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Action of Vagus Nerves and Acethylcholin on the Chronaxie of the Tortoise Heart.

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Introduction.

In my preceeding paper, it was observed, contrary to the results obtained by the former investigators, that the vagus stimulation had no influence on the excitatory conductivity of ventricular muscle of the tortoise. Therefore, it should be a matter of interest to measure the chronaxie of the heart muscle when it is under the influence of vagus stimulation or of acethylcholin, and the following experiment was performed.

According to the results of investigations by *Fredrique*[1], *Lapicque* and *Veil*[2], *Field* and *Bruecke*[3], *Rylant*[4], *Garrey* and *Fredrique*[5], *Fredrique* and *Brouha*[6], *Aschman* and *Garrey*[7], the vagus stimulation causes the value of chronaxie of the heart muscle to decrease.

Experimental.

After destroying the brain and spinal cord of the tortoise and removing the plastron, the vagus nerve was dissected out in the neck along with the carotid arteries, and the heart exposed. In all cases, the ventricular and auricular systoles, were recorded by the suspension method. The chronaxie of the beating auricles and ventricles was determined during the period of normal diastole, and also that while a stimulation was given to the vagus nerve by applying some drops of acethylcholin (1/1000) to the heart.

The measure of the chronaxie was made by the usual method of stimulating by closing the circuit of a constant current and opening it

at a desired interval. The excitation circuit consisted of 1) a 20 volt electric source; 2) a reductor; 3) *Azuma*'s pendulum; 4) a resistance of 7000 ohms introduced in the series and 5) stimulating electrodes. The stimulating electrodes were small silver hooks one of which was attached to the apex of the heart while the other active electrode (the negative pole) was placed on the desired point of the heart. To stimulate the vagus nerve, the platinum electrodes were used, and these were connected to the secondary coil of an inductorium.

Thus the measurement of chronaxie was made with usual precautions, such as 1) measurement of the rheobasic voltage; 2) measurement of chronaxie with double the rheobasic voltage and 3) a check measurement of the rheobase.

The results of the experiments are given in the following tables and figures.

Results.

Table 1. Vagus stimulation.

	Auricle				Ventricle			
	Normal		Vagus stimul.		Normal		Vagus stimul.	
	R. volt	σ	R. volt	σ	R. volt	σ	R. volt	σ
I	1.4	7.0	1.8	7.0	2.2	7.5	2.0	7.5
II	2.7	8.5	2.0	9.5	2.3	7.5	2.3	6.5
III	2.4	6.0	1.4	6.5	3.0	6.0	2.7	6.0
IV	2.0	6.0	1.4	6.0	3.0	8.0	2.7	8.0
V	1.8	8.0	1.6	6.5	3.0	7.0	2.7	7.5
VI	4.0	8.5	3.5	8.5	2.8	7.5	2.8	7.5
VII	4.2	8.0	4.5	8.0	2.7	8.0	2.6	9.0
VIII	1.8	7.0	1.4	7.5	2.9	7.5	2.8	9.0
IX	1.8	8.0	1.5	8.5	2.9	8.5	2.6	8.5
X	1.5	8.0	1.4	8.0	2.7	8.0	2.7	7.5
XI	1.6	7.5	1.5	8.0	4.0	7.0	3.8	7.5
XII	1.5	8.0	1.4	7.5	5.0	6.5	4.5	8.0
XIII	1.7	8.0	1.7	7.0	4.0	7.0	3.7	7.0
XIV	1.6	7.5	1.5	7.5	3.2	7.5	3.0	7.5
XV	1.6	8.0	1.5	8.0	2.8	8.5	2.8	8.0
	2.1	7.6	1.9	7.6	3.1	7.5	2.9	7.6

Table 2. Application of acethylcholin.

	Auricle				Ventricle			
	Normal		Acethylcholin		Normal		Acethylcholin	
	R. volt	σ	R. volt	σ	R. volt	σ	R. volt	σ
I	1.6	7.0	1.2	7.5	1.3	7.5	1.5	7.5
II	0.8	8.0	0.8	8.0	1.2	7.0	1.6	7.0
III	0.8	7.5	0.8	7.5	1.9	7.5	2.3	7.0
IV	0.6	7.0	0.9	7.0	1.8	7.5	1.5	7.5
V	0.5	8.5	0.8	7.5	1.8	8.0	1.4	8.0
VI	1.4	7.0	1.1	7.0	1.7	8.0	1.4	7.5
VII	1.3	7.0	0.6	7.0	1.8	7.5	1.4	7.5
VIII	0.6	7.5	0.6	6.0	1.6	6.5	1.3	6.5
IX	0.8	7.0	0.7	6.5	2.2	8.5	1.9	8.0
X	0.7	6.5	0.7	8.5	2.0	7.0	1.7	7.0
XI	1.2	6.5	0.8	7.0	2.0	7.0	1.7	7.0
XII	0.7	7.0	0.7	7.0	2.0	8.5	1.7	8.5
XIII	1.3	7.5	0.6	7.5	2.0	7.5	1.5	8.0
XIV	1.0	6.5	0.6	6.5	1.8	7.5	1.5	7.5
XV	0.7	7.0	0.6	7.0	1.8	8.0	1.4	7.5
	0.93	7.8	0.76	7.8	1.79	7.5	1.59	7.4

Fig. 1.
Tracing of the ventricle.

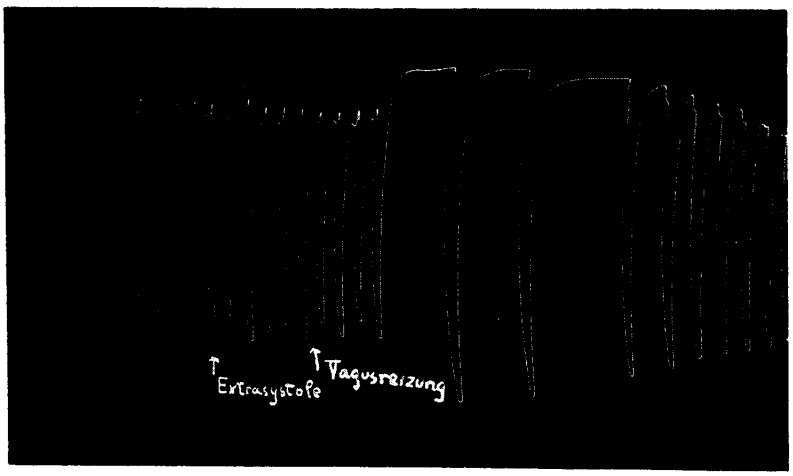
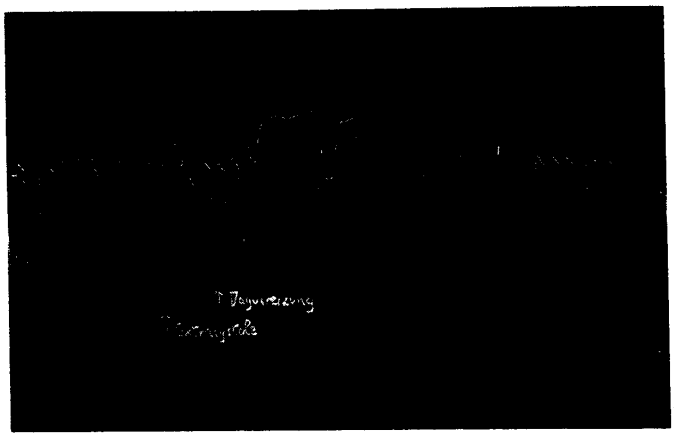


Fig. 2.
Tracing of the auricle.



Discussions.

Referring to the results above obtained, it is noted that, either by the vagus stimulation or by the application of acethylcholin, generally known as "Vagusstoff", the rheobase of auricle as well as of ventricle is reduced, but not the chronaxie. In this regard, the results obtained by the present author differs from those of the former investigators, and it leads us to suppose that it has some relations with the fact established in my previous communication, namely that vagus stimulation has no influence on the conductivity of heart muscle.

Generally speaking, the conduction of excitatory state occurs as follows: Firstly the given stimulus evokes an excitatory state at the point where it is applied. Then this evoked excitatory state acts as a stimulus to the adjacent point which in turn, being itself excited, becomes another stimulus, and so on, thus the state being propagated. Therefore. it is not difficult to suppose that where there is no change of the conductivity there is no change of the value of chronaxie. According to *Lapicpue*[8] and *Gasser*[9], there are some definite relations between the rate of conduction or the time of muscular contraction and the chronaxie, i.e. the faster the former, the smaller becomes the latter. This fact may fairly coincide with my result in that the chronaxie does not alter in the case of the tortoise heart by vagus stimulation and which is considered to be true.

Conclusion.

From the result obtained, the following conclusion is reached:

The value of chronaxie of the tortoise heart (auricle and ventricle) is not altered by vagus stimulation or by the application of acethylcholin.

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References.

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