stomach and small intestines were found empty. The examination of the colon was made at greater intervals of time.

Three normal rats were fed the same food over the same time, but the quantity of food per day was 14 gm. per rat which is considered an average normal amount.[3] On the twenty-first day they also were made to fast and abstain from water for 24 hours, when they were given the same mixture as the other rats and examined in a similar manner by means of the x-rays.

In every one of the 3 starving rats a marked hypermotility was observed of the entire gastro-intestinal tract.

TABLE I. *Averages.*

| Food | No. Rats | Wt. gm. 9/9/30 | Wt. gm. 10/1 | Wt. gm. Lost | Ate gm. | Cecum Ap. time | Stom. Emp. Time | Sm. I. Emp. Time | Col. Emp. Time | Rations per day per rat. 9/9 to 10/1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Starving | 3 | 327 | 243 | 84 | 9.6 | 1:27 | 3:29 | 4:32 | 45 h. | 2 gm. |
| Normal | 3 | 240 | 249.2 | 0 | 8.2 | 3:10 | 7:24 | 9:49 | 70 h. | 14 gm. |

Table I represents the results obtained in these experiments. It will be noted that the rats of both series ate nearly the same amount of buttermilk and barium sulphate and that the passage of this substance through the entire gastro-intestinal tract in the starving rats was very much faster than in the control rats.

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### Potassium Content of Human Cardiac Muscle.

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The investigations of Ringer,[1] Howell,[2] and Zwaardemaker[3] and their coworkers offer the strongest evidence that the element potassium is an indispensable factor in cardiac activity. This conclusion is derived from experimental work on hearts of the lower animals, as a rule amphibians. Zwaardemaker alone has endeavored to adapt his findings to human heart function, in that he has

[3] Donaldson, "The Rat".

[1] Ringer, S., *Am. J. Physiol.*, 1884, **5**, 247.

[2] Howell and Duke, W. W., *Am. J. Physiol.*, 1928, **21**, 51.

[3] Zwaardemaker, H., *Arch. f. d. ges. Physiol.*, 1924, **205**, 20.

theoretically estimated the kinetic energy developed by the emanation of the Beta particles of potassium.

Inasmuch as there are few reliable and accurate series of determinations of potassium in cardiac muscle to be found in the literature, Zwaardemaker's estimation must of necessity be approximate. It therefore seemed desirable that a relatively large number of potassium determinations be made using a method the results of which would be as nearly representative as it was possible to obtain them. The one of choice, an adaptation of the old platinum reduction procedure of Neubauer[4] appeared to be the best. A detailed description of the method with the few modifications will appear in the complete article.

Two series of determinations of potassium have been undertaken, the first comprising 25 hearts, which, because of later modifications in the analysis is not to be looked upon as being as representative as the second series of 30 determinations, of which 27 have so far been completed. However, there is considerable variation in the potassium content of the human heart and for the specimens obtained at that time the means of the first series at least may be regarded as approximations.

TABLE I.
Summary of 25 potassium determinations.

| | Weight of heart in gm. | Dry subst. % | K. % | *K.E. in Erg. sec. |
|---|---|---|---|---|
| Mean | 366 | 19.76 | 0.173 | $9.51 \cdot 10^{-7}$ |
| Probable error of mean | ±2.122 | ±0.0253 | ±0.0054 | ±0.3051 |

*Kinetic energy developed by Beta particles of potassium atoms in 1 gm. muscle.

Zwaardemaker's estimate of the kinetic energy developed by the potassium in a human heart of 300 gm. is $4.10 \cdot 10^{-4}$ erg seconds. The above mean K.E. output for a heart of similar mass is only $2.85 \cdot 10^{-4}$ erg seconds.

The second series of potassium determinations, each with 3 or more very close checks, yields a mean content of 0.230% for potassium and a mean K.E. coefficient of $12.65 \cdot 10^{-7}$ erg seconds per gm. heart muscle. This is equivalent to an energy output derived from potassium of $3.79 \cdot 10^{-4}$ erg seconds for a heart having 300 gm. of muscle substance.

It seems probable that the second series when completed will yield results quite closely confirming Zwaardemaker's hypothetical kinetic energy output of potassium in the human adult heart.

[4] Neubauer, H., *Z. f. Analyt. Chem.*, 1900, **39**, 481.