Gene expression profiles and synaptic interactions in the antennal lobe neurons of the silkmoth

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Functional significance of electrical synapses has been suggested in olfactory information processing of insect antennal lobe (AL). However, little is known about gene expression profiles and functional synaptic connectivity of electrically coupled AL neurons. To address this, we performed single-cell RT-PCR by harvesting the cytoplasm from the individual silkmoth AL neuron following whole-cell patch-clamp recordings. The gene expression profile of each AL neuron was distinguishable on the basis of expression of gap junction channel genes (BmInx2 and BmInx3). We found some cells expressed BmInx2 alone and others expressed both BmInx2 and BmInx3. To estimate the relationship between gene expression and functional synaptic connectivity, we have recorded from pairs of AL neurons (local interneurons and projection neurons) by simultaneous patch-clamp recordings. In the simultaneous recording of local interneurons each other, we observed electrical coupling and found that some of the electrical coupling showed bidirectional and others showed unidirectional responses. The synapses between local interneuron and projection neuron were not electrically coupled, while unidirectional chemical synapses were observed. These data demonstrate that differential expression of gap junction channel genes may underlie heterogeneous properties of synaptic connectivity in silkmoth AL. We are currently investigating gene expression profiles in simultaneously recorded AL neurons.