the second and the third, etc. Though the blastomeres become smaller and direct observation more difficult, it is perfectly evident after some experience that the most perfect elimination of the contents of the cells in the early stages may be accomplished after about two thirds of the total time elapsing between the two cleavages concerned has passed.

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MANGANESE AS A FACTOR IN HEMOGLOBIN BUILDING

FOR the past year the authors have been studying the problem of nutritional anemia as produced when whole milk is fed as the sole diet.

Hart and coworkers have reported that the ash of lettuce and cabbage when added to whole milk and iron make a satisfactory diet for hemoglobin building. In our work we have found that the ash of alfalfa and other plants can be utilized in a like manner with almost if not quite as good results.

These facts, together with certain observations and conclusions of Bertrand, McHargue and others, that manganese is essential in plant growth and for the formation of chlorophyl, led us to the study of manganese as a factor in hemoglobin building.

In our experimental work we have attempted to use the rabbit, but with not very great success, due to the fact that the young rabbit when on a deficient diet is so susceptible to coccidiosis and other diseases that our losses have been excessive before we could produce a severe anemia. More recently we have been using the rat for this work as suggested by Waddell, Steinbock, Elvehjem and Hart and find this animal much more satisfactory.

In this preliminary paper we wish to report on the effectiveness of manganese in hemoglobin building, particularly as it affects rabbits. Some forty rabbits have been on this experiment but not all have received a purified diet. Two rabbits made anemic on a whole milk diet were fed five mgs of copper-free iron chloride and 0.5 mgs of copper-free manganese chloride.

Table I shows the hemoglobin content of the blood during the experiment.

TABLE I

Date 1928		Weight	Grams Hemoglobin per 100 cc blood	Diet
Rabbit No. 662				
Jan.	14	375	12.24	Whole milk only
	19	430	12.36	
	27	440	12.24	Added 5 mgs. iron in form of $FeCl_3$
Feb.	8	570	10.20	
	14	655	8.58	
	21			Added 0.5 mgs. manganese + 5 mgs. of iron, the manganese in form of $MnCl_2$
Mar.	12	1010	11.43	
	26	1135	13.26	
Apr.	30	1356	11.43	
May	15	1540	9.09	
June	20	1779	11.22	
July	26	1779	11.22	
Rabbit No. 678				
May	15	556	12.24	Whole milk only
	22	595	10.62	
	28	625	9.59	Added 5 mgs. iron as $FeCl_3$ + 0.5 mgs. manganese as $MnCl_2$
June	8	855	11.22	
	20	944	14.67	
July	9	—	14.60	
	26	1375	12.03	

The results shown above indicate that manganese has a beneficial effect when added to a milk-iron diet.

Manganese apparently exerts the same beneficial effects upon rats as upon rabbits, as is indicated by a number of these animals which we now have on experiment.

In our experimental work we have exercised every precaution to eliminate copper from the ration, since Hart and coworkers have shown this element to be effective in hemoglobin building.

The manganese used was a Baker & Adamson manganese carbonate, C. P. This salt was dissolved in the least quantity of hydrochloric acid, then treated with hydrogen sulphide under pressure for twelve hours. The solution was then filtered and the excess hydrogen sulphide removed by boiling. The iron used was prepared from a very high purity Bureau of Standards iron and treated with hydrogen sulphide to remove any copper.

The milk was handled and kept in aluminum cans and the animals were kept in galvanized wire cages on wire screens. Porcelain mortars were used for feeding dishes.

Further work is being done on this problem of the relation of manganese to hemoglobin building, the results of which will be reported in more detail a little later.

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