The results are summarized in the following table where fifteen control rats are seen to have given an average medulla H_2O/cerebrum H_2O ratio of .922 ± .003, while thirteen morphinized rats gave an average ratio of .939 ± .007.

TABLE

Condition	Duration	Average $\frac{\text{Medulla } H_2O}{\text{Cerebrum } H_2O}$	
		Rats (No.)	Rabbits (No.)
Anesthesia:			
Morphine sulfate	½–2½ hrs.	(13) .939 ± .007*	
Amytal	½–2½ hrs.	(5) .931	
Ether	½ hr.	(1) .936	(2) .933
Excitement:			
Ether	½ hr.	(1) .928	(2) .920
Muscular activity	½ hr.	(1) .924	
Controls (normal)		(15) .922 ± .003*	(3) .926

* Standard deviation of the average.

The above findings (which we plan to report more completely in *The American Journal of Physiology*) are entirely consistent with the conception that anesthesia in mammals is associated with the dehydration of nerve cell bodies. It is conceivable that early in narcosis the colloidal condition of the cells is altered in such a way as to extrude water (*cf.* Claude Bernard's semi-coagulation theory[6] or Hirschfelder's[7] demonstration of lessened lipoid dispersion).

Dehydration of the cerebrum is the rule, at least in rats. The extra water taken on by the medulla not only may be located entirely outside of the nerve cells but may even be derived from the nerve cells of both medulla and cerebrum. The interfibrillar spaces may well serve as a temporary storehouse for water during readjustments of brain pressure and the like. At all events our results indicate that the first accompaniment of brain narcosis is a temporary storage of water in the medulla, partly at the expense of the cerebrum.

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METALLIZED FOOD IN THE REGENERATION OF HEMOGLOBIN IN RAT AND MAN

To eliminate the acidity of salt solutions used in the regeneration of hemoglobin in animals made anemic by deficient diets, Fe, Co, Mn and Cu were dissolved directly in milk while in the ice box.[1,2,3] After 12 hours half the milk was used after being shaken, and the balance was shaken and used 12 hours later. The metals were washed and placed in fresh milk for the next day and so on. In this way enough of the metals dissolve in milk to supply the requirements for rapid hemoglobin regeneration in rat and man, as seen below.

On April 22, 1929, two dozen young white rats, reduced to 75 per cent. hemoglobin by feeding on pure raw milk, were equally divided in two identical cages, A and B, Fig. 1, and each rat was then fed

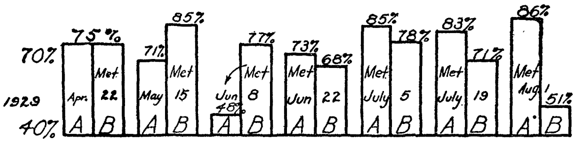

FIG. 1

50 cc of raw milk per day, free from metallic contact in its production and storage.[4] Into the 600 cc of milk for group B 181 gms of Fe, Co, Mn and Cu in alloy form were placed each day for the two feedings. A was the first and B the latter control. All hemoglobin is reported in percentage (Newcomer). The second and third graphs of Fig. 1 show the percentage *differences* after three and six weeks, being respectively 14 per cent. and 29 per cent. on May 15 and June 8. On June 8 the alloys were transferred from the milk for B to that for A. In 14 days group A average hemoglobin had risen from 48 per cent. to 73 per cent., while that of B had fallen from 77 per cent. to 68 per cent. as per the fourth graph. Progressive, average percentage differences increased as seen in the fifth, sixth and last graphs, when on August 1, 6 per cent. beyond a complete reversal appeared in average per cent. hemoglobin of the two groups. Tangents drawn to A and B of the third group and to B and A of the last group meet almost at right angles. Note that B on May 15 equals A on August 1, both with metals. Group B shows evidence of some metal retention by a very gradual decline in hemoglobin during 8 weeks. Fig. 1 shows remarkable hemoglobin control by a metallized diet.

In order to compare the hemoglobin regenerative effects of direct metallization with salt effects, the tests of Fig. 2 were made. The average hemoglobin of the rats studied in the 7 cages of Fig. 2 had dropped on a pure milk diet to 38 per cent., and all

[6] The current work of Bancroft and Richter (Proc. Nat. Acad. Sci., 16: 573, 1930., and *J. Phys. Chem.*, January, 1931) contributes striking evidence that narcotics produce a reversible semi-coagulation.

[7] A. D. Hirschfelder, *J. Pharmacol. and Exper. Therap.*, 37: 399, 1929.

[1] Clarice M. Burns, *Biochem. Jnl.*, 32: 5, 860.

[2] Elvehjem and Hart, *J. Biolog. Chem.*, 84: 131, 1929.

[3] Waddell and Steenbock, *J. Biolog. Chem.*, 84: 115, 1929.

[4] Lewis, Weischelbaum and McGhee, *Proc. Soc. Exp. Biol. and Med.*, 27: 329, 1930.

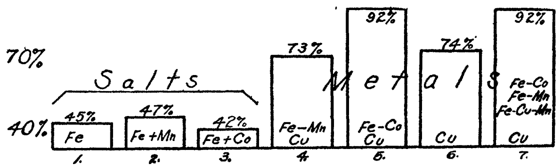

FIG. 2

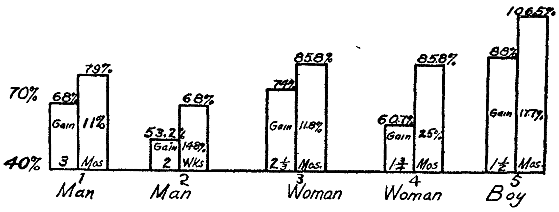

FIG. 3

were remarkably close to the horizontal line in the figure, when, on July 23, 1929, the indicated salts were added to the milk of the first three and the noted metals to the other groups, in weights seen in the table. The average rise in hemoglobin per cent. in each cage of 6 or 8 rats during 7 weeks is seen in the 7 graphs. Graph 6 shows effects of pure Cu only.

The rats in cage 7 were comatose and all below 38 per cent. hemoglobin with little appetite before the metals were put into their milk diet. After 4 days on metallized milk they were playing and ate ravenously, rising in eight weeks from below 38 per cent. hemoglobin to 92 per cent.

THE WEIGHTS OF SALTS FED PER RAT PER DAY IN FIG. 2

Cage	No. 1	No. 2	No. 3
	0.5 mg Fe as $FeCl_3$	0.1 mg Fe, 0.1 " Mn as chloride	0.1 mg Fe, 0.1 " Co as chloride

THE WEIGHTS OF COPPER AND ALLOYS PER RAT PER DAY IN FIG. 2

Cage	No. 4	No. 5	No. 6	No. 7
	Fe–Mn, 3.24; Copper, 0.31 mgs	Fe–Co, 0.135; Copper, .306 mgs	Copper .306 mgs	Fe–Co, 0.16; Fe–Mn, 3.04; Fe–Mn–Cu, .384 Copper, 0.27 mgs

These weights are cage averages. The sheet Cu is free from Fe, Al, Mg, Ni, Zn, Li, and has only traces of Co and Mn, respectively 10 parts and 1 part per million.

Copper alone is quite effective, but more so with other metals, suggesting that mutual influences probably exist when several metals function together, which may fail when they are separate.

After using metallized milk himself for eight months to determine possible pathological results, the writer secured the cooperation of physicians and executives in three local cotton mills and tests were made of the effects of metallized milk on a number of employees who had secondary anemia. Each person was examined after using a directed diet for two weeks including sweet milk, the percentage of hemoglobin being specially noted. Results typical of 50 cases are shown in Fig. 3, with a record of the hemoglobin percentage gain of each and the time involved.

The ages of the two men, two women and one boy, in order, are 59, 28, 49, 28 and 16 years. No change in color, odor or taste occurs if the immersed metals are pure. The man of graph 2, Fig. 3, ingested 0.5 mg of copper per day, and approximately 0.7 mg of iron. Tests of the duration of these effects are being made.

CONCLUSIONS

(1) Metals dissolve enough in milk to supply the requirements for rapid regeneration of hemoglobin in rat and man.

(2) Copper alone is effective but less so than when accompanied by other metals, especially iron.

(2) Much less mortality occurs among rats fed on metallized milk than when salts of the metals are used in anemia tests.

(4) These metals produce no odor, color, taste or other observed change in milk with the quantities used unless they are exposed to air and milk.

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BOOKS RECEIVED

ALLEE, W. C. *Animal Aggregations.* Pp. ix + 431. 35 figures. University of Chicago Press. $5.00.

BRIDGES, T. C., and H. H. TILTMAN. *Master Minds of Modern Science.* Pp. 278. 32 illustratious. Dial Press. $3.00.

HATCH, F. H. *An Introduction to the Study of Ore Deposits.* Pp. 117. 31 figures. University of Chicago Press. $2.50.

HAWKS, ELLISON. *The Book of Electrical Wonders.* Pp. 316. 40 plates and 91 figures. Dial Press. $3.00.

Kyoto Imperial University. *Memoirs of the College of Science.* Series A. Volume XIV. No. 1. Pp. 42. Maruzen Company, Tokyo.

PIERCE, FREDERICK. *Dreams and Personality:* A Study of Our Dual Lives. Pp. xii + 337. Appleton. $3.00.

SMART, HAROLD R. *The Logic of Science.* Pp. vii + 237. Appleton. $2.50.

VON BERNEWITZ, M. W. *Handbook for Prospectors.* Second edition. Pp. xi + 359. 89 figures. McGraw-Hill. $3.00.

WHITNEY, JESSAMINE S., Editor. *Facts and Figures about Tuberculosis.* Pp. 63. National Tuberculosis Association, New York, N. Y. $.75.