fibers; that is, the capillaries do not multiply to accompany the increase in muscle mass.

From this study on human material, which is in accord with the experimental study of Shipley, Shipley and Wearn[4] on normal and hypertrophied rabbit hearts, it is evident that there is an increase in the distance from the center of a given myocardial capillary to the periphery of its region of supply, which is approximately proportional to the degree of cardiac hypertrophy. At the present time the oxygen utilization of normal and hypertrophied hearts is being investigated to determine whether or not the diminished anatomical vascularization of hypertrophied hearts results in a physiological impairment to the exchange of metabolic substances.

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Fat Metabolism of the Isolated Heart.

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It is the conclusion of Cruickshank[1] that the isolated heart derives its energy at least in part from the combustion of fat. This deduction is based on the negative evidence that combustion of other fuels will not account for the total metabolism. According to Visscher and Mulder[2] the total oxygen consumption of the heart-lung preparation cannot be accounted for on the basis of the carbohydrate loss from the tissue and blood in that system. They found that in some cases as much as 80% of the total metabolism is non-carbohydrate, presumably fat. Previous studies on fat burning by striated muscle are conflicting. Palazzolo[3] reported a decrease, while Winfield[4] found no change in the fat content of muscle as a result of activity.

In order to elucidate this question further measurements of the total fat content of the mammalian ventricular muscle were made in two series of cases. For the first series hearts were obtained directly from anesthetized dogs, and for the second ventricular

1 Cruickshank, E. W. H., *Physiol. Rev.*, 1936, **16**, 597.

2 Visscher, Maurice B., and Mulder, Arthur G., *Am. J. Physiol.*, 1930, **94**, 630.

3 Palazzolo, Giovanni, *Archivio di Fisiologia*, 1912-13, **11**, 558.

4 Winfield, G., *J. Physiol.*, 1914-15, **49**, 171.

muscle was taken after periods of work in the heart-lung preparation. The two series were run concurrently and there was no selection of the animals for the two groups. The ventricular muscle was ground and 20 gm. samples taken for extraction and analysis for total fats by the Bloor[5] technique. The heart-lung preparations were made by the usual method and no additions of any material were made to the blood during the course of the experiments.

Analyses were made on 63 hearts, of which 25 were worked for periods of from one to 6 hours, the average time being 3 hours.

TABLE I.
Total Fat Content of Ventricular Muscle (Figures in % of Wet Weight).

Unworked				Worked			
3.64	3.31	4.22		2.58	3.95		
3.27	3.00	4.07		4.66	3.35		
2.37	3.72	3.99		1.91	2.69		
3.31	2.99	2.72		2.32	3.95		
3.24	2.93	1.92		2.63	3.56		
3.19	3.19	4.05		4.07	3.02		
3.17	4.16	2.99		3.00	2.23		
3.32	3.74	3.83		2.96	3.75		
2.89	3.63	3.13		2.76	3.46		
3.33	1.72	2.63		2.59	3.74		
4.10	2.36	3.76		2.82	4.16		
4.21	3.45	5.17		2.84	3.57		
3.74	2.55			2.95			
Mean			3.71	Mean			3.18
Standard Deviation			0.76	Standard Deviation			0.68
Probable Error of Mean			0.083	Probable Error of Mean			0.091
Difference between mean fat contents						0.53	
Probable error of the difference						0.123	

The observed data are shown in Table I. It will be seen that there is great overlapping of values in the two series, as would be expected from the normal variability in fat content. However, the means of the two series differ by 0.53%, while the probable error of this difference is 0.12%. The mean difference is seen to be 4.3 times its probable error and therefore has considerable significance. The absolute difference is 14.4% of the unworked muscle value.

In spite of the fact that the difference observed is statistically quite significant it is still impossible to state categorically that the difference represents fat burned. Unfortunately the heart becomes edematous in time in the heart-lung preparation. An addition of 14.4% of non-lipid containing fluid to the heart muscle would account for the whole change observed. The water content has been determined and this figure does not differ by more than 2% in the worked and unworked hearts. However, this is due partly to the

[5] Bloor, W. R., *J. Biol. Chem.*, 1926, **68**, 33.

fact that hemorrhages occur into the heart muscle, thus increasing its mass by the addition of whole blood or corpuscles. In this case the water content would not be expected to change greatly. Nevertheless if whole blood or corpuscles account for the increase in heart mass the error introduced in the fat analysis is minimized because the total fat content of the corpuscles is high. No way has been found to measure accurately the extent of the error which may be introduced by the occurrence of edema or interstitial hemorrhage. It seems unlikely that these factors could account for the whole difference observed. Even if it were responsible for a half of the observed difference there would remain a substantial probability that fat was also burned. The results are presented as an evidence that fat is utilized by the actively metabolizing heart muscle, recognizing that they do not constitute positive proof because of the possibility that a part of the decline in fat content may be only apparent, due to cardiac edema.

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Digitalis and Coronary Blood Flow.

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Considerable work has been done in an effort to evaluate the effect of digitalis on coronary blood flow. A wide variety of methods have been employed and the results on the whole have been contradictory. Gilbert and Fenn[1] have reviewed the pertinent literature which preceded their report. These workers, after an extensive series of acute experiments in which they studied the effect of a number of preparations of digitalis on the outflow from the coronary sinus of the dog by use of the Morawitz cannula, concluded that digitalis preparations may exert a vasoconstrictor action on the coronary arteries.

The use of the Morawitz cannula requires deep anesthesia, an open thorax and artificial respiration; consequently, the period of observation is necessarily relatively brief. For a number of years

[1] Gilbert, N. C., and Fenn, G. K., *Arch. Int. Med.*, 1932, **50**, 668.