PNAS paper cites discovery of small RNA 'quality-control' mechanism

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Heriberto Cerutti

(PhysOrg.com) -- When a person is exposed to a cold virus, whether he or she actually becomes ill may come down to how well short snippets of RNA in the person's defense response system interact with the RNA-based cold virus.

If the small RNA (ribonucleic acid) matches up well with the virus, it will bind to it and degrade it, and no cold will develop. If it doesn't, the unfortunate person is probably going to get sick.

That's one of small RNA's two key functions. The other is to regulate gene expression to ensure proper development of healthy cells and ultimately entire organisms.

Humans and other organisms produce a lot of small RNAs, and as in any biological or industrial process, when large quantities of something are manufactured, mistakes are inevitably made. Industry establishes quality-control procedures to try to prevent errors from getting out of the factory.

Fortunately for living organisms, nature takes care of it for us, but no one was sure what that biological quality-control was for small RNAs until a recent discovery by a team of microbiologists at the University of Nebraska-Lincoln and the University of Delaware. Working with a species of single-celled green alga, they identified two enzymes (labeled MUT68 and RRP6) that operate in effect as quality controls, eliminating defective small RNAs.

"Cells have to have these to control the quality of the small RNAs. It seems that if they don't have them, many of the small RNAs that are produced don't function properly," said Heriberto Cerutti, associate professor of biological sciences at UNL. He is corresponding author of the paper that announced the finding in the Jan. 25-29 online version of the Proceedings of the National Academy of Sciences.

"It was known that the small RNAs control gene expression as well as playing a role in defense against viruses. What was not known was that we needed a quality control mechanism to eliminate dysfunctional or improperly produced small RNAs. We identified some components of

the machinery that operates as a quality control. If the small RNAs are not correct, it eliminates them."

A researcher in UNL's Center for Plant Science Innovation, Cerutti said the quality-control mechanism is especially relevant for crops and humans since most agriculturally relevant viruses that affect plants and some of the viruses that affect humans (the retroviruses such as HIV) are RNA-based.

Cerutti's co-authors in the study were Linda Rymarquis and Pamela Green of the University of Delaware, and four present and former members of his lab at UNL -- 2009 Ph.D. recipient Fadia Ibrahim (the lead author), technician Eun-Jeong Kim, master's student James Becker and former undergraduate student Eniko Balassa.

Provided by University of Nebraska-Lincoln