'Conductor' gene found in plant root stem cell 'orchestra'

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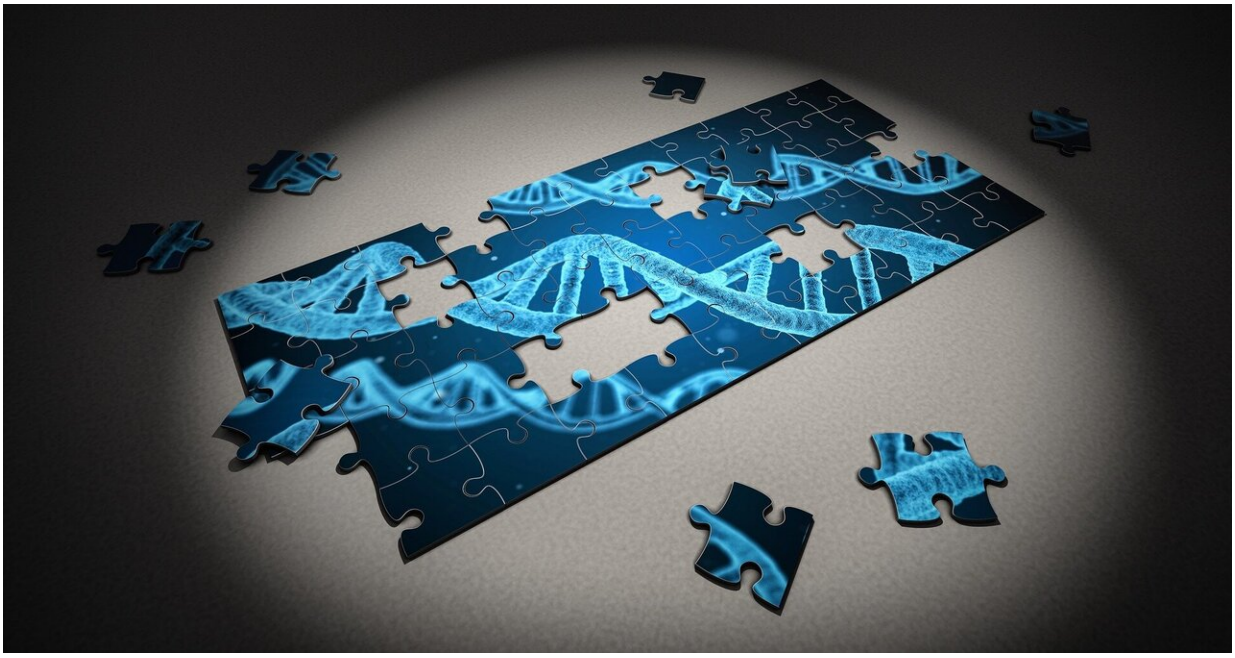

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In a new paper, researchers at North Carolina State University lift the veil on the "conductor" plant root stem cell gene that helps orchestrate and coordinate stem cell division of different root stem cell types, ensuring the harmonic communication necessary for plant growth and maintenance.

Ross Sozzani, an NC State associate professor of plant and microbial biology and corresponding author of the paper, says that the conductor behind this communication—which is critical to key aspects of plant development, including plant cell division, proliferation and differentiation—is a gene called TCX2, which is present in all the different plant root stem cells.

Like an orchestra with its various component instruments working together to create beautiful music, plant root stem cells work within various networks to perform various functions. TCX2 ensures that these local networks communicate with each other, similar to an orchestra conductor making sure that horns, for example, don't drown out the violins.

The interdisciplinary research included molecular biology experiments in Arabadopsis thaliana, or mustard weed, as well as mathematical modeling and machine learning approaches to narrow down some 3,000 candidate genes and learn about the causal relationships between different root stem cell networks.

"We saw that TCX2 was able to target different stem cell genes in different stem cell networks and regulate their functional timing," Sozzani said.

To validate the network prediction and mathematical modeling, the researchers took an experimental approach. They both overexpressed and knocked out the TCX2 gene and found that the timing of plant root stem cell division suffered. Sozzani and Natalie Clark, the paper's first author and a former NC State biomathematics graduate student, likened this to the principle behind the story of Goldilocks and the Three Bears—the porridge was acceptable only when its temperature was "just right."

Sozzani said that future work will use these findings and 3-D bioprinting to learn more about building better plants.

"We can physically change the position or number of these root stem cells and see how those changes help or harm this harmonic system," she said. "If you wanted to help a plant become more drought tolerant, for example, how do you build more vascular tissue which is important for that function? 3-D bioprinting allows us to test this by positioning stem cells in desired spatial arrangements."

The paper appears in *Nature Communications*.

More information: Natalie M Clark et al, Stem-cell-ubiquitous genes spatiotemporally coordinate division through regulation of stem-cell-specific gene networks, (2019). DOI: 10.1101/517250

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