view of Marston's observation that rapid and frequent stirring caused decreased fermentation.

Results of the analysis of the fermentation products obtained in Experiment 4 are presented in Table 2. These data indicate that: (1) acetic and propionic acids are

TABLE 2

VOLATILE ACIDS IN "BREWS" AND DIALYZATE AFTER 24-HR FERMENTATION (G)

Acid	Introduced with 700 ml rumen liquor	Glass bottle	Semipermeable bag		
			Inside	Outside	Total
Propionic ..	1.56	5.11	2.58	2.64	5.22
Acetic	2.26	5.28	2.22	2.38	5.60
Total	3.82	10.39	4.80	6.02	10.82

formed in the same proportions, irrespective of whether fermentation is carried out in the glass or cellophane container; (2) apparently less total volatile acid/g of cellulose digested is formed in the semipermeable bag than in the glass bottle, and (3) acetic acid diffuses at a greater rate from the bag than does propionic acid.

In conclusion it may be mentioned that there was no microscopic evidence of attack by the ruminal organisms on the cellophane bag. This is indeed fortunate, and may be explained on the basis that attack on cellulosic materials usually begins at broken or torn ends and no such surfaces were exposed in these experiments.

This work is being continued to explore ways of improving the technique.

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A Simple Universal Dairy Products Phosphatase Test

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Dairy products vary quite widely in character and composition. For example, there is the extreme contrast that exists between whole milk and ripened cheese. This variability has affected the applicability of standard phosphatase methods to various dairy products. Until recently, the Kay-Graham phosphatase test could not be used for ripened cheese or for chocolate milk products because interfering substances in them turned blue with the Folin-Ciocalteu reagent, resulting in false positive readings.

In addition, in all present-day phosphatase tests, including Sanders and Sager's (*3*), the concentration of the buffer and precipitating agent has to be shifted for many of the dairy products having different buffer capacities. This has led to a great deal of added effort and much confusion.

TABLE 1

SENSITIVITY OF THE CORNELL PHOSPHATASE METHOD WITH FRESH WHOLE MILK AND 15-MONTH-OLD CHEDDAR CHEESE

Milk	Phenol γ/0.5 ml*	Cheddar cheese	Phenol γ/0.25 g*
Pasteurized†	1.3	Made from	
" + 0.1% raw	14.2	pasteurized	
" + 0.4% raw	47.0	milk	1.2
" + 1.0% raw	64.0	" + 0.1% raw	8.4
		" + 0.4% raw	22.0
		" + 1.0% raw	30.0

* Tentatively, any value over 5.0 γ phenol/0.5 ml milk or 0.25 g cheese is considered underpasteurized.

† Pasteurized milk for this test is milk heated to at least 143° F for 30 min.

During the past year, an ether extraction technique has been evolved for the elimination of all interfering substances in dairy products when using the Kay-Graham phosphatase method with the Folin-Ciocalteu reagent (*1*). This work also brought out the fact that the barbital buffer used in the Kay-Graham test was unsatisfactory. As a result, a highly concentrated sodium carbonate-sodium bicarbonate buffer was substituted, with excellent results (*2*).

Though the extraction process proved highly satisfac tory in improving the Kay-Graham test, information obtained during this investigation pointed toward the development of a very simple procedure for all dairy products without extraction when using 2,6-dibromoquinonechlorimide (BQC) as the color indicator.

The method used in this new test is to incubate dairy product samples with a sodium carbonate-sodium bicarbonate buffer substrate at pH 9.5–9.7 for a period of time, then to precipitate the protein with an acid precipitant. After filtration, the filtrate is brought back to an alkaline reaction with carbonate, and BQC is then added. Blue color is produced if sufficient phosphatase was present in the milk during incubation to split the added disodium phenyl phosphate in the buffer substrate.

This test differs from others in that (1) the buffer and precipitating agent are of different nature, (2) only one concentration of buffer and precipitating solutions is required for all dairy products, and (3) it is not necessary to heat-inactivate the phosphatase enzyme after incubation, since the precipitating agent reduces the milk-substrate solution to pH 1–2.

The details of the method are briefly outlined as follows: 1 ml of milk or fluid dairy product or 0.5 g of cheese or other solid dairy product is mixed with 10 ml of warm carbonate buffer substrate (sodium carbonate 11.5 g; sodium bicarbonate 10.5 g; disodium phenyl phosphate 1.09 g/l).

The test tubes are then incubated at 32–37° C for 18–24 hr. After incubation, 1 ml of an acid precipitant

solution (25.0% trichloracetic acid + 18% hydrochloric acid) is added to each tube. The resulting precipitate is filtered off through Whatman No. 42 paper (11 cm).

Five ml of the filtrate is pipetted into a small test tube, followed by the addition of 1 ml of 0.05% copper sulfate plus 2% Calgon solution, and 5 ml of 8% sodium carbonate solution. Then 2 drops of BQC solution (50 mg/10 ml absolute methyl alcohol) are added, and the colors allowed to develop for 15 min at 37° C. The developed colors are compared with suitable standards.

For ripened cheese, the color development procedure is the same, except that 1 ml of 10% Calgon solution is substituted for 1 ml of the copper sulfate-Calgon solution.

Tentatively, for the long incubation method any value over 5 γ phenol/0.5 ml milk or 0.25 g cheese indicates underpasteurization or raw milk products. A 1-hr test using the identical steps but with a different critical standard has also been developed.

The sensitivity and accuracy of this test are very high, and the value of blanks is low. Table 1 shows some data obtained with milk and aged Cheddar cheese.

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Comments and Communications

Electronic Enhancement of X-Ray Film Contrast[1]

A viewing device for x-ray films, which makes use of some principles of television, promises to be of aid in certain long-standing problems of roentgenology. Many films contain questionable faint shadows whose existence and outlines ought to be ascertained definitely. If such a film is scanned by a densitometer, small but distinct differences in density can sometimes be found in homogeneous-looking regions of the film.

A television camera, using an orthicon tube or other scanning device, is employed as a continuously acting densitometer. The electrical output from the camera is amplified, "clipped" as described here, and fed into a kinescope, or viewing tube, as in conventional television practice.

The new feature of this method lies in the clipping. Unlike photographic film, which necessarily has black as the origin of its intensity-axis, a camera-amplifier-clipper combination can be arranged to ignore all light of less than a prescribed intensity. This is possible because a vacuum tube can be made insensitive to voltages more negative than a chosen threshold. The tube can also have an arbitrarily placed upper limit beyond which it fails to respond. Thus the voltages representing the darkest and the lightest portions of the film are clipped off, permitting those parts of the signal between the limits to be amplified as desired.

Thus a suitably high-gain video amplifier with adjustable cut-offs for both the black and the white ends of the signal can expand any portion of the gray to the full contrast of which the kinescope is capable. Everything darker than a certain gray is reproduced as black and everything brighter than another (lighter) gray comes through as white, but the outlines of those areas which have intermediate brilliance but small contrast are vividly portrayed by the picture tube.

[1] The authors wish to express their thanks to the Balaban and Katz Television Studios, Station WBKB, Chicago, for making available equipment for these experiments.

Successive parts of the black-gray-white scale can be examined by rotating a knob, analogous to the brilliance control of a television receiver. Let us imagine a solid, formed by erecting a line perpendicular to the film at each point of its surface, each line having a length proportional to the density of its foot. This solid is cut by two planes parallel to the film (one plane representing black on the kinescope and the other white), and the frustum can be examined in detail. The brilliance control regulates the distance of these planes from the base, and the contrast (sensitivity) control adjusts their distance from each other. The result can be metaphorically described as taking serial sections along the density axis of the film.

To date, a few x-ray films have been viewed by this method, and the improvement in contrast is striking, especially when one personally operates the controls and watches the shifts in emphasis. If the kinescope is photographed with the controls properly set, a more vivid picture results than can be taken from the film directly.

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The High School Biology Teacher

Victor A. Greulach (*Science* 1949, **109**, 385) in sharing Dr. Van Overbeek's concern over the inadequacy of high school biology teaching, (*Science* 1949, **109**, 210) exhorts "professional biologists through their societies to support a program designed to improve the quality and quantity of secondary school biology."

A practical and more immediately feasible suggestion might be for some university departments of biology to remove—or at least to open—the academic curtain that they keep tightly drawn between themselves and departments of education. I know of one large university in the East in which the zoology department schedules its courses at hours which seem deliberately designed to keep out high school biology teachers.