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Blood Regeneration in Nutritional Anemia. Influence of Iron, Iron and Copper, Nickel, Cobalt, Germanium, or Sodium Germanate.

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Young rats were made anemic by feeding whole milk for a period of 6 weeks after weaning. When the erythrocyte count was about 3-4 million per cu. mm., and the Hb content 4-6 gm. per 100 cc., additions of Fe, Fe + Cu, Fe + Ni, Fe + Co, and Fe + Ge, Fe + Na_2GeO_3 were made. Erythrocyte counts and Hb estimations were made weekly on a few drops of blood obtained by clipping the end of the tail. A Levy counting chamber with double Neubauer ruling was used. Hb determinations were made by the acid hematin method, color comparison being made with a calibrated Newcomber disc. The results are summarized in the table.

When 0.5 mg. Fe was given daily to anemic rats recovery of both erythrocytes and Hb was complete in 4.3 and 6 weeks; with 1 mg. the time for recovery was 3.5 and 4.8 weeks; and with 1.5 mg. it was 3.5 and 3.7 weeks, respectively. Since this iron solution was prepared from standard iron wire using hydrochloric and nitric acids, it would hardly seem that the effect of iron salts, as $FeCl_3$, in blood regeneration could be due to the impurities these salts might contain, as Hart and coworkers suggest.[1] Mitchell and coworkers[2] had previously shown that some iron salts, *e. g.*, $FeCl_3$, were effective in blood regeneration in rats fed whole milk diets. Our results seem to confirm those of Mitchell in respect to this one iron salt. The experiments also appear to confirm those of Hart and his coworkers[3] on the supplementing action of copper when added to iron, but do not indicate that copper is unique in this respect.

The data in the table show that traces of copper, nickel, cobalt, germanium and sodium germanate plus 0.5 mg. Fe all brought about regeneration of erythrocytes and hemoglobin in less time than did 0.5 mg. iron alone. A number of other elements have been studied.

[1] Hart, E. B., Elvehjem, C. A., Waddell, J., and Herrin, R. C., *J. Biol. Chem.*, 1927, lxxii, 299.

[2] Mitchell, H. S., and Schmidt, L., *J. Biol. Chem.*, 1926, lxx, 471; Mitchell, H. S., and Vaughn, M., *J. Biol. Chem.*, 1927, lxxv, 123.

[3] Hart, E. B., Steenbock, H., Waddell, J., and Elvehjem, C. A., *J. Biol. Chem.*, 1928, lxxvii, 797.

TABLE I.
Average Values.

No. of Animals	Body Wt.		Erythrocytes		Hemoglobin		Time for Recovery		Daily Diet of Whole milk plus
	Beginning	End	Beginning	End	Beginning	End	Erythrocytes	Hemoglobin	
	gm.	gm.	million cu	mm.	gm. 100	c.	weeks	weeks	
11	97.0	139.0	4.1	8.5	5.2	14.0	4.3	6.0	0.5 mg. Fe
6	105.0	144.5	4.5	8.3	5.3	14.2	3.5	4.8	1.0 mg. Fe
3	95.0	121.5	3.4	8.5	4.1	13.7	3.7	3.7	1.5 mg. Fe
10	88.0	112.5	4.4	8.4	5.7	14.2	2.5	2.9	0.5 mg. Fe + 0.05 mg. Cu
2	57.0	100.0	4.0	9.9	6.9	14.3	1.5	3.0	0.5 mg. Fe + 0.05 mg. Ni
2	61.0	94.0	3.2	9.0	5.5	13.6	2.0	3.0	0.5 mg. Fe + 0.1 mg. Ni
2	48.0	86.0	3.0	8.2	5.0	14.0	3.0	5.0	0.5 mg. Fe + 0.05 mg. Co
2	53.0	72.0	4.0	8.7	6.3	11.1*	3.0	4.0	0.5 mg. Fe + 0.1 mg. Co
7	104.0	126.5	4.8	8.4	6.1	13.7	2.4	2.6	0.5 mg. Fe + 0.5 mg. Ge
4	75.0	137.0	2.9	8.6	4.7	13.4	2.8	4.8	0.5 mg. Fe + 0.05 to 0.2 mg. Na_2GeO_3

* Experiment still in progress.