ascidians, but the presence of vanadium in association with the proteid escaped Griffith's observation. Whether non-metallic respiratory pigments represent degeneration, or whether they are phylogenetic predecessors of metallic pigments, is difficult to decide; but their presence in the animal kingdom shows that the function of oxygenation is not dependent upon the presence of a metal in the pigment molecule—a fact which gives strong indication that the association with metals was occasioned by the need of a greater capacity for ready oxidation and reduction, the need, that is, of a catalyst.

John F. Fulton, Jr.
Harvard University

THE INFLUENCE OF HEAT AND OXIDATION UPON THE NUTRITIVE AND ANTISCORBUTIC PROPERTIES OF COW'S MILK[1]

In a recent paper[2] from the Minnesota Experiment Station we submitted data which indicated that the nutritive and antiscorbutic properties of cow's milk are dependent upon the nature of the feeding materials which constitute the dairy ration.

In April, 1920, a series of studies was initiated with the view of ascertaining the influence of heat upon the nutritive properties and the antiscorbutic potency of milk. The experimental milk used in these studies was obtained from an Ayershire cow fed upon a ration composed of the same types of feeding materials throughout the experimental period. By this method it was hoped that we might eliminate fluctuations in the vitamine content of the dairy ration and thereby reduce to a minimum any variations in the nutritive properties of the milk.

In these studies we have used a total of 163 guinea pigs, and control groups were included in each series. In the first series of experiments it was found that boiled milk was practically equal, in nutritive properties, to the unheated raw milk. The pasteurized milk, heated at 145° F. for 30 minutes, produced scurvy very quickly and all of the animals died in a very short time. Examination revealed the fact that the pasteurized milks had been stirred rather violently with motor-driven propellors, while the boiled milk had not been stirred mechanically. This led us to believe that oxidation had occurred in the pasteurized milks due to the intimate contact of air with the milk particles. Consequently, many new animals have been added with the result that we have been able to show that the nutritive and antiscorbutic properties of cow's milk are destroyed by oxidation. Some destruction occurs when air is bubbled through milk at 145° F. for 30 minutes, but the destruction is much more marked when oxygen or hydrogen peroxide is used. Oxygen and hydrogen peroxide will destroy the antiscorbutic accessory at room temperature although the destructive action is hastened as the temperature increases. Milk may be pasteurized in closed vessels or boiled in the open air without appearing to lose its nutritive and antiscorbutic properties when fed to guinea pigs. When carbon dioxide is bubbled through the milk, it compares very favorably in nutritive properties with the raw milk.

Our work, now in progress, on orange juice shows that the antiscorbutic properties are not destroyed by boiling for 30 minutes. At least, if destruction occurs it is not discernible with the methods employed. Hydrogen peroxide destroys the antiscorbutic factor in orange juice at room temperature, and the speed of the oxidation is hastened as the temperature increases. Oxidation would appear to be a more important factor than heating as far as the nutritive and antiscorbutic properties of milk are concerned.

Edla V. Anderson,
R. Adams Dutcher,
C. H. Eckles,
J. W. Wilbur
Minnesota Experiment Station,
University Farm, St. Paul

[1] Published with the approval of the director as Paper No. 247, of the Journal Series of the Minnesota Agricultural Experiment Station.

[2] Dutcher, R. A., Eckles, C. H., Dahle, C. D., Mead, S. W., and Schaefer, O. G., *J. Biol. Chem.*, XLV., 119–132, December, 1920.