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Observations on Auricular and Ventricular Fibrillation.*

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Of the several theories which have been advanced to explain auricular and ventricular fibrillation 2 have been very widely accepted. One, advocated by Rothberger¹ and Scherf,² is that fibrillation is due to one or several foci sending out impulses at a very rapid rate, resulting in tachysystole which is manifested as fibrillation. The other theory, advanced chiefly by T. Lewis³ and his coworkers, states that in auricular flutter and fibrillation a single mother wave circulates usually about the orifices of the superior and inferior vena cavae and sends off centrifugal waves into the remainder of the auricular tissue. Lewis and Garrey⁴ suggest that auricular and ventricular fibrillation are the same and Lewis assumes that the mechanism in ventricular fibrillation is the same as was shown by him to be the cause of auricular fibrillation.

A series of experiments was performed by us to test the validity of the assumption that ventricular fibrillation is caused either by a single focus or a single mother wave as stated above. Twelve dogs were used, under morphine and sodium barbital anesthesia, and artificial respiration was maintained with the open chest. The heart was exposed and permitted to remain in a cradle made from the pericardium. Two direct non-polarizable leads were fixed to the left ventricle and 2 to the right. These were connected with an electrocardiograph. Ventricular fibrillation was induced by temporary faradic stimulation at the base of the right ventricle.

As soon as the rate of spontaneous fibrillation became somewhat stabilized a control tracing was made from the right and left ventricles, both of which were visibly fibrillating. The 2 ventricles were then quickly and completely severed from each other, care

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¹ Rothberger, C. J., *Klin. Wchnschr.*, 1922, **1**, 82; 1923, **2**, 1407.

² Scherf, D., *Z. f. d. ges. Exp. Med.*, 1928, **61**, 30.

³ Lewis, T., *Mechanism and Graphic Registration of Heart Beat*, 1925, 2nd Edition, Chap. 31.

⁴ Garrey, W. E., *Physiol. Rev.*, 1924, **4**, 215.

being taken not to displace them, and the records taken quickly again.

Separation of the 2 ventricles from each other should result in disappearance of fibrillation in one ventricle if the causative ectopic focus or mother ring were in the other ventricle. In any event the electrocardiogram after separation should be grossly changed. Such was not the case, except for slight slowing which could also be demonstrated in the intact fibrillating heart and was parallel in the 2 sides.

Another series of experiments was performed to test these theories in auricular fibrillation, using the same technique as in the ventricular records. Auricular fibrillation or flutter was induced by temporary faradic stimulation of the right auricle near the inferior vena cava. After the fibrillation persisted spontaneously for at least 30 seconds control records were made from the leads of each auricle. A heavy 10-inch clamp was then tightly placed along the inter-auricular septum up to the ventricles, crushing the tissue. Electrocardiograms were then taken from the leads of the right and left auricles. In the 2 experiments to date in which this was done, fibrillation persisted in the same form in both auricles, after crushing the tissue between them. These experiments cannot be explained by a single focus or single mother wave.

The results of our experiments are incompatible with the assumption of Lewis that a single mother circus wave with centrifugal off-shoots is responsible for auricular or ventricular fibrillation. The same is true of the theory which supposes that a single focus sends out rapid impulses causing coordinated but very rapid contractions. Our results are not incompatible with the assumption that auricular and ventricular fibrillation may be due to numerous ectopic foci acting at the same time. The results of our experiments are also compatible with the theory of Garrey who assumes that an impulse becomes sinuous because of areas of transient block and that the impulse eventually gives rise to multiple, shuttling circuits which cause fibrillation.