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Novel Regulation of Sodium and Body Fluid Balance in Oxytocin-mRFP Transgenic Rats

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Summary

Oxytocin as well as vasopressin is synthesized in the magnocellular neurosecretory cells (MNCs) in the supraoptic nucleus (SON) and the paraventricular nucleus (PVN) of the hypothalamus. The MNCs project their axon terminals to the posterior pituitary gland and secrete oxytocin and vasopressin into the systemic circulation. Oxytocin is well known to facilitate the birth and cause milk ejection reflex. On the other hand, previous studies demonstrated that oxytocin caused natriuresis in kidney, oxytocin stimulated the secretion of atrial natriuretic peptide from the heart and central administration of oxytocin suppressed sodium appetite in rats. In addition, chronic salt loading caused an increase of the synthesis and secretion of oxytocin. The accumulating evidence has suggested that oxytocin may be involved in the regulation of sodium and body fluid balance.

Recently, we generated a transgenic rat that expresses the oxytocin-monomeric red fluorescent protein 1 (mRFP1) fusion gene in the hypothalamo-neurohypophysial system. Chronic salt loading (2% saline to drink for 5 days) caused marked increase of mRFP1 fluorescence in the SON and the PVN. A single MNC isolated from the SON of an oxytocin-mRFP1 transgenic rat was identified by red fluorescence and action potentials were recorded by whole-cell patch clamp technique in current clamp mode. We generated another transgenic rat that expresses the c-*fos*-enhanced green fluorescent protein (eGFP) fusion gene after adequate stimuli such as osmotic challenge. The double transgenic rat that expresses both the oxytocin-mRFP1 fusion gene and the c-*fos*-eGFP fusion gene showed a nuclear green fluorescence in red fluorescent cytoplasm in the SON and the PVN after systemic administration of cholecystokinin-8.

The oxytocin-mRFP1 transgenic rats as well as the c-*fos*-eGFP transgenic rats are useful animal models to examine the relationship between oxytocin and sodium and body fluid balance in *in vitro* and *in vivo* preparations.