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Control of root growth direction through indole-3-butyric acid uptake mediated by NPF7.3/NRT1.5 in Arabidopsis

An ability to precept and respond to gravity, so-called gravitropism, is largely known to be a fundamental function for ensuring the optimal development of terrestrial plants. Plant hormone auxin serves as a signal molecule, and its uneven distribution in developing tissues, which triggers gravitropic responses, are established by the polar transport of indole-3-acetic acid (IAA) that is the most abundant naturally occurring auxin. Here, we propose that cellular uptake of indole-3-butyric acid (IBA), one of the precursors of IAA, contributes to the formation of auxin-uneven distribution in a root tip as well as IAA transport and that this step is mediated by one family protein of the Nitrate transporter1/Peptide transporter Family (NPF), NPF7.3/NRT1.5 in Arabidopsis. Mutations in the NPF7.3/NRT1.5 gene inhibited root gravity responses inducible by auxin, consequently resulting in the disrupted growth direction of Arabidopsis roots. Direct transport assay using yeast cells showed that IBA is preferable to IAA as a transport substrate of NPF7.3/NRT1.5. Our findings shed light on the physiological significance of endogenous IBA and its uptake mediated by NPF7.3/NRT1.5 in root development in Arabidopsis.