CHAPTER I

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Investigations on the cardiac conducting structures of vertebrates have always been a subject of great interest. The basic function of the heart is to initiate and propagate the stimulus of contraction. Despite the great importance of the subject and numerous researches, many aspects of this problem are not properly understood.

In the hearts of birds and mammals, investigators have reported specialized muscular elements and attributed them the function of impulse-initiation and conduction. However, several workers have denied the existence of any form of specialized conducting muscles in any portion of the vertebrate heart. Davies and Francis (1941, 1946); Davies et al. (1952) have alleged that impulse initiating and conducting structures of birds and mammals are neomorphic in origin. Mackenzie (1913), Keith and Mackenzie (1910) and Lewis (1916, 1921) reported that specialized muscles of birds and mammals are mere remnants of the tissue of a similar nature found in lower vertebrates. Mackenzie and Robertson (1910) denied the existence of sinuatrial and atrioventricular nodes in birds. In recent years Prakash (1953a, 1954a, c, 1956a); Bhatnagar (1957) and others on the basis of detailed investigations concluded that the specialized
conducting (connecting) muscles in the hearts of higher vertebrates are a product of evolutionary changes which manifest from lower to higher vertebrates. Glomset (1941), Glomset and Birge (1945), Glomset and Cross (1952) and their other associates in numerous publications criticized the concept of specialized cardiac conducting muscles and considered them as irrelevant and immaterial. Surprisingly these workers regarded some of the conducting muscles as mere leisons of the heart. It appears rather inconvincing that identical specialized muscles should have been observed in a number of birds and mammals, and in all cases should be called leisons.

A complex neurogenic system has been reported by several workers (Glomset and Glomset, 1940; Glomset and Birge, 1945; Glomset and Cross, 1952; Yousuf, 1965; Abraham, 1969) in association with the heart of birds and mammals. The nerve elements exhibit structural modifications in different portions of the heart and also along with the specialized muscles. The intrinsic cardiac nerves are both sympathetic and parasympathetic in nature. There is a controversy whether or not the specialized cardiac conducting muscles are supplied with nerves. Truex and Copenhaver (1947), Davies, Francis and King (1952) and Halpern (1955) established nerve fibres in the specialized muscles. However, contrary to these observations, Baird and Robb (1950)
and some other workers noted the absence of nerve fibres from the atrioventricular node and atrioventricular bundle. Cohn and Trendelenburg (1910) and Field (1951) have pointed out the difficulties in assessing the functional importance of the conducting tissue; because direct physiological experiments interfere with the nerve trunks as well as with the differentiated muscle bundles. De Witt (1909) held that the cardiac conduction is neither purely myogenic nor neurogenic but is due to neuromuscular complex. It is obvious that there is a need to examine the relationship between the conducting structure and nerve elements of the heart.

It becomes evident from the foregone account that there are many controversies on the subject of cardiac conduction, which need further investigation. Rossi (1955) suggested that the proper procedure for the studies concerning this question would be a combined examination of both the neurogenic and myogenic structures of the heart. In the present studies an attempt has been made to resolve some of the controversies by examining both the nerves and muscles of the heart simultaneously.

Isolated investigations have numerous limitations and often create rather than solve problems.
This appears to be true, particularly with regard to cardiac conducting structures of birds and mammals. In the present investigation an attempt has been made to study this problem from all aspects.