Excitation, inhibition, and suppression by odors in isolated toad and rat olfactory receptor neurons

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Vertebrate olfactory receptor neurons (ORNs) exhibit odor-induced increases in action potential firing rate due to an excitatory cAMP-dependent current. Fish and amphibian ORNs also give inhibitory odor responses, manifested as decreases in firing rate, but the underlying mechanism is poorly understood. In the toad, an odor-induced Ca2+-activated K+ current is responsible for the hyperpolarizing receptor potential that causes inhibition. In isolated ORNs, a third manner by which odors affect firing is suppression, a direct and nonspecific reduction of voltage-gated and transduction conductances. Here we show that in whole cell voltage-clamped toad ORNs, excitatory or inhibitory currents were not strictly associated to a particular odorant mixture. Occasionally, both odor effects, in addition to suppression, were concurrently observed in a cell. We report that rat ORNs also exhibit odor-induced inhibitory currents, due to the activation of a K+ conductance closely resembling that in the