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Effect of Hypophysectomy on Glycogen Distribution in Tumor-Bearing Rats.*

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In an experiment in which the effect of pituitary removal on the rate of growth of Walker tumor No. 256 was compared with the effect of caloric restriction in intact tumor-bearing male rats, samples of liver, muscle, and tumor tissue were secured for glycogen determinations.

All animals had been fed by stomach tube with a formula composed of

Powdered whole milk	100 gm.
Glucose	100 "
Harris Yeast Extract	15 "
Water to	300 cc.

The hypophysectomized animals received twice daily throughout the experiment 1 cc. of this mixture per 40 gm. of body weight, calculated at the beginning of the experiment when tumor weight was negligible. The amount of food received by the controls was varied to maintain the total weight (somatic weight plus tumor weight) roughly equivalent to that of the hypophysectomized rats. This resulted in a restriction to approximately ¾ of the normal food intake in the intact tumor-bearing animals, while the hypophysectomized animals were given more food than they would have voluntarily consumed. At the time the glycogen samples were secured the hypophysectomized group had been deprived of pituitary tissue for 21 days. Liver, muscle, and tumor samples were taken in the order mentioned under amytal anesthesia 4 hours after the last feeding, and were frozen, weighed, and digested in the usual manner. Analyses were made according to the method of Good, Kramer and Somogyi[1] except that, in addition, the precipitate was washed once with 60% alcohol after being drained. The wash alcohol was also carefully drained off. The sugar in the final hydrolysate was determined by the Shaffer-Hartmann-Somogyi method. The percentage of glycogen present in the sample was calculated

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1 Good, C. A., Kramer, H., and Somogyi, M., *J. Biol. Chem.*, 1933, **100**, 485.

TABLE I.

Glycogen Values for Livers, Muscles, and Walker No. 256 Tumors in Post-Absorptive Hypophysectomized and Intact Male Rats.

	No. Animals	Aver. Tumor Size in gm.	Livers %	Muscles %	Tumors %
Intact	11	21.8±1.9	2.42±0.23	0.295±0.023	0.026±0.0017
Hypophysectomized	7	6.04±0.49	2.32±0.23	0.367±0.013	0.046±0.0025
Ratio of Difference to Probable Error of Difference		8.0	0.31	2.8	6.7

TABLE II.

Glycogen Values for Livers, Muscles and Walker No. 256 Tumors in Hypophysectomized and Intact Rats on a High Caloric Intake.

	No. of Animals	Average Tumor wt., gm.	Livers %	Muscles %	Tumors %	Tumors mg./cm.^{2}
Intact		8.68±0.56				
Post-absorptive	7		2.59±0.14	0.318±0.032	0.058±0.008	0.095±0.017
Fasted 28-30 hrs.	4		0.0279±0.0034	0.157±0.0055	0.055±0.026	0.088±0.011
Hypophysectomized						
Post-absorptive	5	4.06±0.91	3.03±0.34	0.222±0.012	0.186±0.015	0.26±0.014
Ratio of Difference to Probable Error of Difference (groups 1 and 3)		4.3	1.19	2.8	7.5	7.5

from this figure. For the tumors, glycogen was expressed as percentage of the total weight, or as mg. per sq. cm. of surface.

The data in Table I reveal that the small slow-growing tumors of the hypophysectomized animals contain significantly larger amounts of glycogen than the tumors of the intact group, while the liver and muscle values are not significantly different.

Another experiment was done in which both groups of animals received a high caloric diet by stomach tube. In this instance the tumors of the hypophysectomized animals contained about 4 times as much glycogen as in the first experiment while the tumors of the unoperated controls showed only twice as much as formerly (Table II). In this instance there was not as marked a difference in tumor size as formerly, and the sampling of the tumors of both groups was more uniform. Since tumor necrosis is preponderantly central it is perhaps preferable under these circumstances to express the glycogen values as a function of the surface. In the first experiment this was not done, since only peripheral portions of the large control tumors were used for analysis whereas the small tumors of the hypophysectomized animals were used *in toto*.

The question of the nature of the glycogen in the tumors naturally arises. Is it purely a storage phenomenon? The values for the fasted intact animals indicate that whereas large proportions of the liver and muscle glycogen may be lost through fasting, the tumor glycogen concentration remains at the same level as formerly, a level almost twice that found in the livers of this group. It appears, then, that the tumor glycogen fraction is not a labile one. We have neither a satisfactory explanation of why glycogen values are higher in tumors of hypophysectomized animals nor of what the presence of this glycogen means in terms of tumor metabolism.