cyte GSH was observed with subcutaneous injections of adrenalin in rats.

The fact that the concentration of these compounds in the liver and the kidney is readily altered by adrenalin, which stimulates the increased metabolism of carbohydrates, suggests the labile role that sulfhydryl groups may play in intermediary metabolism. Several investigators have already shown that GSH is essential in reactions involving the metabolism of glycogen to form energy (*11, 12*). Since a rapid mobilization of glycogen from the liver occurs upon the application of a general physiological stress (which releases adrenalin) or upon the administration of adrenalin, it appears that the diminution in sulfhydryl groups under these conditions may be due partially to their utilization in glycogen breakdown.

Note added in proof: Because the notation TSH may be confused with the thyroid-stimulating hormone, it might well be replaced by NPSH.

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Action of T_2r^+ Bacteriophage on Host-Cell Membranes

Leonard F. Barrington* and Lloyd M. Kozloff

Department of Biochemistry, University of Chicago

Weidel has shown in studies with bacterial membrane preparations that the interaction of intact T_2r^+ bacteriophage with the host-cell membranes results in a disintegration of the membranes (*1*). However, there has been no quantitative information concerning the liberation of nonsedimentable material from the host (cell membranes).

Escherichia coli, strain B, was grown with aeration to a concentration of 1.4×10^9 cells per milliliter on a synthetic glucose-salt medium, with 7.7 atom percent excess N^{15} $(NH_4)^+$ as the nitrogen source. From this culture, a cell-membrane suspension was prepared and isolated according to the procedure of Weidel. The preparation was free of viable cells and moved as a single boundary in both the ultracentrifuge and the electrophoresis apparatus, as indicated by Weidel, but differed somewhat from his preparation. The sedimentation constant, 2300 *S*, differed from his value of 6500 *S*; the electrophoretic mobility was -7×10^{-5} cm^2/v sec at *p*H 6.72, $\Gamma/2 = 0.2$, while Weidel reported a value of -10×10^{-5} cm^2/v sec at *p*H 7.0, $\Gamma/2 = 0.1$; the elemental analysis showed an N/P ratio of 10, compared with his reported ratio of N/P of 11.

Table 1. Results of T_2r^+—*E. coli* B membrane interaction.

Expt.	T_2r^+ infective units introduced per membrane	T_2r^+ units adsorbed per membrane	Percentage of membrane N-nonsedimentable*	Percentage of T_2r^+ N-nonsedimentable†	Membrane N made nonsedimentable per T_2r^+ adsorbed (10^{-15} mg)
1	2.5	2.48	4.2	17.3	101
2	2.5	2.48	3.3	38.2	87
3‡	2.5	1.40	1.3	15.7	61
4	5.0	4.95	7.7	19.1	98
5	11.25	11.0	15.0	34.7	86
6§	187.5	185.5	73.8	13.0	29

* Based on N^{15} determinations and corrected for small amount of nonsedimentable N in original membrane suspension.

† T_2r^+ N by difference, based on total N and N^{15} determinations.

‡ System contained $9 \times 10^{-2} M$ Ca^{++}.

§ System contained $6 \times 10^{-4} M$ Ca^{++}.

Ninety-nine percent of both added T_2r^+ and added T_6r^+ were adsorbed by these membranes as determined by plaque count of free phage before and after incubation with the membranes. In the study of the release of nonsedimentable N, only T_2r^+ bacteriophage was used.

Unlabeled T_2r^+ bacteriophage and the bacterial membranes were incubated at 37°C for 150 min in an isotonic phosphate buffer, *p*H 7.0 ($\Gamma/2 = 0.16$). Samples were withdrawn for assay of free phage by plaque count, and the incubation samples were centrifuged for 2 hr in the cold at 18,000 *g*. Such conditions of centrifugation are capable of completely sedimenting the original virus particles and the membranes. The final supernatants were assayed for total nitrogen and for N^{15}.

Analyses of the samples indicated that membrane nitrogen is converted into a nonsedimentable form by virus-membrane interaction in amounts proportional to the ratio of virus particles to membranes.

Earlier findings, with intact bacterial cells, have shown that virus material is also made nonsedimentable by interaction with bacteriophage (*2–4*). Hershey

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and Chase have observed that adsorption of T_2 to bacterial membranes results in liberation of the phage DNA in a nonsedimentable form (*5*). In the present studies, emphasis is placed on the release of nonsedimentable nitrogen from the host-cell membranes, but release of nonsedimentable virus nitrogen is also shown. Representative experimental values are given in Table 1.

Electron micrographs taken at zero time and after incubation showed that adsorption of T_2r^+ was accompanied by disintegration of the virus and the conversion of the membrane to a granular residue.

The chemical nature of the substances "solubilized" from the membranes and the application of the foregoing findings to studies with intact host cells are presently being investigated.

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The Effect of Pasteurization on the Stability of Phosphates Can Be Used as a Test for Heated Milk

Socrates A. Kaloyereas

Department of Agricultural Chemistry and Biochemistry, Louisiana State University, Baton Rouge

It has been known for a long time that heating of milk results in a lowering of its *pH* (*1*). However, neither the explanation given for its cause by Whittier and Benton (*2*), who attribute it to the lactic acid formed from lactose, nor the earlier idea expressed by Orla-jensen and Plattner (*3*), attributing it to the formation of lactic acid from casein, seems justified in light of the results reported here. It was found that heating of milk at 62°C for 30 min, in order to pasteurize it, results in a decrease of its *p*H, whereas more prolonged heating does not have any further effect on the *p*H (Table 1).

These results indicate that a stable equilibrium is reached during the early period of heating and, as will be explained, the reaction that takes place stops when one of the reactants, namely, the carbonic acid, is unavailable. Titration curves of the rennet serums from raw and pasteurized milk show two characteristic differences at the points ending the titration of monocalcium phosphate and dicalcium phosphate. The dB/dpH values of milk serum changed by pasteurization from 0.0146 to 0.0159 at the range of the titration of monocalcium phosphate and from 0.0059 to 0.0052 at the range of the titration of dicalcium phosphate. These differences indicate an increase of monocalcium phosphate and a more or less proportionate decrease of dicalcium phosphate in pasteurized milk serum. The new equilibrium established between monocalcium phosphate and dicalcium phosphate in the heated milk serums is a result of a reaction that, most probably, takes place between dicalcium phosphate and carbonic acid as follows:

$$2CaHPO_4 + H_2CO_3 \longrightarrow Ca(H_2PO_4)_2 + CaCO_3.$$

Serum from heated milk exhibits a characteristic increase in stability, especially at *p*H 4.6, when heated at 70°C as compared with the serum of raw milk. This increased stability is shown not only by the increased heating time required to bring about the precipitation of phosphates but also by the smaller amount of the precipitate formed. Furthermore, the increased turbidity found in the supernatant liquid of the precipitated heated-milk serum indicates the greater stability of the phosphates there and provides further evidence of the reaction that takes place during pasteurization. It was found that the greater cause of turbidity of the supernatant liquid is the presence of carbonates and that by eliminating them—according to the Curtman and Hart method (*4*)—the tur-

Table 1. Effect of heating on the *p*H of milk.

Sample	Raw (*p*H)	Pasteurized at 62°C: For 30 min (*p*H)	Pasteurized at 62°C: For 60 min (*p*H)
1	6.75	6.71	6.71
2	6.77	6.69	6.69
3	6.70	6.62	6.62
4	6.73	6.65	6.65
5	6.68	6.63	6.64
6	6.81	6.78	6.78
7	6.78	6.73	6.73
8	6.63	6.57	6.57
9	6.65	6.60	6.61
10	6.64	6.58	6.58

Table 2. Average values for moist precipitates turbidity of supernatant liquids and stability (time needed for flocculation) of serum at *p*H 4.6 when heated at 70°C in a constant-temperature water bath.

Milk serum	Moist precipitate	Stability (min)	Turbidity optical density	Decrease of turbidity after elimination of carbonates (%)
Raw	2.6	15–20	0.300	84
Pasteurized	1.0	20–25	.900	60
Powdered milk				
Pet	0.4	More than 30	.290	
Starlac	.1	No flocculation	.400	