

Modulation of excitability and olfactory responses in mouse vomeronasal sensory neurons by estrogen

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Aggression and parental care are behaviors that are often mediated by chemical cues. Many of these chemical responses occur in the vomeronasal organ (VNO). Vomeronasal sensory neurons (VSNs) are the chemical sensors of the VNO and express specific odor receptors that are G protein coupled and linked to a PLC pathway. While hormonal modulation of neurons in the CNS by steroids has been well established in mammals little is known about such modulation in VSNs especially rapid (non-genomic) effects of estrogen.

To determine if estrogen plays a role in the VNO in mice, RT-PCR was used to determine that the mRNA for two estrogen receptors GPR30, a G protein coupled estrogen receptor and the classical α -estrogen receptor were present in the VNO but not the β isoform estrogen receptor. Immunocytochemistry revealed that it was the VSNs that labeled for GPR30. Recording from isolated VSNs, using perforated patch clamp, showed that physiological concentrations (1nM) of 17 β estradiol can hyperpolarize the membrane by 3-5 mV (n=5/7) and decrease the spontaneous firing of action potentials (n=3/6). VSNs respond to urine, natural stimulus that is a complex mixture of pheromones, metabolites and salts. Estrogen was found to inhibit urine induced current responses by 50% or more (n=16/17). Also urine induced action potentials were decreased in number in presence of estrogen (n=3/5). By studying such effects and dissecting the pathways behind it, a better understanding of how behavior is modulated by the ever-changing concentration of hormones that occurs in response to internal and external cues may be possible.