2-YIA-17

Young Investigator Outstanding Oral Presentation Award Sessions (YIA)

An optogenetic approach to identify L-DOPA as a neurotransmitter in the nucleus tractus solitarii

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We have proposed that L-DOPA is a neurotransmitter. L-DOPA when exogenously microinjected into the nucleus tractus solitarii (NTS) induces depressor and bradycardic response. Electro-stimulation of aortic depressor nerves (ADN) induces L-DOPA release from the NTS, and induces depressor and bradycardic response. These our findings suggested that L-DOPA may play a neurotransmitter role in the primary baroreceptor afferents terminating in the NTS. To further determine the role of L-DOPA as a neurotransmitter in the ADN, we investigated whether depressor and bradycardic responses to L-DOPA was mimicked by stimulating ADN using optogenetic procedure in rats. We injected adeno-associated virus encoding ChR2-EYFP or EYFP into the ganglion of ADN. Four to five weeks after injection, ChR2-EYFP and EYFP signals were partially localized with tyrosine hydroxylase-positive neurons in the NTS of the fixed brain tissues. Photostimulation (473 nm, 40 mW, 20 Hz, 20s) from the surface of the NTS induces depressor and bradycardic response in the animals expressing ChR2-EYFP, but not EYFP in the ADN. The effects of photostimulation were attenuated by treatment with L-DOPA cyclohexylester (1 μ g), an antagonist for L-DOPA, in the NTS, as were those of exogenously applied L-DOPA. These results suggested that L-DOPA is a neurotransmitter in the ADN terminating into the NTS.