THE ATRIOVENTRICULAR BUNDLE IN THE HEART OF THE BANDED KRAIT, *BUNGARUS FASCIATUS* *

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INTRODUCTION

His (1893) discovered and described a muscular bundle connecting the atrial and ventricular septa in the adult mouse, new-born dog, and new-born and adult man. Keith and Flack (1906), Kistin (1949) and Prakash (1954*a*) have pointed out that the bundle of His is the only tissue to connect the atria and the ventricles of the heart of mammals. Kent (1893) studied the heart of a large number of mammals but could not find any specific bundle to connect the atria and the ventricles. He stated that in mammals like all other vertebrates multiple muscular connexions exist to transmit the atrial wave of contraction to the ventricles. Davies (1930) believes that, correlated with the rapid rate of heart beat, birds possess the bundle of His as well as the multiple muscular connexions of Kent for a quick transmission of the cardiac stimulus of contraction from atria to ventricles. Prakash (1954*d*) holds the view that, if any atrioventricular connexion in addition to the bundle of His would be present in mammals, premature excitation of the ventricle would occur giving rise to Wolff-Parkinson-White syndrome.

Regarding the phylogeny of the conducting system of the heart of vertebrates, Davies (1930) believed that the atrioventricular conducting tissue of the bird's heart presents an arrangement which is intermediate in nature between that of fish and reptile on one hand and that of mammal on the other. However, Davies, Francis and King (1952) were unable to find any specialized tissue in the crocodilian heart and therefore they believe that the impulse initiating and conducting tissue of the heart of birds and mammals is neomorphic in nature. Prakash (1953, 1954*a*, *b*, *c*, *d*) upholds the view that the specialized conducting system of the heart of birds and mammals is not a neomorphic development but is a further specialization of a similar system which is present in the heart of lower vertebrates.

Having observed special impulse initiating and conducting structures in the heart of fishes and amphibians (Prakash, 1953, 1954*b*, *c*), the object of the present study was to find out if the reptilian heart also possessed these structures or not. With this aim in view, in the present investigation the heart of the banded krait, *Bungarus fasciatus*, has been chosen and studied with special reference to its atrioventricular connecting tissue.

MATERIAL AND METHODS

About a dozen eggs of *B. fasciatus* were collected from the area adjoining the small lake of Bhopal. After breaking the mature eggs, young ones of kraits were removed and dissected to take out the hearts in beating condition. The hearts

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were immediately fixed in Bouin's picroformol. As usual serial sections, six micra thick, were cut off paraffin embedded blocks, and stained in acid fuchsin.

Observation

The two atria almost of equal size communicate with a single ventricle. A spherical body composed of fine narrow interlaced muscle fibres has been observed in the serial sections of the heart at the atrioventricular junction (Figs. 1, 2). This body lies as an isolated bundle and is quite distinct from the tissue present all round it. The cells of the bundle, as well as the fine narrow muscle fibres which form these cells, take a deep stain indicating the specialized nature of the bundle. A definite shape has been assumed by this bundle, because of the presence of a compact layer of fibres all round it (Fig. 3). An examination of the sections passing through this bundle, under Reichert's Fibroscope, has revealed that the fibres from the left atrium enter into the cranial portion of the bundle, while the ventricular fibres are continuous with the muscle component present in the caudal part of the bundle. The fibres of the bundle resemble on one hand those of the atria and on the other those of the ventricle. The structure and disposition of the bundle, and the fact that the atria and the ventricle are connected with each other only through this bundle, warrant its identification as the atrioventricular bundle.

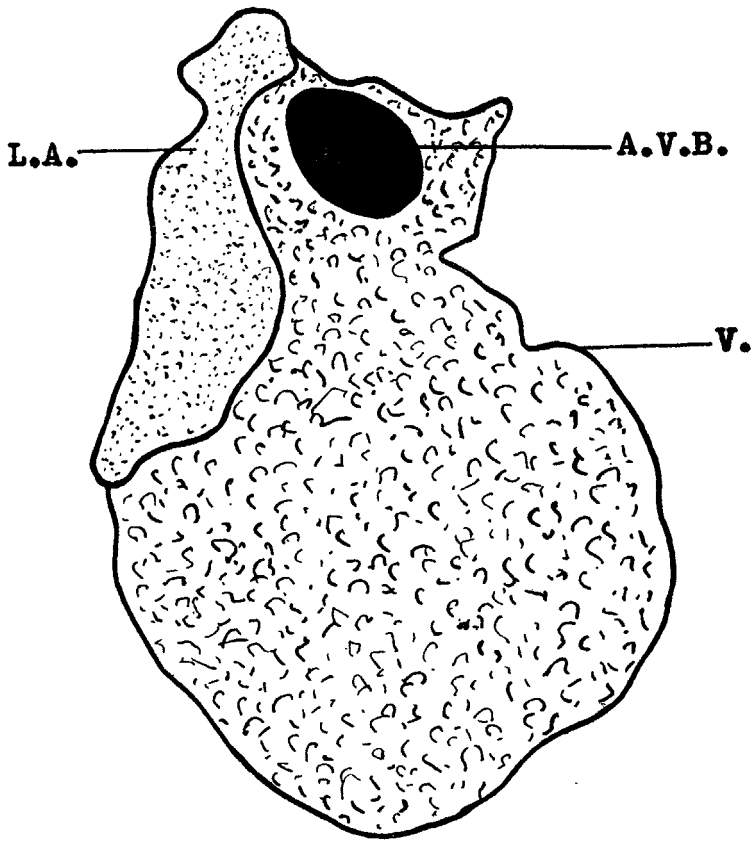

Fig. 1. Diagram to show the position of the atrioventricular bundle in *Bungarus fasciatus*. ×500.

FIG. 3. Photomicrograph of a section passing through the atrioventricular bundle of *Bungarus fasciatus*. ×500.

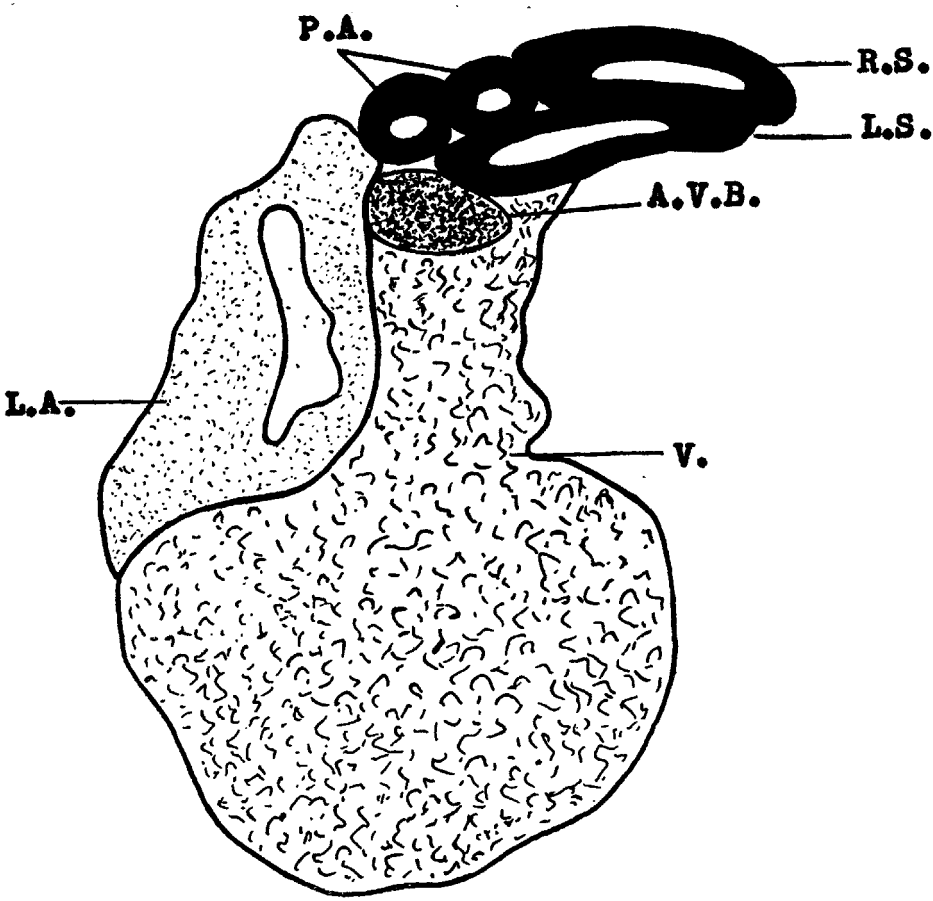

FIG. 2. Diagram to show the atrioventricular bundle at the junction of the left atrium and the ventricle of *Bungarus fasciatus*. ×500.

A continuity between the atrial and ventricular muscular fibres through the muscle component of the atrioventricular bundle, and the fact that this bundle is the only tissue to connect atria and ventricle show that the muscle tissue forms an integral part of the impulse conducting system of the heart of the kraits.

DISCUSSION

In the heart of the banded krait, *B. fasciatus*, an atrioventricular bundle, resembling the atrioventricular plug of fishes and amphibians (Prakash, 1953, 1954c) and the bundle of His of birds and mammals, is also present. It connects the left atrium with the ventricle for the propagation of the cardiac rhythm of contraction. There is, therefore, no other connexion between the atria and the ventricles than that through the atrioventricular bundle which passes on the atrial stimulus of contraction to the ventricle. As this bundle is formed of special muscle fibres, it is to be inferred that the impulse conduction is carried out by the muscle tissue. The myogenic theory of cardiac conduction, therefore, holds good also in reptiles as in other vertebrates (Prakash, 1954; Davies and Francis, 1946).

Robb (1953) observed 'Purkinje-like' specialized tissue in the heart of the turtle, *Pseudonyms elegans*. Mori (1955), in his paper on the atrioventricular system of the crocodile heart, stated that, 'the connecting system in the interventricular septum in crocodile heart is the precursor of the principal connecting system of bird and the conducting system of mammalia'. Prakash (1953, 1954*c*) has also observed that an atrioventricular plug which is a bundle of closely woven fibres is present in the heart of the fish, *Heteropneustes fossilis*, and in the tadpoles of the frog, *Rana tigrina*, to transmit the contraction impulse from the atria to the ventricle. The present study reveals that in the heart of *B. fasciatus* a similar atrioventricular bundle is also present to conduct the stimulus of contraction from the atria to the ventricle. From the above it is concluded that the plug of fishes and amphibians and the atrioventricular bundle of reptiles resemble in structure, and presumably in function also, the atrioventricular bundle of birds and mammals.

Summary

In the heart of the banded krait, *Bungarus fasciatus*, an atrioventricular bundle is present to conduct the stimulus of contraction from the atria to the ventricle. Furthermore, it is observed that the atrioventricular bundle of the heart of krait resembles in structure and presumably in function also the atrioventricular plug of the heart of fishes and amphibians and the bundle of His of the heart of birds and mammals.

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Abbreviations

A.V.B.—Atrioventricular bundle; *L.A.*—Left atrium; *L.S.*—Left systemic arch; *P.A.*—Pulmonary artery; *R.S.*—Right systemic arch; *V.*—Ventricle; *V.S.*—Ventricular septum.

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