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Evidence Against the "Latency Theory" of Partial A-V Block.

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There are two fundamentally opposing explanations of the characteristic groupings of beats separated by a pause when occasionally the ventricle fails to follow the auricle in low grade heart block (Wenckebach's periods). The "latency theory", Mobitz,[1] holds that the velocity of conduction through the muscular elements is invariable with constant auricular rate, and that the gradual prolongation of A-V interval following the pause in partial block is due to the arrival of the sinus impulse at the A-V junction at progressively earlier times during the recovery in the excitability on the ventricular side of the junction. Thus the impulse is regarded as arriving at the junction, pausing a moment, and then going forward. The duration of the pause is supposed to depend upon the excitability of the tissue immediately beyond the boundary plane.

That such a conception is inadequate is regarded as certain by some, and yet it is difficult to secure direct evidence against it.

The first evidence herein outlined is obtained from excised turtle hearts, rendered quiescent by removal of the sinus and driven at varying rates by break induction shocks applied to an auricle. In one experiment, after a 10 second rest, the auricle was twice stimulated, the interval between auricular responses measuring 3.026 seconds. The first A-V conduction time was 0.526 second; the second, 0.538. A 3 second rest was, therefore, almost sufficient for complete recovery of conductivity. In a second test after a 10 second rest the interval between the 2 transmitted auricular impulses was again practically 3 seconds, but an auricular response which was not transmitted to the ventricle was interpolated between the two, 1.156 second before the following transmitted auricular response. Although the ventricle did not respond to the interpolated impulse, the conduction time for the next impulse increased from the expected 0.540 second to 0.652 second. In a third test the interpolated response was elicited slightly later after the first, and was now transmitted to the ventricle in 0.614 second. The third auricular impulse, again 1.156 second later, reached the ventricle in 0.676 second.

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[1] Mobitz, W., *Z. f. Klin. Med.*, 1928, cvii, 449.

In the second test the *blocked* impulse had almost as great an effect upon the conduction time of the following impulse as did the *transmitted* impulse in the third test, although in the second test the ventricle was allowed a much greater time to recover from its refractory state. Obviously, under the conditions of this experiment, ventricular "latency" can play little or no part in prolonging the conduction time. This experiment is typical of the results in a considerable series of hearts.

The prolongation of conduction time observed in certain human cases of heart block is, as Mobitz recognized, much too long to be readily explained by a latency in the ordinary physiological sense. To surmount this difficulty he suggested that the "latency" in partial block is more complex, mediated in some fashion by the nerve cells concentrated at the A-V boundary; and he asserts that where such nerve elements are lacking, as in a ventricular strip, Wenckebach's periods are not obtainable.

However, it is possible to obtain true Wenckebach's periods by producing a region of block of the bridge type in transverse ventricular strips and by stimulating at the proper rate. In one such experiment the conduction intervals in seconds between the responses of the 2 ends of the strip, given in chronological sequence, were 0.29, 0.33, 0.39, blocked, 0.316, 0.40, 0.446, blocked. Mobitz's idea of the function of the nervous elements thus becomes gratuitous.

Examination of over 4000 human electrocardiograms has failed to reveal any cases not explicable on the basis of the more generally held conception, namely, that the variations in P-R intervals, either in partial A-V block or in other conditions, is due to a variation in the time of conduction from element to element of the conducting system, and not to a single exaggerated pause at one boundary.