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## Functional Genomic Analysis of Soil Microorganisms

<b>Status</b>	Past
<b>Competition</b>	II
<b>Sector</b>	Environment
<b>Genome Centre</b>	Ontario Genomics Institute
<b>Project Leader</b>	Turlough Finan and Brian Golding

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### Project Description

Genome Projects include the study of many kinds of organisms that are important in our daily lives, for example bacteria. One of the most important groups of bacteria in the world is also one of the least known by many people—microbes that cause the formation of nodules on the roots of many plants. Inside these nodules specialized bacteria convert atmospheric nitrogen into a chemically useful form, which is essential for plant growth and thus ultimately for life on Earth. One of the best-studied nitrogen-fixing bacteria is called *S. meliloti*, which fixes nitrogen in the roots alfalfa and other plants.

We aim to understand more about *S. meliloti* by using genomic methods to study its genes—how they direct nitrogen fixation and many other important biochemical reactions.

Using complex genetic methods, we constructed light-emitting versions of almost 50% of *S. meliloti* proteins. This gave us an easy way to measure the amount of these proteins present in *S. meliloti* cells, a reflection of genetic activity, under over 100 conditions of growth. We used similar genetic methods to remove many individual genes from the *S. meliloti* genome. This enabled us to learn how the absence of these genes affected bacterial growth under many conditions. We used a method called DNA micro-arraying to measure gene-expression from all *S. meliloti* genes (6,200). The deeper understanding of *S. meliloti* growth that stems from our research will lead to better and more environmentally friendly methods of nitrogen fixation for the food and agricultural industries in Canada and the world.

## **Fast Facts**

**Highlighted outcome:** Creation of a body of knowledge about *S. meliloti*, a bacterium that fixes nitrogen, which is an essential process for plant growth.

**Number of research personnel employed by the project:** 28 undergraduates, 9 graduate students, 3 fellows, 15 technicians

**Number of peer-reviewed publications:** 17 research papers

**Co-funders:** McMaster University, Ontario Research Development Challenge Fund, Premier's Research Excellence Fund, Canada Foundation for Innovation, University of Waterloo