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Canning and Its Bacteriology

By CLARISSA CLARK, Instructor of Bacteriology

LONG before the theory of spontaneous generation was disproved—long before Pasteur had shown that all fermentation, that is, practically all spoiling was due to the presence of micro-organisms, a Frenchman by the name of Appert had demonstrated that food could be kept by canning. This made it possible to keep many foods hitherto had only been used during season.

Many processes for keeping foods had been known thru practically all time. Brine, heavy syrups and splices had been used in ancient times, but in many cases these processes were not practical, or if they were, did not give a product at all like the fresh food. But at the same time canning had opened up a great field for danger. Many troubles had been unknown. None had heard of botulism, for example, and the term ptomaine poisoning was used promiscuously for everything in the way of sudden disorders caused by eating.

Bacteriology is practically a new science. It had it battles to fight—Liebig, the great German chemist, kept the world laughing by his clever articles ridiculing Pasteur's germ theory of fermentation. The idea that microorganisms could bring about chemical changes was very unique but Pasteur finally proved that he was right and the world accepted his theory.

Was it not rather alarming to consider that most of the food eaten was perhaps filled with tiny germs? Fortunately Pasteur showed that many of these actually were essential to the development of certain types of desirable fermentations.

Yeasts were necessary for wine and this paved the way for the more same consideration of the group of minute plants which we will consider—namely, bacteria, yeasts and molds.

Molds, because of their characteristic appearance, can easily be recognized. We all know, too, what they do, and so they are probably less of a menace. In some cases they are of very real value. Several of the cheeses, like Roquefort and Camembert are dependent upon this group of microorganisms for their characteristic flavor. But in canning they may cause much grief.

Molds require a certain set of conditions for their best growth and these are very splendidly met in the case of fruits and the acid vegetables, but as they require air for their best development they can very readily be controlled. Their spores are not so easily disposed of. They may remain alive for a long period of time and if a leak develops, the mold can grow.

Yeasts are very necessary in bread making and in the fermentations of fruit juices for vinegar, but may be very troublesome in fruits and jellyes. Yeasts do not generally produce spores tho, and as they require oxygen for their growth their activities may be controlled.

Another class of microorganisms which should be considered here are the torus or false yeasts. These are often the cause of deterioration in sauerkraut and dill pickles. They can break down the acids, so essential to the keeping and flavor of the pickles, and provide a way for bacteria to bring about putrefaction. They, too, require air, and if the food is sealed properly will cause no trouble.

Finally considering bacteria, we find a bigger problem. Both yeasts and molds announce their presence rather plainly, but this is not true in all cases with bacteria. Here we have all types; the desirable and the undesirable; the ones producing spores, and those easily destroyed by heat; the aerobic, or those requiring atmospheric oxygen, and the anaerobic, or ones requiring no free oxygen, and each class must have a different sort of treatment. Besides this we must consider just how far we desire the development of bacteria. We want them in the ripening of cheeses, in the making of vinegar, and sauerkraut, so much depends upon the selection of our bacteria.

In the canning of fruits and vegetables, however, we must consider the best methods of keeping the development of bacteria, as well as of yeasts and molds, to the minimum. Here they become decidedly a contamination. So first, we will consider the selection of foods to can. Bacteria do not have a sharply cut thermal death point, and if the initial contamination is heavy, we will find many resistant individuals. We have the old rule of an "hour from field to can" which would be a good one to follow wherever at all possible, but as this is not at all times practical, we must be careful in selecting fresh, sound foods, watching for blemishes and signs of decay. We should also consider very carefully, the containers to be used in canning, if they have been used before and left soiled for several hours or days before cleaning, they may harbor very resistant spores. This is especially true if they happened to contain food which spoiled after canning.

It is easy to see that cans and, of course, the covers, should be thoroughly sterilized. Sound covers are essential as are new rubbers. A little air may make it possible for spores, harmless in themselves, to develop and the food may mold or putrefy. We feel very safe where we have an acid content or a good supply of sugar or spices. It is better to be safe than sorry, however, and so we take every precaution. Do not let over-confidence get the better of common sense. Especially in the canning of the non-acid vegetables and of meats, we have to consider very carefully the proper methods of sterilization, for many organisms may develop and cause spoiling after sealing, unless the process of sterilization has been very thorou indeed.

Organisms not in the food originally may gain entrance thru careless handling so the necessity of extreme cleanliness cannot be overestimated. After the food is put in the cans, the work is not done. We have a class of organisms which will develop only at quite high temperatures. These thermophiles, as they are called, may not be killed during processing, and would cause no trouble if the cans were cooled quickly, but if they are packed away while hot these organisms may do some harm.

Jars of food should be examined carefully before final storing. Any signs of leak or the presence of gas should be signals for discarding or, at least, for careful examination. A cool storage place for canned food is of great importance. The slow development of even harmless microorganisms may cause "off flavors." When the time comes to eat the food, it is difficult to use enough caution. Too often foods are opened and dumped immediately into a dish for the table, without proper inspection.

Some of the distress signals might well be considered. Has the food a sound appearance, or does it become soft and mushy? This change in appearance may be due to spoiling. Did the can open too easily? If so, the very desirable, if not necessary, vacuum was lacking. This means air and the possible development of yeasts, molds, or of many sorts of bacteria. Then does it smell good? A bad smell is good proof that the food should not be eaten.

If in doubt, "play trump" and our best trump here is to discard food about which there is any question.

The natural odor of some foods may cover the putrefying odor and in a case of this sort very thorough heating will destroy many of the dangers. For example, the toxin developed by the organism causing botulism may be destroyed by twenty minutes thorough heating provided all parts of the food are heated to the boiling point for this length of time. This does not kill the organisms, however, and a new supply of toxin may develop (Continued on page 14)
Bits About Cheese

By KATHERINE HOLDEN

He much-talked-of green cheese of the moon has not yet been tested for its quality and flavor, but students in the experimental cookery classes have done all sorts of interesting things with every other kind of cheese with results that may prove helpful to cheese-loving cooks.

Preparation of cottage cheese, a product often made at home, from leftover sour milk, was the first experiment. The object of the tests was to determine the best method of heating the milk to precipitate the curd. Results proved that direct boiling over the fire made a very tough, stringy product. Heating in the double boiler to a temperature of 40-50 degrees Centigrade made a curd of good texture, but not very tender.

A good cottage cheese was made by draining the sour milk in cheese cloth over night, but this was of course, a long process. The best product was obtained by adding an equal quantity of hot water to the sour milk and draining the mixture through cheese cloth.

Cheddar cheese was also subjected to experiments with heat. Three samples of cheese were used. One was heated directly over the fire, one in the double boiler, and the third heated with milk in the double boiler. In every case the cheese was found to melt at 69 degrees Centigrade. Above that it immediately became tough and stringy, and with continued heating was unusable.

Don't you just love Welsh Rarebit, and don't you wish you knew how to combine everything to get just the right result? It seems to be a deep, dark mystery to many people, who blame their failures on luck, or the cheese, rather than their method of procedure.

Three methods were used in the class experiments. In the first, to a medium white sauce, the grated cheese was added. This gave a smooth, well-blended product of good flavor. Another method which proved difficult, but which gave an excellent rarebit was one in which a custard was made of the egg and milk, to which the cheese was added. Results of the third method were varied. Some were thin, some curdled, and others were very good. In this case, the milk in the double boiler was added the cheese, until it began to melt. The beaten egg was added to this mixture and heated until thick.

From all these it appeared that the best method of making Welsh Rarebit was also the simplest—adding cheese to the plain white sauce.

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(Continued from page 1)

If the food is left for several hours before eating, very specific directions for canning may be secured so easily and the necessary precautions for examining a canned food are so thoroughly based upon common sense that we should be able to control the dangers which have been much overdrawn. Cases of food poisoning are really rare indeed and much of the ranting about home canning is probably propaganda. Canned foods are an important part of our diet and should be eaten, but discretion must be used in selection here as well as in fresh foods. Canned, but can carefully. Do not cut food which is not fresh enough for the table and do not use canned food about which there is a doubt.

Directions concerning time and method of processing should be followed carefully. These methods have been worked out carefully and errors eliminated. Much of the high cost of living may be eliminated if canning is practiced with proper precautions and the menu is certainly more attractive where there is variety.

Salads and Sandwiches

(Continued from page 3)

Cream cheese, chopped nuts and salad dressing.

Cream cheese, nuts and chopped green peppers.

Cottage cheese may be used instead of cream cheese.

Pimento, nuts and cottage cheese with salad dressing.

Lettuce, ground nuts and salad dressing.

Lettuce with salad dressing.

Diced cooked green vegetables with salad dressing.

Sliced onions with seasonings.

Lettuce, celery and tomato, seasoned with salad dressing.

Interesting and unusual sandwiches may be made in the following ways:

Ribbon Sandwiches. Cut white and graham bread in one-fourth inch slices, having four slices of white and three of graham. Spread two slices of white bread and all the graham bread on both sides with creamed butter. Spread remaining two pieces of white bread on one side. Beginning with the white slice (buttered on but one side) pile in seven layers, alternating bread, and have second slice of white bread (unbuttered on one side) on top. Wrap in cheesecloth and press

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