

# MORPHOLOGY AND PATHOMORPHOLOGY

## A CYTOPHYSIOLOGICAL FEATURE OF THE CONDUCTING SYSTEM OF THE HEART

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Many investigators identify the conducting system with embryonic tissue, considering it as a vestige of the tissue of the embryonic heart which has not undergone subsequent differentiation. The specificity of the conducting system related to its special function gives reason to suspect the existence of metabolic processes distinct from those proceeding in the myocardium. Both these hypotheses may be tested by means of the leucobase method proposed by G. I. Roskin and M. E. Struve [1].

### EXPERIMENTAL METHOD

Sections were prepared from the auricles and ventricles of adult mice, rats, rabbits, pigs, and oxen, and also the bundle of His of the hearts of the pig and ox. As embryonic tissue we took hearts from embryos of mice, rats, and rabbits. The method of staining with the leucobase of methylene blue (GLM-reaction) has been described previously [1].

### EXPERIMENTAL RESULTS

Nuclei of atrial or ventricular muscle fibers of all species examined were stained an intense blue and were always very sharply outlined. The cytoplasm acquired a pale blue color but in some cases remained colorless. With counter staining with acid fuchsin the cytoplasm was stained pink.

The nuclei of the conducting system stained pale blue, and their outlines were not distinct. The cytoplasm was always stained blue or pale blue. After it had been stained with acid fuchsin the cytoplasm was colored blue-violet. The nuclei and the cytoplasm of embryo hearts were not stained.

G. I. Roskin and M. E. Struve [2, 4] showed that nuclei of cells of embryonic tissue are unable to oxidize the leucobase of methylene blue to transform it into the colored form. Our observations agree with his findings; embryonic cardiac tissue remains unstained.

Having applied the present method to the staining of the conducting system of the heart we showed that the nuclei and cytoplasm of the conducting system are stained by the leucobase. Consequently on this count the conducting system differs from embryonic tissues. But if we take account of the intensity of the staining of the nuclei and still more of the cytoplasm of the conducting system and of cardiac muscle it can be seen that there is evidence of an accumulation of enzymes in the conducting system which differs from that of the ordinary musculature of the heart.

It has been shown that the enzymes peroxidase, phosphatase [4], succindehydrase [3] do not influence the GLM-reaction.

It is highly probable that the enzymes participating in the oxidation of the leucobase are dehydrogenases. Thus, Rie and Gersch [5] have proposed leucomethylenedehydrogenase as a name for the factor causing coloration of the leucobase. According to Schiebler [6] the enzymatic composition of the Purkinje fibers differs markedly from

that of the normal cardiac musculature. In the conducting system lactic, malic, and alcohol dehydrogenases preponderate. The first two enzymes are associated with anaerobic glycolysis, which, in all findings distinguishes the conducting system from the working heart muscle. These enzymes are distributed in the cytoplasm, and it is quite likely that they are responsible to some extent for oxidation of the leucobase of methylene blue.

#### SUMMARY

Marked differences between the conducting system of an adult heart and embryonic tissues were demonstrated by staining the nuclei with methylene blue leucobase. The nuclei and the cytoplasm of the conducting system differed in their staining reactions from those of the myocardium, thus demonstrating a difference in the enzymes contained.

#### LITERATURE CITED

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4. G. I. Roskin and M. E. Struve, *Scientific Reports of the Higher School* (1953), No. 3, p. 35.
5. M. Gersch (Ed.) *Rie's Biologie der Zelle*, Leipzig (1953).
6. T. H. Schiebler, *Naturwissenschaften* (1961), Bd. 48, S. 502.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.

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