Comparative electrophysiological properties of locus coeruleus neurons in young and adult mice

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Neuronal plasticity is a normal ongoing process in the mammalian brain. It is known that in various neuronal types, including spontaneously firing midbrain dopaminergic neurons, electrophysiological properties can change from young to adult animals. We have investigated this in regard to ion channels involved in pacemaking in the locus coeruleus (LC). Both LC and midbrain dopaminergic neurons have an intrinsic involvement with age-related neurological disorders such as Parkinsons disease. LC degeneration seems to be an early event in this disease that has been reported to occur before damage to dopaminergic neurons. Indeed, these two neuronal types also share common enzymes from the dopamine/noradrenaline synthesis pathway. Due to the key importance of LC neurons in brain function, we compared electrophysiological properties of LC neurons in young and adult mice. The methods used for euthanizing mice were approved by the Animal Care and Ethics Committee at the University of Newcastle. It was found that the resting membrane potential was slightly hyperpolarized in adult animals (n=24), resulting in many of the adult LC neurons not being spontaneously active compared to LC neurons from the young mice (n=25). Input resistance and some of the pacemaking currents also were significantly different in adult compared to neonatal LC neurons. These results suggest that basic electrophysiological properties of LC neurons change with normal development, suggesting this phenomenon is a common process among both dopaminergic and noradrenergic neurons.