It is proposed that several amines in the central nervous system have been acknowledged to regulate blood pressure. Furthermore, it is well known that monoamine oxidase (MAO) plays an important role in the metabolism of monoamines such as noradrenaline, adrenaline, dopamine and serotonin. In this study, the relationship between the onset of hypertension and changes in MAO activity in the brain and heart of SHR were studied and in addition, the effects of propranolol on the hemodynamics and MAO activity were investigated.

Male normotensive rats of the Wistar Kyoto (WKY) strain and spontaneously hypertensive rats (SHR) were used. Four-weeks-old (80-90 g) WKY and SHR were divided into three groups: a WKY control group, a SHR control group and a SHR propranolol-treated group (SHR-P group). The SHR-P group was given propranolol, 10 mg/kg/day by gavage. Treatment was started at 5 weeks of age and continued up to 15 weeks of age. Heart rate and blood pressure were determined weekly prior to drug administration using the rat tail method. The brain, heart, liver and kidney were removed for MAO preparation every two weeks after drug administration. Five rats from each group were sacriﬁced by decapitation, and the organs were promptly removed and then chilled. The brains were dissected into four regions: the cerebrum, the brain stem, the medulla oblongata and pons and the cerebellum. The tissues were weighed and homogenates were prepared in 10 volumes of 0.01 M phosphate buffer (pH 7.4). MAO activity was determined by the radiometric assay using $^{14}$C-5-hydroxytryptamine (5-HT) and $^{14}$C-tyramine as substrates.

After 7-weeks-old, blood pressure of SHR increased rapidly and reached a level of 170 to 180 mmHg. However, following 4 weeks of propranolol treatment, blood pressure decreased signiﬁcantly compared to that of untreated SHR. Heart/body weight ratio of SHR was higher than that of WKY. MAO activities in the brain stem, the medulla oblongata and pons of the SHR were signiﬁcantly higher than those in WKY at 7 weeks of age, and MAO activity in the brain stem of the propranolol-treated SHR was signiﬁcantly lower than that in the untreated SHR. Propranolol inhibited MAO activity in brain tissue in vitro, and the $K_m$ values of propranolol were identical (0.1 mM) in SHR and WKY. In both the WKY strain and the SHR, the $V_{max}$ values of heart MAO increased with age, and the $V_{max}$ values of SHR were twice those of WKY. $K_m$ values for tyramine of heart MAO in WKY and SHR were approximately 100 and 140 $\mu$M, respectively; however, these values were not age-dependent.

Hypertension in SHR is considered to result from an increase in peripheral resistance in vessels, and hyperactivity in the peripheral sympathetic nervous system was found at an early stage of hypertension. Propranolol has been used as an antihypertensive drug, but the exact mechanism of this drug is still unknown. In this study, propranolol prevented an increase in the blood pressure of SHR after 4 weeks of treatment. These results suggest that propranolol can reduce the rise in blood pressure if the treatment is begun at an early stage of hypertension. We have found increase in brain stem MAO activity in SHR at 7 weeks of age, which corresponded to the stage at which there was a rapid increase in blood pressure. This increase in MAO activity may cause a decrease in the noradrenaline content of the brain stem. The inhibition of the brain stem MAO activity in SHR by propranolol suggests that a reduction in noradrenaline levels may be restored and that this restoration in noradrenaline level may reduce peripheral sympathetic activity. MAO activity of rat heart is known to increase with age. The mechanism of this increase is not clear, but this increase in MAO activity was found to increase in its $V_{max}$ value. The $K_m$ values of heart MAO did not change with age, and the $K_m$ value in SHR was higher than that in WKY. These results suggest that the increase in MAO activity in the heart of SHR may be of genetic origin.