INTRODUCTION  Over the past decade there have been frequent reports (e.g. Wilkie and Eisdorfer, Science, 172, 1971) that essential hypertension is associated with significant changes in cognitive and intellectual capacity. However, the precise nature of these deficits, as well as an understanding of the mechanisms which underlie them, have been difficult to determine in a clinical population. With the establishment of spontaneously hypertensive rats (SHR) and stroke-prone SHR (SHRSP), great progress has been made in understanding the anatomical, biochemical and physiological alterations which accompany hypertension and stroke (Yamori and Horie, Stroke, 8, 1977; Horie, Jpn. Circ. J., 41, 1977). The purpose of the present study was to attempt to determine whether this animal model could be equally useful for the investigation of long-term behavioral changes associated with hypertensive disorder.

MATERIALS AND METHODS  The data were obtained from male WKY and SHRSP rats which were maintained at NIH and the Japan Stroke Prevention Center. They were approximately 6 months old at the time of testing. Ten WKY and 10 SHRSP were used for the experiment on behavioral characteristics. Animals were tested using a fully automated discrimination apparatus which has been previously described (Rothblat and Schwartz, Brain Research, 158, 1978; Schwartz and Rothblat, Experimental Neurology, 68, 1980). One end of the darkened chamber (45 x 20 x 20 cm) had two recessed milk glass panels (6 x 6 cm) onto which the stimuli were back-projected by a Kodak Carousel projector. A food cup was located midway between the two panels and an initiate lever was located on the opposite end of the box. Animals were pretrained to initiate each trial by depressing the initiate lever to produce stimulus onset, then push the appropriate stimulus panel to receive reward. A press on the correct panel terminated the stimuli and deactivated the initiate switch for 20 sec. After an incorrect response the same stimulus presentation was repeated. The left-right position of the correct stimulus was varied according to prearranged Gellerman series. Thirty trials were given each day until the animal met a criterion of 90% correct responses in a daily session or until 1200 trials were completed. All animals were initially pretrained to discriminate between two circles differing in size and flux and were tested on columns and rows of 5 mm squares. Additional male rats (10 WKY and 10 SHRSP) were used for the measurement of regional cerebral blood flow (rCBF) by the hydrogen clearance method (Yamori and Horie, Stroke, 8, 1977).

RESULTS AND DISCUSSION  Eight out of 10 hypertensive SHRSP (<240 mmHg) failed to reach the criterion within 1200 trials in contrast to only one of the 10 normotensive WKY (<130 mmHg). rCBF in the occipital cortex in SHRSP and WKY were 58 ± 4 (ml/100g/min) and 121 ± 7 (ml/100g/min), respectively. No marked abnormal findings were observed in the histological examination (light microscopic study) in both SHRSP and WKY. In the present study, rCBF in the visual cortex was significantly reduced in SHRSP in comparison with that of WKY. The SHRSP were also severely impaired in learning a visual discrimination task. We have previously shown that successful performance of this task is dependent on the integrity of visual cortex (Rothblat and Schwartz, Soc. Neurosci. Abstr., 4, 1978). Whether a causal relationship between rCBF and behavior can eventually be established remains to be determined.