

Cleveland Section

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6701

Action of Copper and Other Elements in Iron Metabolism.

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Since work from this laboratory¹ has indicated that copper is not the only inorganic element which can supplement iron to bring about hemoglobin regeneration in the nutritional anemia of the rat, the present study was undertaken to compare the influence of copper and other elements on the iron content of the liver. The experimental procedure was very similar to that employed by Elvehjem and Sherman.² The tissue iron content was determined by the method described by Hanzal.³

The present report deals only with the influence of copper. The accompanying table shows the changes in the iron content of the various rat livers.

TABLE I.
Changes of Iron Content in Liver of Rat.

No. Animals	Liver Fe Dry Tissue	Red Blood Cells per c.mm.			Hb Increase over Anemic Level	Remarks
		Anemic Level	14 days	28 days		
	mg. per gm.	millions	millions	millions	gm. per 100 cc.	
5	0.33					Normal animals
8	0.31	2.04				Anemic "
5	0.51	2.47	6.03		7.1	" "
						+.5 mg. Fe dai- ly 14 days
5	0.38	1.86	5.12	4.77	3.5	Same, then 14 days milk, no Fe and no Cu
5	0.17	2.12	4.42	7.19	6.0	Same, then 14 days .05 mg. Cu
5	0.11	1.94	4.71		2.4	

¹ Myers, V. C., and Beard, H. H., *J. Biol. Chem.*, 1931, **94**, 89.

² Elvehjem, C. A., and Sherman, W. C., *J. Biol. Chem.*, 1932, **98**, 309.

³ Hanzal, R. F., *Proc. Soc. Exp. Biol. and Med.*, 1933, **30**, 846.

As can be seen when iron is administered to the anemic animal for 14 days there is an increase in the iron content of the liver as well as an increase in the blood hemoglobin and erythrocytes. With discontinuing the iron at the end of 14 days and giving milk only the liver iron decreases as does the blood hemoglobin and erythrocytes. When copper is given at the end of 14 days, and no iron, the liver iron markedly decreases, while the blood hemoglobin and erythrocytes increase. Copper given to anemic animals reduces the liver iron to a minimum level with a coincident increase in blood hemoglobin and erythrocytes.

It may be concluded that copper when given to anemic rats can mobilize the iron stored in the liver to produce hemoglobin and increase the red blood cells.

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Determination of Iron in Biological Material.

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A method is proposed for the determination of iron in biological material which makes use of the reaction between iron and thioglycollic acid in an alkaline solution with the production of a purple color.

Method for blood. Measure 0.2 cc. of blood into a pipette accurately calibrated to contain 0.2 cc. and deliver it into a Pyrex test tube, 20x180 mm., calibrated at 10, 15 and 20 cc. Add 1 cc. of 10 N sulfuric acid and introduce a small piece of silica or a glass bead to prevent bumping. Heat, preferably over a hot plate to evaporate the water. As soon as the material chars, allow to cool for 45 seconds and add 4 drops of 30% hydrogen peroxide drop by drop. Continue the heating for 5 minutes after the solution becomes colorless. Allow it to cool and add 10 cc. water. Into a similarly calibrated Pyrex test tube accurately measure 1 cc. of standard iron solution containing 0.1 mg. iron and dilute with distilled water to about the 15 cc. mark. Add one drop (0.05 cc.) of thioglycollic acid to both standard and unknown, mix by lateral shaking. Run in concentrated ammonium hydroxide from a burette until the permanent purple color makes its appearance, pH of 8 to 10. Mix con-