3) The Shift Rate Map of the Surface-Recorded QRS-Complex of the Rat. Chie Kitagawa*, Atsushi Chiba*, Shiko Chichibu*, Hiroyuki Ito** and Kozo Okamoto**. *Department of Physiology, **Department of Pathology, Kinki University School of Medicine, Osaka-fu, 589.

Introduction: Cardiac dysfunction in SHR frequently comes from an abnormal increase in the cardiac output. There are several reports on the ECG of SHR, but it is still insufficient to understand the propagation of excitations in the heart of the normal rat. The processing of the isopotential contours to reveal the direction and magnitude of the cardiac electromotive force(emf) is needed. In this report, the shift rate map was introduced in order to estimate the distribution of swiftness of the cardiac dipole direction movement.

Methods: The animals used were 10 Wistar STs, 5 Wistar SDs and 5 WKYs. They were anesthetized with i.p. urethan- α -chloralose at the dose of 0.5 g/kg and 40 mg/kg, respectively. The horizontal line passing at the cranial edge of the sternum was regarded as the standard and named "0-level". Downward from this line, D1-, D2- and D3-level and so on, were decided at an interval of 1cm. In the same way, the mid-sagittal line was regarded as the original, and both directions towards right and left from this, R1, R2, and L1, L2, were drawn. The ECGs were recorded at the grid points of these lines with a small alligator clip electrode. The isopotential contour map was made by the potential value at interval of 2ms on the ECGs in each point. Afterwards, these isopotential contours were differentiated and the shift rate map was obtained. The dipole shift rate is the index to the wax-and-wane of the spreading current.

Results: On D2-level, the QRS-complex at the mid-sagittal line showed the largest amplitude. The size of R-spike recorded on the dorsal surface was relatively small. The tendency of the potential shape on levels D1-D4 of the ventral surface was similar. Both on D2- and D3-levels, the QRS waveforms showed the largest amplitude. Since the beginning of the excitation of the ventricle, the positive pole of the QRS-complex potential increased its positivity upto +800mV. The size of the negative pole suddenly became appropriate to that of the positive pole. Then the dipole made one rotation anticlockwise with sudden reduction of its intensity on the ventral thorax. On the left half of the thorax, the positive pole moved from the caudal part at the beginning, toward the cranial direction with the increase of its intensity, and then to the dorsal-ward direction. When the movement of the dipole mentioned above was projected on the shift rate map, the picture of the current density changes became simple owing to the reduction of contour lines and it showed the dipole movement in a clearer pattern.

Discussion: The cardiac isopotential map is affected erroneously by the posture of the animal and the movement of the heart owing to the incomplete fixation of the cardiac basis in the rat. Averaging process of a succession of the ECG record yielded a rather constant regular waveform. The relatively smaller amplitude of QRSs on the dorsum would be come from its longer spatial distance from the origin of the emf in the heart. The electrophysiological position of the ventricle determined by the amplitude and the shape of the QRS-complex was locating close to the mid-sagittal line than that expected from the anatomical location. This would be come from that the apex of the rat heart is functionally floating toward the mid-sagittal direction due to the incomplete development of the pericardium around the ventricle. The maximum amplitude changes at the horizontal levels(D2-D3) will show that these are corresponding to the averaged localization of the ventricle. The map illustrated by the shift rate shows the rate of potential change on the body surface at a certain time. The expression of the dipole movement by the shift rate was clearer than that by the potential contour map. This procedure yielded enhanced picture of the current density changes due to the excitation of the ventricle, and would help to estimate the direction and magnitude of the cardiac emf.