Landmark project to map genomics of complex ant systems (w/ Video)

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Emory researchers are tapping the latest-generation DNA sequencing technology to become the first explorers of the genomics of agricultural ant societies.

"This project is one of the first attempts to use genomics to understand a complex interacting system, rather than a single organism," says Nicole Gerardo, assistant professor of biology and lead investigator of the project. "If we can understand how these ants have evolved to process huge amounts of organic material over 50 million years, we might discover more efficient ways to process our own waste materials, produce bio-fuels, or improve our agricultural methods."

Gerardo is an expert in the ecology and evolution of fungus-growing ants. These "gardening" insects cut and transport leaves to nourish their food crops of fungi. Some ant species can process 15 percent of the leaves within a dense rain forest. An array of microbes have co-evolved along with the ants and the fungi - including fungal pathogens that attack the ants' crops, and other microbes that benefit the ants and their crops.

Take a video tour of the world of fungus-growing ants.

As a recipient of the highly competitive 10 Giga-base Grant Program for DNA sequencing and transcriptome analysis from Roche Applied Sciences, Gerardo put together a project to not only sequence ant genomes for the first time, but also the genomes of some of the key bacteria and fungi associated with the gardens of these ants. She selected

two highly sophisticated ant species for sequencing, and one ancient, more primitive species.

Entering new territory

Roche will sequence the DNA using its proprietary high-throughput genome sequencing technology, which will provide 10 giga-bases of data - an amount equivalent to three human genomes. Previously, it would have required millions of dollars and extensive manpower to sequence just one organism.

"We're entering completely new territory," says James Taylor, assistant professor of biology and math and computer science at Emory, and a co-investigator on the project. "DNA sequencing technology is becoming faster and cheaper, but this transition is just happening. The amount of data that this grant is providing us will likely be easily obtainable within five years, but right now we're among the first to explore co-evolution from a genomics perspective."

For years, Gerardo and her collaborators have studied the biology, environmental influences and chemistry of fungus-growing ants. The wealth of new data generated by the grant will include three areas of DNA sequencing: genomics, providing all of the base pairs of DNA within an organism; transcriptomics, revealing which genes are being turned on during a given situation; and metagenomics, delineating which organisms are within a system.

Bringing genomics into classrooms

Among the many mysteries Gerardo looks forward to analyzing through the sequencing data are the genetics underlying ant diversity. "We think that humans are so complex, but ants in these colonies have different

sizes and muscle structures," she says. "The genetic basis for what makes a soldier ant different from a worker ant is an incredibly interesting question in biology."

A key part of the project is bringing genomics into classrooms, by giving high school and college students experience at analyzing genomic data.

"We hope to build up a public research community around this project to facilitate broader analysis," says Taylor, a leading expert in bio-informatics. "We will provide supporting infrastructure to allow people to discover new things. This project is novel - and it's going to be fun."

Source: Emory University (news : web)