Summary. 1. Section of the vagus nerves below the diaphragm was found to have no effect on the tolerance of normal dogs to intravenously injected glucose. No evidence was obtained which pointed to secretory or tonic inhibitory fibers in either of the vagus nerves. 2. Removal of one adrenal and denervation of the other resulted in a slightly more rapid fall in blood sugar after intravenous injection of glucose. This difference in rate, though persistent in the animal studied, was nevertheless small and of doubtful significance. 3. Cœliac ganglionectomy after bilateral vagus section and after removal of one adrenal and denervation of the other was without effect on glucose tolerance. 4. No evidence was obtained in normal dogs to substantiate a theoretical basis for operative procedures designed to increase tolerance to glucose.

We are indebted to Dr. David Rapport for valuable suggestions in carrying out this work. We wish to express our gratitude to Drs. David D. Berlin and Joseph Tartakoff for performing all the surgical procedures.

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Calorigenic Action of Methylene Blue During Muscular Exercise.*

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In previous communications (Rapport,[1] Canzanelli, Segal and Rapport[2]) we have presented evidence indicating that while the energy of the calorigenic action of certain substances, (such as protein, certain amino acids, thyroxine, etc.) can not be used as a fuel for muscular work, that of carbohydrate and fat could be so used. The present communication deals with similar observations in regard to methylene blue, a substance foreign to the body, which, when administered, has a considerable effect on the total metabolism.

The experiments were made on a single well-trained female dog, weighing about 9 kilos, and subsisting on a constant maintenance

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1 Rapport, D., *Am. J. Physiol.*, 1929, **91**, 238.

2 Canzanelli, A., Segal, M., and Rapport, D., *Am. J. Physiol.*, 1934, **110**, 410.

diet, the methods being the same as those used in the above mentioned researches. The gaseous exchange was obtained in a closed system, into which, for the purpose of exercise, a horizontal treadmill was introduced. Exercise consisted of 15 minutes running at about 2.5 kilometers per hour, and the metabolism of exercise and recovery was calculated by computing the amount of respiratory exchange in excess of that at rest. This was done both on days when the resting metabolism was basal, and on days after the injection of 10 mg. of methylene blue in one percent watery solution per kilo of body weight.

Three alcohol checks were performed during the course of the work, the respiratory quotients being 0.660, 0.667 and 0.671 respectively, the maximum error in the R.Q. being 0.007, or about one percent.

TABLE I.

Date	Resting Metabolism* per hour		Increased Resting Metabolism over "A"	Work†	Excess Metabolism‡ of Exercise			Increase in Metabolism during exercise over "A"
	R.Q.	Cal.			R.Q.	Cal.	Gm. cal. per kgm. of work	
				Basal "A"				
1935				Kgm.				
March 27	0.92	11.8		6153	0.86	10.3	1.67	
April 17	0.94	11.7		5519	0.89	10.6	1.91	
" 18	0.91	11.5		5563	0.90	10.2	1.83	
" 20	0.96	12.4		5457	0.94	9.9	1.82	
Aver.	0.93	11.9			0.90	10.3	1.81	
			Methylene Blue, 10 mg. per kilo, intravenously.					
1935			%					%
May 1	0.95	16.1	35		0.96	14.5	2.53	40
" 23	0.93	17.6	48		1.10	14.6	2.65	46
Aver.	0.94	16.9	42		1.03	14.6	2.59	43

* Average of pre- and post-exercise resting metabolism.

† Running on a horizontal treadmill for 15 minutes at about 2.5 km. per hr. The term "work" is used loosely.

‡ Important to note that these excess calories are above the resting "*basal*" level, and not above the resting level of the same experiment.

The results are shown in Table I. In 4 experiments under "basal" conditions, the resting metabolism was 11.9 cal. per hour. When the animal was exercised, there was an "extra" metabolism which averaged 1.81 $\pm$ 0.07 gm. cal. per "horizontal" kilogrammeter of work.

After giving methylene blue, the resting metabolism averaged 16.9 cal. per hour, an increase over the basal of 42%. The extra metabolism due to exercise has been calculated as the excess above the "basal" resting level. As has been indicated in previous com-

munications, this is simply a matter of convenience, to illustrate the point made. Calculated in this way, the energy consumption during exercise in the methylene blue experiments averaged 2.59 gm. cal. per kg. of work, which is 43% higher than the exercise metabolism in the "basal" experiment. In other words there was complete summation of the metabolism of work and that of the calorigenic action of the methylene blue, showing that none of the latter could be used to provide energy for the oxidative phase of muscular exercise—another instance of specificity, that is, the failure to use certain exothermic oxidative reactions, in this process.

In the experiments of Rapport[1] it appeared that the calorigenic action of carbohydrate was abolished during exercise. In the present experiments the calorigenic action of methylene blue was, as shown by the R.Q., predominantly at the expense of the oxidation of carbohydrate, yet this "waste heat" persisted when the animal exercised. It seems to follow that the calorigenic action of the methylene blue is not due to the so-called specific dynamic action of sugar, and also that the latter is not due to "waste" necessarily accompanying its oxidation.

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Structures Developed in Amphibians by Implantation of Living Fish Organizer.

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The study of mutual interactions between developing fish and amphibian tissue was tested by implanting parts of fish blastulæ into the blastocœle of developing amphibians. This method applies also to the study of the capacity for differentiation of isolated embryonic cells of the teleostean. Halves of blastulæ of the eggs of *Danio rerio* (the Zebra fish), isolated from their yolk an hour before the commencement of the visible processes of gastrulation, were implanted into the blastocœle of *Triturus torosus* eggs. The hosts were fixed after 10 days of development.

The developing fish and amphibian cells are mutually compatible during gastrulation and the stages immediately following. Thus

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