ear was moistened with 1 c.c. of commercial xylol in order to produce irritation and edema.

Two groups of control experiments were carried out. In the first group, each normal rabbit received 10 c.c. of horse serum intraperitoneally and after 30 to 45 minutes the ear was treated with the same kind and amount of xylol. In the second group of controls no horse serum was administered, merely one ear was treated with xylol.

The results were strikingly different and support the working hypothesis. In a great majority of the 36 *controls* edema of a fair to good degree developed in six hours; it was generally less in 24 hours, and after 48 hours had largely disappeared, leaving a practically normal ear. No dermatitis with blisters and crusts was observed; nor were hemorrhages or gangrene seen except once among the controls. In this instance the loss of substance was not more than one half millimeter of the ear tip.

In the *sensitized* series (17 rabbits) the edema of the ear developed more slowly and less frequently than among the controls. The maximum was reached generally in 24 hours, and the subsidence was slow, lasting 5 to 9 days. Within 22 to 48 hours, numerous small hemorrhages, blisters and subsequent crusts appeared. In these rabbits (10 out of 17) the ear after a few days showed the picture of an exfoliative dermatitis. This dermatitis involved 1/3 to 1/2 of both surfaces of the ear, healed slowly as the deeper tissues were affected, and always caused dry gangrene of the ear tip. The loss from gangrene varied from 1 to 3 centimeters. Healing was usually complete in three to four weeks. The ear stump was bald at first, but slowly became covered with a new growth of white hair.

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**The selective effect of the accelerator nerves on ventricular systole.**

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*Object of Investigation.*—Acceleration of the heart in man is chiefly due to a varying balance of control exerted through the

vagi and the accelerator nerves. The only hopeful method of determining which mechanism is at least predominantly concerned is suggested by the observations of Baxt, Pavlow, Frank and Reid Hunt and others[1] that the accelerator nerves exert a predominant effect on the length of systole, whereas the vagi nerves affect chiefly diastole. This, on superficial examination, of course appears contrary to any mechanical conception of the cardiac regulation, such, for example, as the "law of Uniformity of Behavior" advanced by Henderson and his coworkers.[2]

It is quite obvious that, if, as appears from volume curves recorded by many different investigators, the rate of ejection diminishes late in systole, then, on the basis of the uniformity law enunciated by Henderson, the length of systole will be only slightly altered during the longer cycles but will be progressively more and more abbreviated in a mechanical way as the heart cycles become shorter and shorter. Inasmuch as vagus section and vagus stimulation ordinarily do not alter the heart rate beyond the range where slight variations might be expected, whereas accelerator stimulation quickens the beat so that pronounced shortening of systole might be anticipated, the *mere demonstration that accelerator stimulation shortens the systole is proof neither of any specific influence of these nerves over ventricular contraction, nor does it prove that the heart deviates in its beat from a mechanical scheme. Only if it can be shown that the periods of systole during accelerator nerve stimulation vary materially from those which may be accounted for on the basis of volume curves, can any inference be drawn as to a selective action of the accelerator nerves on the ventricle.* Such proof has, however, not been presented by previous investigators, hence a reconsideration of the subject seemed desirable.

*Methods.*—As a criterion of the length of systole, we used the interval elapsing between the first and second heart sounds recorded from animals by the direct method described by Wiggers and Dean.[3] Sounds were recorded consecutively during the

[1] For literature see Hofmann in Nagel's "Handbuch der Physiologie des Menschen," 1905, I, 269.

[2] Henderson, *Amer. Jour. Physiol.*, 1909, XXIII, 351.

[3] Wiggers and Dean, *Amer. Jour. Med. Sciences*, 1917, CLIII, 666; *Amer. Jour. Physiol.*, 1917, XLII, 476 also Wiggers, *Arch. Int. Med.*, 1918, XXII, 28.

following experimental conditions, the general order being varied only to suit particular occasions:

(1) during normal cardiac action under morphine and chloretone anesthesia;
(2) during stimulation of stellate ganglion or accelerator nerves;
(3) following section of both vagi;
(4) during stimulation of stellate ganglion with vagi severed and
(5) during combined stimulation of vagus and accelerator mechanisms.

Using these results, we have found it possible, on the basis of the duration of systole and diastole of a long vagus beat to construct for each animal a theoretical volume curve and to calculate from this the theoretical relations of systole and diastole at all heart cycles in that animal provided the "law of uniformity" applies. With these "theoretical systoles" in different cycle lengths we compared (best in the form of a plot) the actual systole lengths of different cycles during the above mentioned experimental activities.

*Results.*—We find as follows:

1. The lengths of normal systoles agree very closely with those of theoretical systoles.

2. Vagus section, causing cardiac acceleration, decreases the length of systole slightly but in accordance with its theoretical duration.

3. Vagus stimulation, causing only a moderate slowing, increases the length of the actual systole, practically in accordance with the theoretical values at different rates.

4. Accelerator stimulation shortens the length of actual systole far more than that of the corresponding theoretical systole, indicating that *in some way the accelerator nerves are capable of shortening systole more than can be accounted for by the mechanical operation of the law of "Uniformity of Behavior."*

We append a few data of a single experiment typical of many others to support these conclusions.

| Cycle. | Theoretical Systole. | Actual Systole Determined. | |
|---|---|---|---|
| .54..... | .22 | .23 –.24 | Normal controls. |
| .67..... | .23 | .23 –.24 | |
| .34..... | .19 | .135–.14 | Accelerators stimulated. Vagus intact. |
| .50..... | .215 | .155–.16 | |
| .56..... | .22 | .215–.22 | Vagi cut. |
| .59..... | .225 | .22 | |
| .90..... | .235 | .28 | Vagus stimulation. |
| .98..... | .238 | .275 | |
| 1.50..... | .25 | .25 | |
| .28..... | .175 | .125–.135 | Accelerator stimulation, vagi cut. |
| .33..... | .19 | .14 | |
| .63..... | .228 | .20 | Combined vagus and accelerator stimulation. |
| .80..... | .235 | .20 | |
| .83..... | .235 | .205 | |
| .96..... | .238 | .20 | |
| 1.08..... | .24 | .20 | |

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## The influence of anxiety on gastric digestion.

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The study of the influence of emotional strain on digestion in man offers some difficulties due to the fact that the emotions cannot be readily controlled, nor are the subjects of extreme emotion readily amenable to experimentation. We were, however, able to obtain an interesting illustration of the profound effect of mental anxiety on gastric digestion in the case of one of our subjects. The man was a first-year medical student who had previously served as a subject of gastric tests. He was given one hundred grams of fried chicken on the morning of an important examination in chemistry, and was asked to write out his answers during the course of the test. He was plainly worried over the outcome of the examination and of his year's work. The resultant effect upon gastric digestion in prolonging evacuation for over two hours with high intra-gastric acidity is charted in the figure. The