steel (or nichrome) produce irritative foci whose stimulative action on certain neurons continues long after the flow of electric current has ceased.

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Effect of Cold Acclimation on Vitamin A Metabolism.* (27010)

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Rodahl and Moore(1) reported that the liver of the polar bear contains a very large amount of vit. A, and concluded that the toxic effects noted in man following his ingestion of polar bear liver are symptoms of hypervitaminosis A. They also mentioned that similar findings are sometimes seen with the liver of seals.

It would seem most likely that this high hepatic Vit. A content of polar bear and seal livers is related to the nature of the diet of these animals. However, it is also possible that low environmental temperature may play a direct role. To test this possibility, experiments designed to determine the effect of cold acclimation on hepatic vit. A content were carried out with rats.

Experimental. Adult male rats of the Wistar strain were fed *ad libitum* for 10 days a standard diet of the following composition: 25% casein, 10% lard, 51% dextrose, 3% salt mix (2), 5% cellulose, 6% brewers yeast, 0.04% cod liver oil concentrate, 0.01% alpha-tocopherol. After a period of dietary stabilization, the rats were divided into the following 4 groups: Group A was fed the standard diet *ad libitum* for 4 to 5 months while living at 25°C; Group B was fed the standard diet *ad libitum* for 4 to 7 months while living at 0−2°C; Group C was fed the standard diet minus the cod liver oil concentrate *ad libitum* for 4 months while living at 25°C; Group D was fed the standard diet minus the cod liver oil concentrate *ad libitum* for 4 months while living at 0−2°C. In the case of Groups A and B the diets contained 34 units of vit. A per gram of diet, thus providing an abundance of the vitamin. In the case of Groups C and D the rats were administered orally 40 units of vit. A as cod liver oil concentrate in carrier corn oil once a week, thus providing just over the minimum vit. A requirement for rats(3).

At the end of the experimental period the rats were killed by decapitation. The liver was excised, weighed, wrapped in aluminum foil and quickly frozen in liquid nitrogen. The livers were stored in the frozen state at −30°C until analysed for vit. A content.

The method of Ames *et al*(4) was used for vit. A analysis. These authors point out that when levels of vit. A are below 10 γ per gram of liver, turbidity problems can interfere with the assay. In many of the livers analysed in the present work, levels of less than 10 γ of vit.

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A per gram of liver were encountered. However, we found that vigorous centrifugation of suitable aliquots of liver extract overcame the turbidity problem in all but one instance. In one case the turbidity could not be successfully dealt with; the data from this assay were discarded.

Results and Discussion. The data on the effects of cold acclimation on vit. A content of the liver of rats allowed to eat a vit. A containing diet *ad libitum* are presented in Table 1. Livers of cold-acclimated rats contain much more vit. A than do livers of rats maintained at 25°C. Moreover, since the liver of the cold-acclimated rat is smaller than that of the control rat, the increase in vit. A content accompanying cold acclimation is even greater when the data are expressed on a per gram liver basis.

TABLE I. Effects of Cold Acclimation on Hepatic Vit A Content of Rats Fed *Ad Libitum* a Diet Containing Vit A.

Physiological State	No. of Rats Used	Vit A Content of Liver Total γ	γ/g wet wt
Acclimated to 25°C	6	12,230 ± 2066*	1160 ± 73
" "0-2°C	6	24,400 ± 5660	2950 ± 361

* SEM.

In considering the reasons for this increase in hepatic vit. A content during cold acclimation, it seemed most likely that it resulted from an increase in vit. A intake, a simple corrollary of the increased food consumption observed in cold-acclimated animals(5,6). To test this possibility experiments were carried out in which rats were fed at either 25°C or 0−2°C the standard diet from which the cod liver oil concentrate had been deleted. Each week these rats were given 40 units of vit. A. A dosage of vit. A near the minimum required amount was chosen so that any alteration in vit. A metabolism leading to vit. A sparing in cold-acclimated rats would be exaggerated.

The results of these experiments are recorded in Table 2. When fed the same amount of vit. A, the cold-acclimated rats store a little less vit. A in the liver than do the rats acclimated to 25°C, the p being less than 0.01 when expressed on the basis of total liver and less than 0.02 when expressed on the basis of per gram liver weight. Thus no evidence was found to indicate that cold-acclimation exerts a sparing action on vit. A metabolism.

TABLE II. Effects of Cold Acclimation on Hepatic Vit A Content of Rats Administered 40 Units of Vit A per Week.

Physiological State	No. of Rats Used	Vit A Content of Liver Total γ	γ/g wet wt
Acclimated to 25°C	9	103 ± 10.4*	10.2 ± 1.13
" "0-2°C	10	57 ± 7.8	6.5 ± .85

* SEM.

These data appear to support the generalization that vit. A requirement is not related to food intake, i.e., to energy metabolism, but is more closely correlated with body size(7). The fact that this holds even when the voluntary food intake is increased by cold acclimation is an interesting observation.

Summary. Hepatic vit. A levels are much higher in cold-acclimated rats than in rats maintained at 25°C. This increase in hepatic vit. A content does not stem from a sparing action induced by cold acclimation but is rather a simple corollary of increased food consumption that accompanies cold-exposure. Moreover, evidence is presented which suggests that the amount of vit. A needed for rats to live at 0-2°C is not markedly greater than the amount needed to live at 25°C.

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