A Maternal Influence on the Incorporation of Methionine into Liver Protein[1]

Robert J. Rutman[2]

Division of Biochemistry, School of Medicine, and
Division of Genetics, College of Agriculture,
University of California, Berkeley

It was previously demonstrated (*3*) that two highly inbred strains of rats, differing in body size and growth rate, incorporated labeled S^{35} DL-methionine into surviving liver-slice proteins at significantly different rates. In studying the mode of inheritance of this character, earlier observations have been confirmed and extended to a demonstration of the influence of maternal genotype on the process *in vitro* under foster nursing.

The results were obtained by the technique of Melchior and Tarver (*2*). According to this procedure, the labeled protein, *in vitro*, is freed of adsorbed radioactivity and the cyst(e)ine sulfur separated as the cuprous mercaptide. The remaining (methionine) sulfur is converted to sulfate, precipitated as benzidine sulfate, counted, and titrated. Results are expressed as % replacement, defined as the fraction of the methionine recovered which was replaced by radioactive methionine.

The foster-nursing tests were conducted on four litters of J (Fisher Strain No. 344) and four litters of F (Wistar King Albino) progeny, interchanged between mothers 12–36 hr after birth. The fostered offspring were weaned at 4 weeks and continued on stock diet of Purina chow and greens until they were sacrificed at 100-g body weight. Triplicate tests were performed on individual foster-nursed and control animals, and the results are summarized in Table 1.

TABLE 1

INFLUENCE OF FOSTER NURSING ON PROTEIN SYNTHESIS *in Vitro* IN RAT LIVER SLICES

Litter No.	J ♂ nursed by F		F ♂ nursed by J	
	No. of tests	% Replacement	No. of tests	% Replacement
1	2	0.41	3	0.59
2	3	0.42	2	0.46
3	3	0.44	3	0.41
4	3	0.37	3	0.41
Average	11	0.41*	11	0.46
Standard error		± 0.02		± 0.03
Normal controls	13	0.29	10	0.43
Standard error		± 0.02		± 0.02

* Significantly different from normals at 1% level.

It is apparent that the maternal influence, acting through the milk, has stimulated the liver activity of the J strain to the level of the foster parent. The maternal influence on liver activity is accompanied by a marked increase in the growth of the fostered J progeny. It is also noticeable that the failure of F progeny to respond to J maternal influence on liver activity is reflected in the undisturbed growth of these animals, as shown in Table 2.

TABLE 2

INFLUENCE OF FOSTER NURSING ON GROWTH

	No. of animals	Weight in g at end of weeks		
		4	8	10
J ♂ nursed by F	17	67	200	244
J ♂ " " J	185	55	170	212
F ♂ " " J	15	66	194	230
F ♂ " " F	167	66	184	232

The demonstration of genetic control of the incorporation of an amino acid into the protein of liver tissue under the conditions of this study, and of the strong maternal (milk) influence on its hereditary transmission, raises certain questions concerning the generality of the phenomenon. It is to be wondered whether milk influence on specific metabolic processes in the mammal is part of a normal developmental mechanism. In this regard, the improvement of suckling ability and the elimination of cannibalism by vitamin B_{12} supplementation to the diet of pregnant mothers (*1*), and the correction of developmental deformities by riboflavin supplementation to the diet (*4*), show the gross effect of maternal nutritional deficiency on normal development. The results of this study extend the effect of variable maternal potency to normal metabolic processes and development.

[1] This work was aided, in part, by a research grant from the American Cancer Society.

[2] Present address: Jefferson Medical College, Philadelphia.

References

1. LEPKOVSKY, S. Personal communication.
2. MELCHIOR, J., and TARVER, H. *Arch. Biochem.*, 1947, **12**, 301.
3. RUTMAN, R. J., DEMPTSTER, E., and TARVER, H. *J. biol. Chem.*, 1949, **177**, 491.
4. WARKARY, J., and SCHAFFRENBERGER, E. *J. Nutrition*, 1944, **27**, 477.

Phenylhydrazine Oxalate as "Trapping Agent" for the Simultaneous Fixation of Intermediate Products in Lactic Acid Fermentation with Living Cells

V. Bolcato

Istituto Chimico Farmaceutico e Tossicologico della Università di Pavia, Italy

The chemistry of lactic acid fermentation is still based upon that of glycolysis because of the difficulties encountered in separation of the intermediate products which, on the contrary, was rather easy in the case of the cells of yeast and animal tissues.

Phosphorylation was, however, observed by Virtanen (*16, 17*), and Neuberg and Kobel (*6*) obtained a high