

Research reveals aquatic bacteria more recent move to land

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Research by University of Tennessee, Knoxville, faculty has discovered that bacteria's move from sea to land may have occurred much later than thought. It also has revealed that the bacteria may be especially useful in bioenergy research.

Igor Jouline, UT-Oak Ridge National Laboratory joint faculty professor of microbiology and researcher at ORNL's Joint Institute for [Computational Sciences](#), performed a [genome sequence](#) analysis of the [soil bacteria](#) Azospirillum, a species' whose forbearers made the sea-to-land move. The analysis indicates the shift may have occurred only 400 million years ago, rather than approximately two billion years earlier as originally thought.

Published in the journal [PLoS Genetics](#), Jouline calculated the timing of the sea-land transition through studies of genome sequences of two species of Azospirillum, a terrestrial genus with almost exclusively aquatic relatives.

Jouline conducted his research with Kristin Wuichet and Leonid Sukharnikov of the Department of Microbiology, Gladys Alexandre of Department of Biochemistry, Cellular, and Molecular Biology, and Kirill Borziak, a graduate student in the ORNL-UT Genome Science and Technology program.

"In the absence of [fossil records](#) for bacteria, it is hard to estimate when and how bacteria transitioned from sea to land," said Jouline. "Using

genome sequencing and analysis of bacteria of the genus *Azospirillum*, which colonizes roots of important cereals and grasses, we show that these organisms transitioned from [aquatic environments](#) to land approximately at the same time that plants appeared on land—400 million years ago."

Jouline said the *Azospirillum* lineage the team studied has obtained nearly half of its genome from terrestrial organisms, which suggests the much later water-land transition, which coincides with the first appearance of plants on land.

The study is of interest to researchers beyond its evolutionary significance. *Azospirillum* is currently used as a biofertilizer for grasses and some other plants. Commercial fertilizers containing the bacteria are available worldwide.

"Because these bacteria colonize roots of grasses and improve their growth and development, they might be important for [bioenergy research](#)," Jouline said.

"Switchgrass is one of the most important potential sources of bioethanol. In this study, we have shown that genomes of *Azospirillum* contain as many cellulolytic enzymes as those from known effective cellulose degrading bacteria," he said. "We have also demonstrated experimentally that azospirilla do degrade cellulose, especially the strain that can penetrate grass roots."

Provided by University of Tennessee at Knoxville

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