Scientists reveal molecular interaction of carbon/nitrogen metabolism in rice

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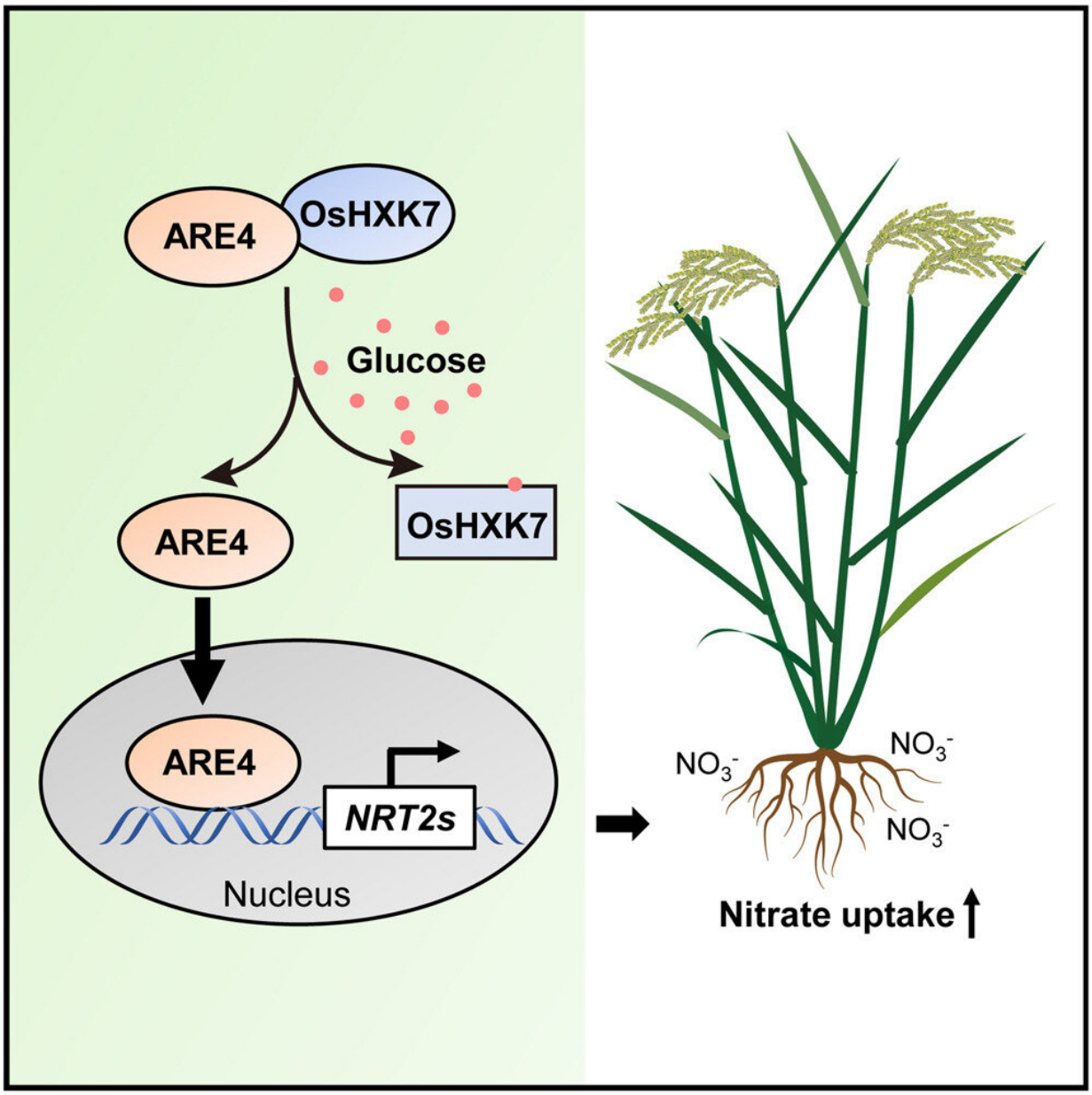

Model of linking glucose signaling to nitrogen utilization by the OsHXK7-ARE4 complex. Credit: IGDB

Carbon and nitrogen are the two most abundant nutrients for all living organisms. The metabolism of carbon and nitrogen is tightly coupled and coordinated by different metabolites and signaling pathways. What are the molecular mechanisms that sense and control carbon and nitrogen metabolism following environmental nutrient changes in plants?

To understand the mechanisms regulating carbon/nitrogen metabolism, researchers led by Prof. Zuo Jianru and Prof. Li Jiayang from the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences (CAS) identified that key factors OsHXK7 and ARE4 link glucose signaling to nitrogen use in rice. The results were published in *Developmental Cell* on July 5.

In this study, the researchers found that the MYB-related transcription factor ARE4 is retained in the cytosol in complex with the glucose sensor OsHXK7. Upon sensing a glucose signal, ARE4 was released, translocated to the nucleus, and activated the expression of a subset of high-affinity nitrate transporter genes, thereby boosting nitrate uptake and accumulation.

Further studies revealed that the ARE4 regulatory scheme exhibited a diurnal pattern in response to circadian changes in soluble sugars, and overexpression of ARE4 increased grain size in rice.

These results uncover a previously unrecognized mechanism by which the OsHXK7-ARE4 complex senses a sugar signal and subsequently promotes nitrogen utilization, directly linking carbon and nitrogen metabolism. This study may identify promising targets for breeding high-

yield cultivars.

More information: Xiaohui Ma et al, Link glucose signaling to nitrogen utilization by the OsHXK7-ARE4 complex in rice, *Developmental Cell* (2023). DOI: 10.1016/j.devcel.2023.06.003

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