 inhibits normal spore germination.

Degradation of Aflatoxin M₁ in Milk by Ultraviolet Energy, Ahmed E. Yousef and Elmer H. Marth, Department of Food Science and the Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 48:697-698

Raw whole milk was artificially contaminated with 0.5 or 1 ppb aflatoxin M₁. Contaminated milk was exposed to UV-irradiation from different sources and under different experimental conditions. In all instances, exposure to UV-irradiation caused aflatoxin M₁ in milk to degrade. The magnitude of degradation (3.6 to 100%) depended on time of exposure (2 to 60 min) of milk to UV-energy, volume of treated milk and design of the experiment. Presence of hydrogen peroxide (1%) in milk greatly enhanced degradation (100% in 10 min) of aflatoxin M₁ by UV-irradiation.

Antibacterial Nature of Molds Isolated from Aged Beef, S. G. Campano, A. W. Kotula and D. M. Kinsman, Agricultural Research Service, U.S. Department of Agriculture, Meat Science Research Laboratory, Beltsville, Maryland 20705 and Department of Animal Industries, University of Connecticut, Storrs, Connecticut 06268

J. Food Prot. 48:699-701

The antibacterial and competitive nature of the molds *Thamnidium elegans*, *Mucor mucedo* and *Chaetostylum fresenii*, commonly isolated from beef aging at refrigeration temperature for extended periods, were examined to determine if their presence on meat would inhibit bacterial growth. An agar plate method revealed no growth inhibition of six strains of meat spoilage bacteria by the molds examined. Eye round (semitendinosus) roasts were inoculated with spore suspensions containing nine strains of the three fungal species and incubated for 48 h at 4 or 18°C. Initial aerobic bacterial counts (35°C) on the meat samples were 2.4×10^4 CFU/cm². Mold treatment had no significant effect ($P > 0.05$) on reduction of aerobic bacterial counts (35 and 7°C), coliforms or fecal streptococci when compared with uninoculated controls. No surface fungal growth was evident after 48 h at 4°C, the normal storage temperature for meat, whereas appreciable mycelial development was apparent after 48 h at 18°C. *T. elegans*, *M. mucedo* and *C. fresenii* were not capable of reducing or controlling bacterial growth on meat surfaces at refrigeration or elevated temperatures.

Relationship of Hot-Processing and Method of Forming with Quality of Whole Hog Sausage Patties, D. L. Huffman, C. F. Ande, M. H. Stanley and C. N. Overbaugh, Department of Animal and Dairy Science, Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849-4201

J. Food Prot. 48:702-704

Two crossbred sows (ca. 160 kg) were slaughtered for each of two replications of an experiment designed to determine the effect of hot-processing and method of patty-forming on the quality of whole hog sausage. One side from each carcass was randomly selected for either hot-processing or cold-processing (control). For each replication, two sides per processing treatment were hand-deboned and the meat ground through a 9.5-mm plate, seasoned, then reground through a 3.2-mm plate and subdivided into two batches. One batch was stuffed into 7.6-cm diameter casings, frozen, tempered and sliced into patties (Stuffed/Sliced), whereas the remaining batch was formed into the same size patties using a Versaform forming machine (model VF 20). Patties were placed in styrofoam trays, overwrapped with PVC film, sealed in wax-lined boxes, and stored at -10°C until analyzed. Hot-processed patties had greater bind, lower shear values and less expressible free water (higher water-holding capacity) than cold-processed patties. Formed patties had less free water than Stuffed/Sliced patties. Micro-textural properties were evaluated by scanning electron microscopy (SEM). The micro-texture was slightly different for patties from the various treatments.

Comparison of Deoxynivalenol (Vomitoxin) Production by *Fusarium graminearum* Isolates in Corn Steep-Supplemented Fries Medium, Abdalla El-Bahrawy, L. Patrick Hart and James J. Pestka, Department of Food Science and Human Nutrition and Department of Botany and Plant Pathology, Michigan State University, East Lansing, Michigan 48824

J. Food Prot. 48:705-708

Four out of nine North American *Fusarium graminearum* isolates produced deoxynivalenol (DON) and 15-monoacetyl deoxynivalenol (15-ADON) when grown in stationary cultures of modified Fries medium supplemented with 4% corn steep liquor. Strains R-6576, Van Wert A-1 and Stuckey produced primarily DON after 20 d of incubation at 28°C. In these strains, low levels of 15-ADON accumulated after 5 d but then declined over time. Disappearance of 15-ADON and subsequent appearance of DON coincided with both a rapid rise of pH above 8.0 and onset of the stationary phase. DON levels peaked after the exhaustion of carbohydrate (day 20) and then began to decline. In contrast to these three strains, strain NRRL 5883 produced primarily 15-ADON during an extended growth phase (day 10) and only small amounts of DON during late stationary phase (day 25). NRRL 5883 exhibited a slow rise in pH relative to the other three strains and utilized only 75% of the available carbohydrate during the 25-d period. Qualitative and quantitative production of DON and 15-ADON in liquid culture was dependent on the strain of *F. graminearum*.

Controlled Atmosphere Storage of Spotted Shrimp (*Pandalus platyceros*), Jack R. Matches and Miguel E. Layrisse, Institute for Food Science and Technology, University of Washington, Seattle, Washington 98195

J. Food Prot. 48:709-711

Spotted shrimp (*Pandalus platyceros*) were stored head on and head off on melting ice in air and controlled atmosphere for 14 d to test effects of controlled atmosphere on storage life of the shrimp. Pure carbon dioxide was allowed to flow through the controlled atmosphere chamber at the rate of 0.5 L/min maintaining a 100% CO₂ atmosphere. Aerobic bacteria counts, ammonia, weight loss and sensory analyses were determined initially and after 7 and 14 d. Bacterial counts increased more rapidly and to higher levels in air pack than controlled atmosphere samples. The levels of ammonia were very low in the fresh shrimp and increased to 21 and 16 mg% in head-on and head-off air-pack samples, respectively. The levels reached only 12 and 6 mg% in similar samples stored in CO₂. Weight loss was greater for shrimp stored in CO₂ than in air. Sensory evaluation showed air-pack head-off samples to be unacceptable after 14 d of storage but CO₂-packed samples had only moderate discoloration and no detectable off-odors. These data show that spotted shrimp could be shipped on ice under controlled atmosphere to fresh fish markets.

Toxin Production by *Clostridium botulinum* and Organoleptic Changes in Vacuum-Packaged Raw Beef, A. H. W. Hauschild, L. M. Poste and R. Hilsheimer, Microbiology Research Division, Health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2 and Food Research Institute, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

J. Food Prot. 48:712-716

Vacuum-packaged beef, inoculated with *Clostridium botulinum* spores of types A and B and incubated at 25°C, was monitored for the production of toxin and for changes in appearance and odor. Toxin was detected first after 6 d of incubation and was always accompanied by significant organoleptic changes when compared to meat stored at 4°C. Uninoculated meat samples stored at 25°C remained non-toxic, whereas their sensory scores, in particular with respect to appearance, were similar to those of the inoculated samples.

Foodborne Viruses: Their Importance and Need for Research, John H. Blackwell, Dean O. Cliver, J. J. Callis, Norman D. Heidelbaugh, Edward P. Larkin, Peter D. Mc Kercher and Donald W. Thayer, Eastern Regional Research Center, ARS, USDA, 600 East Mermaid Lane, Philadelphia, Pennsylvania 19118

J. Food Prot. 48:717-723

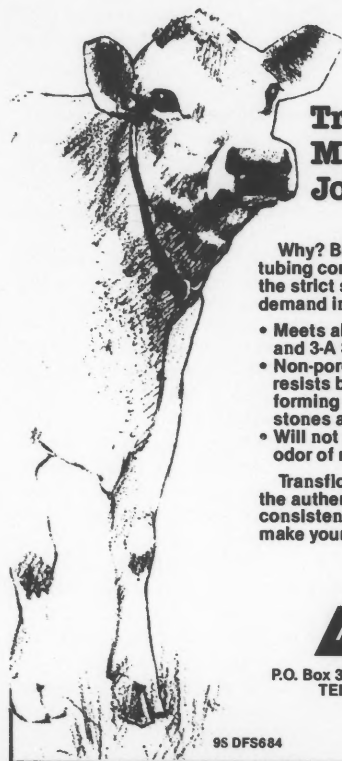
All viruses known to be normally transmissible through foods and of concern to human health emanate from the human intestine. The outbreaks of hepatitis A and recently of gastroenteritis

attributed to Norwalk-like viruses most likely developed from feces-contaminated fingers of infected food handlers or water polluted with feces. With few exceptions no recorded outbreak has depended on the ability of virus to withstand even limited heating in food. New and better methods of detection are needed for hepatitis A and Norwalk viruses in foods. It has been well documented that international trade in food products of animal origin can result in the introduction of animal disease into areas in which the disease does not exist. This fact has given rise to programs of research and development for industrially applicable technology to rid animal products from the agents of animal diseases. The survival of viruses inclusive of etiological agents of foot-and-mouth disease, African swine fever, swine vesicular disease and hog cholera virus is reviewed in this paper and new research approaches are suggested. The general need for additional research of foodborne viruses is discussed.

Contaminants in Human Milk -- An Update, Vernal S. Packard, Department of Food Science and Nutrition, University of Minnesota, St. Paul, Minnesota 55108

J. Food Prot. 48:724-729

Breastfeeding is a natural and worthy practice, encouraged and promoted by many health professionals. Under most conditions, breastmilk serves infant nutritional and immunological needs well. Nevertheless, there are risks engendered in the practice, one of the more serious of which centers on contamination of human milk with drugs, pesticides, and environmental contaminants. As a reminder of the fact and to highlight some recent research findings, this review is offered.



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AUG. 4-8, IAMFES ANNUAL MEETING to be held at the Hyatt Regency, Nashville, TN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.

August 5-9, "BIOTECHNOLOGY: MICROBIAL PRINCIPLES AND PROCESSES FOR FUELS, CHEMICALS AND BIOLOGICALS," to be held at the Massachusetts Institute of Technology, Cambridge, MA. For more information contact: Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139.

August 19-30, IN-STORE BAKERY TRAINING PROGRAM, to be held in Manhattan, KS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

August 25-30, 9TH SYMPOSIUM OF WAVFH. The World Association of Veterinary Food Hygienists (WAVFH) will hold their 9th Symposium in Budapest, Hungary. For more information contact: 9th WAVFH Symposium, Organizing Committee, Mester u. 81, H-1453 Budapest Pf 13, Hungary.

September 9-10, ILLINOIS SANITARIAN'S AND DAIRY FIELDMEN, will combine their fall meeting, to be held in Champaign, IL. For more information contact: Clem Honer, 1 S 760 Kenilworth Ave., Glen Ellyn, IL. 312-693-3200.

September 9-12, ASEPTIC PROCESSING AND PACKAGING OF FOODS, sponsored by The International Union of Food Science and Technology Food Working Party of the European Federation of Chemical Engineering, to be held in Tylosand, Sweden. For more information contact: Ann-Britt Madsen, Kurssekretariatet, Lund Institute of Technology, P.O. Box 118, S-221 00 Lund, Sweden.

September 16-20, MAINTENANCE MANAGEMENT SEMINAR, to be held in Manhattan, Kansas. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

September 17-19, NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS, to be held at the Sheraton Inn, Syracuse, NY. For more information contact: D. K. Bandler, 11 Stocking Hall, Cornell University, Ithaca, NY 14853. 607-256-3027.

September 18-24, EMETREX-ENPROTEX-INTERNATIONAL ENVIRONMENTAL AND ANTI-POLLUTION EXHIBITION '85, to be held at Beijing Exhibition Centre, Beijing, People's Republic of China. For more infor-

mation contact: Harry C. Lepinske, Clinton International Trade Center, 1719 South Clinton Street, Chicago, Illinois 60616. 312-421-7000.

September 25-26, SIXTH ANNUAL JOINT EDUCATIONAL CONFERENCE, to be held at Valley Inn, Neenah, WI. For more information contact: Ron Buege, West Allis Health Department, 7120 West National Avenue, West Allis, WI. 414-476-3770.

September 30 - October 2, ADVANCED SANITATION PROGRAM, to be held in Chicago, IL. For more information contact: Shirley Grunder, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

September 30 - October 11, IN-STORE BAKERY TRAINING PROGRAM, to be held in Manhattan, KS. For more information contact: Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

October 1-2, SOUTH DAKOTA STATE DAIRY ASSOCIATION CONVENTION to be held at the Ramada Inn, Sioux Falls, So. Dakota. For more information contact: Shirley W. Seas, Ex Secretary, Dairy Science Dept., So. Dakota State University, Brookings, SD 57007.

October 1-3, STORAGE LIVES OF CHILLED AND FROZEN FISH AND FISH PRODUCTS, to be held at The Conference Centre, University of Aberdeen, Aberdeen, Scotland. For more information contact: IIR Conference Organiser, Torry Research Station, PO Box 31, 135 Abbey Road, Aberdeen AB9 8DG, UK.

October 2-4, WORKSHOP IN FOOD FLAVOR: DEVELOPMENT, MANUFACTURE AND USE, to be held at the University of Minnesota, St. Paul, MN. For more information contact: Joanne Parsons, Office of Special Programs, 405 Coffey Hall, 1420 Eckles Avenue, University of Minnesota, St. Paul, MN 55108. 612-373-0725.

October 4-10, THE ENVIRONMENTAL MANAGEMENT ASSOCIATION, and its subsidiaries will hold its 28th annual National Educational Conferences and Exposition at the Holiday Inn Surfside Conference Center, Clearwater Beach, FL. For more information contact: Jean M. Day, EMA, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

October 5-9, DFISA FOOD & DAIRY EXPO '85, to be held at the Georgia World Congress Center, Atlanta, GA. For more information contact: Bruce L. D'Agostino, Director, Public Relations, Dairy and Food Industries Supply Assoc., Inc., 6245 Executive Boulevard, Rockville, MD 20852-3938. 301-984-1444, Telex: 908706.

October 7-9, BIOTECHNOLOGY IN THE FOOD PROCESSING INDUSTRY, sponsored by the Department of Food Science and Nutrition, University of Minnesota. To be held at the University Radisson Hotel, Minneapolis, Minnesota. For more information contact: Lynette Marten, 405 Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108. 612-373-0725.

October 8-9, SEMINAR ON NEW DAIRY PRODUCTS VIA NEW TECHNOLOGY, jointly sponsored by USNAC and IDF, Georgia World Congress Center, Atlanta. For more information contact: Harold Wainess, Secretary, U. S. National Committee of IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 14-18, ADVANCED BAKERY PRODUCTION, to be held in Manhattan, KS. For more information contact: Mrs. Donna Mosburg, Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. Register by Phone: Call Donna at 913-537-4750 or 1-800-633-5137.

October 21-23, STABILITY AND QUALITY CONTROL WORKSHOP, to be held in Palo Alto, CA. For more information contact: Tragon Corporation, 365 Convention Way, Redwood City, CA 94063. 415-365-1833.

October 21-26, 69TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION AUCKLAND, NEW ZEALAND. For more information contact: H. Wainess, Secretary, U. S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 22-23, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS ANNUAL CONFERENCE, to be held at the Clarion Hotel, 401 East Millbrae Avenue, Millbrae, California. For more information contact: Richard C. Harrell, Executive Sect/Treas, 1554 West 120th Street, Los Angeles, CA 90047.

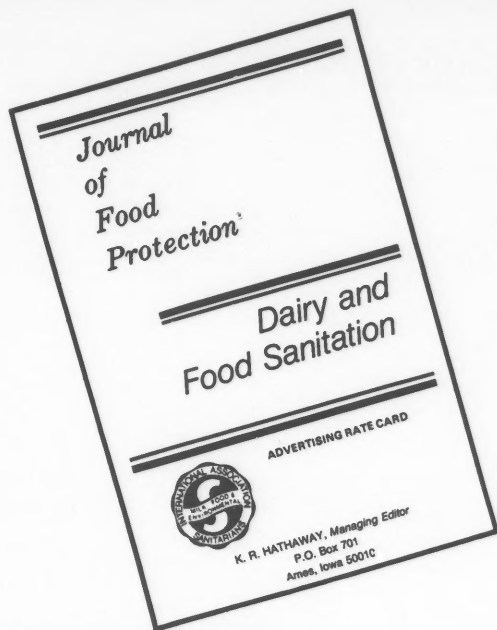
October 21-25, 69TH ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION, to be held in Auckland, New Zealand. For more information contact: H. Wainess, Secretary, U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

October 24, FOCUS ON FOOD SYMPOSIUM VI; ASSURING MEAT WHOLE-SOMENESS, to be held in Manhattan, Kansas. For more information contact: Dr. David Schafer, Department of Animal Sciences and Industry. 913-532-6134. Or contact Dr. Karen Penner, Extension Home Economics, Kansas State University, Manhattan, KS. 913-532-5773.

October 28-30, PCO RECERTIFICATION, to be held in Manhattan, KS. For more information contact: Shirley Grunder, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502. 913-537-4750.

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AUG. 3-7, IAMFES ANNUAL MEETING to be held at the Radisson South, Minneapolis, MN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.



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CIRCULATION INFORMATION

Major Responsibilities

Milk/Food Quality Control	33%
Managers	16%
General Sanitation	21%
Laboratory	16%
Teaching - Research	5%
Industry	7%
Sales	2%
	100%

The circulation of the *Journal* is international and averages 3500 copies per month. *Dairy and Food Sanitation* circulation averages 3000 copies per month.



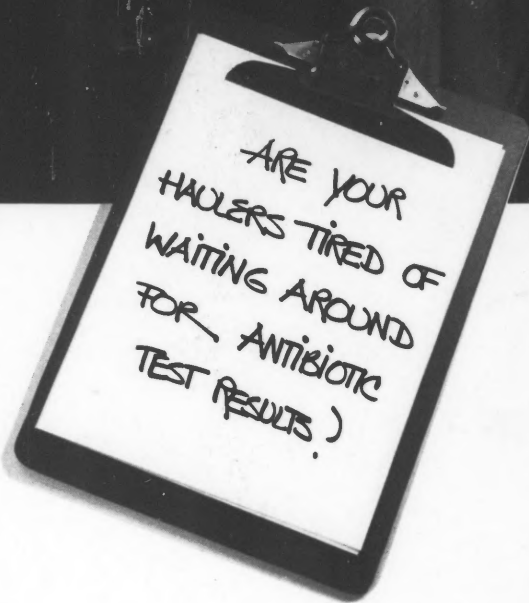
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