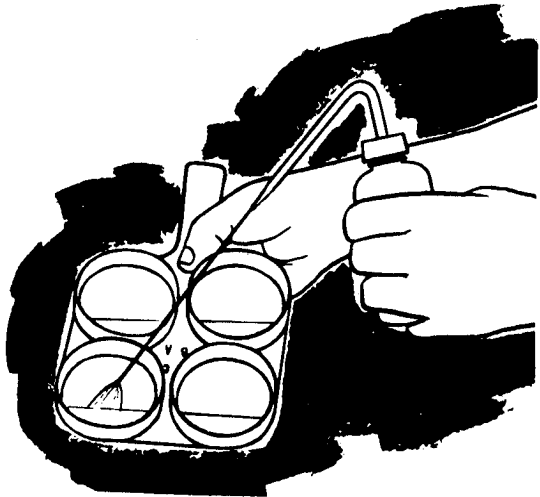


	VISIBLE REACTION	INDIVIDUAL QUARTER SAMPLE	BUCKET MILK SAMPLE
<b>NEGATIVE</b>	Mixture remains liquid. No slime or gel forms.	NO MASTITIS	NO MASTITIS
<b>TRACE</b>	<b>SUSPICIOUS</b> Mixture becomes slimy or gel like. It's seen to best advantage by tipping paddle back and forth, observing mixture as it flows over the bottom of cups.	TRACE OF MASTITIS	MASTITIS IN ONE OR MORE QUARTERS
<b>WEAK</b>	<b>POSITIVE</b> Mixture distinctly forms a gel.	MASTITIS	DEFINITE MASTITIS CHECK QUARTERS
<b>DISTINCT</b>	Mixture thickens immediately, tends to form jelly. Swirling cup moves mixture in toward center exposing outer edges of the cup.	MASTITIS	SERIOUS MASTITIS CHECK QUARTERS

- #28006 CMT Kit (COMPLETE)
- #28007 CMT Starter Kit
- #28008 CMT Concentrate, Pints
- #28009 CMT Ready-to-use, Pints
- #28010 CMT Ready-to-use, Gallons
- #28011 CMT Milk Testing Paddles

# ORIGINAL CMT

## California Mastitis Test



US Pat. Nos. 2998392, 2935384 and 3102418

Rhinehart Development Corp.  
Dairy Research Product, Inc.  
Spencerville, IN 46788

## Grading and Interpretation

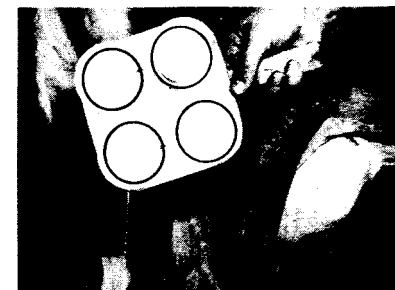
Symbol	Suggested meaning	Description of visible reaction	Interpretation*
	negative	Mixture remains liquid with no evidence of formation of a precipitate.	0 - 200,000 cells/cc 0-25 per cent PMN.
T	trace	A slight precipitate forms and is seen to best advantage by tipping the paddle back and forth and observing the mixture as it flows over the bottom of the cup. Trace reactions tend to disappear with continued movement of the fluid.	150,000 - 500,000 cells/cc 30-40 per cent PMN.
1	weak positive	A distinct precipitate but no tendency toward gel formation. With some milks the reaction is reversible, for with continued movement of the paddle the precipitate may disappear.	400,000 - 1,500,000 cells/cc 40-60 per cent PMN.
2	distinct positive	The mixture thickens immediately with some suggestion of gel formation. As the mixture is caused to swirl, it tends to move in toward the center, leaving the bottom of the outer edge of the cup exposed. When the motion is stopped, the mixture levels out again and covers the bottom of the cup.	800,000- 5,000,000 cells/cc 60-70 per cent PMN.
3	strong positive	A gel is formed which causes the surface of the mixture to become convex. Usually there is a central peak which remains projecting above the main mass after the motion of the paddle has been stopped. Viscosity is greatly increased so that there is a tendency for the mass to adhere to the bottom of the cup.	Cell number generally over 5,000,000/cc 70-80 per cent PMN.
+	alkaline milk pH 7.0 or over	This symbol should be added to the C.M.T. score whenever the reaction is distinctly alkaline, as indicated by a contrasting deeper purple color.	An alkaline reaction reflects depression of secretory activity. This may occur either as a result of inflammation or in drying-off of the gland.
y	acid milk	Bromocresol purple is distinctly yellow at pH 5.2. This symbol should be added to the score when the mixture is yellow.	Distinctly acid milk in the udder is rare. When encountered, it indicates fermentation of lactose by bacterial action within the gland.

PMN = Polymorphonuclear leukocyte

## THE CALIFORNIA MASTITIS TEST



Collecting milk from individual quarters.



Draining off excess milk.



Adding reagent to milk in equal volume.



Brief rotary movement of paddle brings out reaction.

O. W. Schalm and D. O. Noorlander

School of Veterinary Medicine, University of California, Davis

October 1956

The California Mastitis Test (C.M.T.) is a new procedure for estimating cell content of milk. Irritation to mammary tissue, such as occurs in mastitis, results in an increase in the number of body cells in the milk. Chemical compounds belonging to the group of surface active agents containing long-chain hydrocarbon salts have been found to become visibly altered in the presence of native proteins of cellular origin. Such compounds can be used on milk to detect the increased cell content resulting from mastitis. This is the principle of the California Mastitis Test.

Bromocresol purple has been used widely in mastitis diagnosis to detect variations in pH of die milk. On fresh milk, this dye is especially useful for observing increasing alkalinity, which is characteristic of milk coming from glands in which secretion has been depressed by either inflammation or the natural dry-

## IS MASTITIS WIDESPREAD?

Surprisingly enough, mastitis appears to be much more widespread than most realize. Dairy authorities have estimated that as many as one out of two cows has some mastitis in one or more quarters. Not all are serious cases, of course.

## WHAT IS C M T?

CMT is an abbreviation for the original California Mastitis Test developed by Dr. O. W. Schalm of the University of California's School of Veterinary Medicine for the detection of increased leukocyte cell count in fresh milk, resulting from mastitis. It's a simple test to make and interpret. CMT tells in seconds whether milk is mastitic, and pinpoints the quarter delivering mastitic milk.

## HOW DO YOU USE CMT?

The CMT Kit contains a bottle of CMT Concentrate (enough to make 1 gallon of test solution), and paddle. Complete instructions on diluting the concentrate are on the bottle label. Details on administering the CMT procedure are illustrated and described on the facing page.

Primary value of CMT is at the side of the cow where it aids in quick diagnosis of mastitis, as well as control, for it pinpoints the quarter secreting mastitic milk.

CMT also can be used to test bulk milk. When doing this, it's important to keep the milk cold and not to let it become too old. After 24 hours, aging and/or bacterial action tend to destroy factors responsible for positive reaction to the test.

Mastitic milk tends to jell when tested by the CMT procedure. The degree of jelling indicates the presence and severity of mastitis.

## WAS THE TEST POSITIVE?

If CMT shows a positive mastitis reaction, as determined by consulting the chart on the back page, call your veterinarian at once so that he can determine the extent and nature of the treatment necessary. Follow his instructions.

After discarding the first stream of milk, draw the next milk into the shallow cups on the paddle, keeping the quarters separate.

A



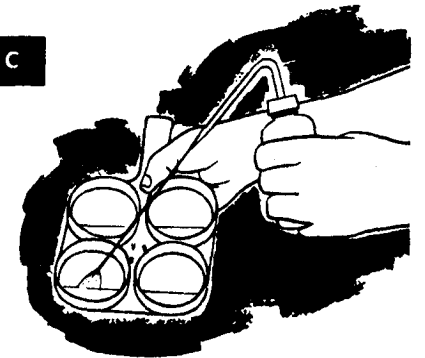
The ideal amount of milk is that which remains in the cup when the paddle is tilted to an almost vertical position, as shown.

B



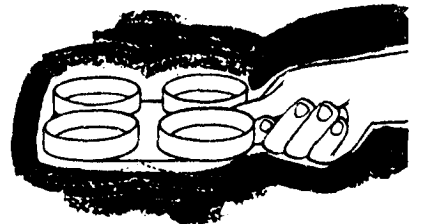
Form pools of milk in cups, as shown, by tilting paddle. Squirt test solution over milk. Avoid making bubbles. Proportion of solution to milk should be at least one to one.

C



Mix solution and milk by gently rotating paddle in horizontal plane, swirling the mixture. Positive reactions occur and can be graded during this rotary motion.

D



ing-off process. Bromocresol purple is employed in the C.M.T. solution to provide a contrasting color with the milk and also to permit detection of milk having a significantly altered pH.

**Procedure:** The test was designed for use in the dairy barn on milk drawn directly from the individual mammary quarters. A white plastic paddle containing four shallow cups is employed. The cups are designated A, B, C, and D for easy identification of the individual quarter from which the milk was obtained. When used from the right side of the cow, the paddle is held by its handle and the proper cup is placed under the teat as the milk is collected, so that A = right front quarter; B = right rear quarter; C = left front quarter; and D = left rear quarter (upper left photograph). When used from the left side of the cow, the paddle is grasped by the side opposite the handle and milk is drawn from each teat into the respective cup in accordance with the letter designation given above.

Either foremilk or strippings may be used. With foremilk, positive reactions tend to be more intense with the first streams of milk and to wane or disappear completely from succeeding streams. This is especially true of glands in which inflammation is limited. Strippings tend to show a more intense reaction than foremilk; therefore, when results on foremilk are in doubt the test may be repeated on strippings for verification.

The optimum amount of milk is that quantity that will remain in the receptacle when the paddle is tipped almost to the vertical, that is, about 3 cc. The amount of milk required for the test is easily estimated as it is drawn from the teat. If one or more cups contain more milk than is needed, the paddle is merely tipped toward the vertical and the excess milk drains away (upper right photograph). Next, the paddle is tipped forward and downward to produce a pool of milk in each cup. The test solution is squirted into the pool of milk from a polyethylene wash bottle (lower left photograph). The stream of reagent is directed into the milk by beginning at one side of the pool and moving across to the other side. In doing this, the formation of bubbles should be avoided. When the white color of the milk has been entirely masked by the color imparted by the reagent, enough test solution usually has been added. The proportion of reagent to milk should be at least one to one. Too little of the test solution may preclude the full development of positive reactions, while an excess does not significantly interfere. The reagent and milk are mixed by gentle circular movement of the paddle in a horizontal plane (lower right photograph). The fluid is made to swirl, and it is during this motion that the positive reactions occur and are graded.

The paddle is made ready for use on another cow by emptying its contents and rinsing it in cold water. Rinse water contained in a pail may be used to wash the paddle following several tests before the water needs to be changed. When going from the rinse water to the next cow, the paddle should be tilted so that the cups will drain well. However, it is not necessary to dry the paddle before use again, for a trace of moisture does not affect the results.

**Application of C.M.T. to the mastitis problem:** The test was designed to be applied to either foremilk or strippings at the side of the cow, but it may also be used on mixed milk from the entire udder (bucket sample) or even on bulk milk as delivered to the creamery. When used either on bucket milk or bulk milk, it is important to keep the milk cold and not let it become too old. Aging and/or the lowering of pH by bacterial action tend to destroy the factors responsible for positive reactions. Dry boric acid to provide a final concentration of 0.5 per cent may be added as a preservative to sample bottles for bucket or bulk milk studies. However, such samples should also be kept cold and the C.M.T. applied within 2436 hours.

The dilution of mastitic milk with normal milk tends to reduce the intensity of positive reactions. For this reason, reactions of lower score have more significance in bucket and bulk milk than in quarter-sample milk. A negative reaction with bucket milk does not necessarily mean that all quarters are free from inflammation, for a distinctly mastitic quarter may be contributing too little secretion to the total milk of the udder to cause the cell count of the mixed milk to be great enough to support a positive reaction. On the other hand, strong C.M.T. results with bucket milk definitely indicate that the entire milk is of poor quality. Strong reactions to C.M.T. in bulk milk would suggest a high level of udder irritations in the herd. When C.M.T. is used to screen large numbers of samples, as a routine laboratory procedure, it is convenient to use a plastic plate presenting ten cups and to mix the milk and reagent mechanically.

At the side of the cow, C.M.T. is of value in mastitis diagnosis and control, for it directs attention to individual mammary quarters that are secreting milk of high cell content. The results will provide convincing evidence that subclinical and chronic mastitis exist to a far greater extent than previously realized by the herd owner. Cell content is normally high at both extremes of lactation; therefore, C.M.T. should not be used before the third day after calving or on the secretion of the dry or drying-off udder.

Programs for the prevention and control of mastitis may be planned around the routine use of C.M.T. on all lactating cows. By using C.M.T. at weekly intervals and recording the results on a master sheet, it has been possible to detect mastitis in the incipient stages and to locate all quarters affected with chronic mastitis. When employed routinely, the test is a means of evaluating the effect on udder health of changes in management and of therapeutic agents used to treat mastitis. It is also useful to check for incipient acute mastitis when a cow goes off feed or shows other signs of a systemic reaction.

Traumatic injury to the udder by the milking machine occurs commonly. For this reason, C.M.T. *should not be used as the sole means for selecting glands for therapy.* The first step in alleviating widespread subclinical and chronic mastitis is to make certain that the milking machines are in good working order, that cows are stimulated for milk let-down before the machines are applied, and that the *teat cups are removed individually as soon as milk flow ceases from the respective teat.* Such a program will reduce the number of glands reacting to [CALT](#) in herds where milking practices have contributed significantly to udder irritation.

Individual quarters that fail to improve following the introduction of better milking practices should be sampled for bacteriologic studies, and if pathogenic bacteria are found, the indicated therapeutic agent should be administered. Quarters that continue to produce an alkaline and strongly C.M.T.-positive secretion, despite all effort to bring about improvement, might best be dried-off. A long period of rest before the next lactation may return the gland to better health.

In a mastitis control program where the goal is to eradicate *Streptococcus agalactiae*, milk samples should be collected periodically from all cows, both lactating and dry, for the bacteriological detection of *Str. agalactiae*. In this kind of program, C.M.T. is also of value, for it directs attention to glands showing evidence of irritation, irrespective of cause.

