Biologists identify genes that prevent changes in physical traits due to environmental changes

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New York University biologists have identified genes that prevent physical traits from being affected by environmental changes. The research, which studied the genetic makeup of baker's yeast, appears in the latest issue of the Public Library of Science's journal, *PloS Biology*.

NYU biologists Mark Siegal, an assistant professor, and Sasha Levy, a post-doctoral fellow, who are part of NYU's Center for Genomics and Systems Biology, conducted the study.

The researchers sought to understand how organisms develop and function reliably, despite experiencing a range of environmental conditions and genetic differences caused by mutations.

"Most species maintain abundant genetic variation and experience a wide range of environmental conditions, yet phenotypic—or physical—differences between individuals are usually small," Siegal explained. "This phenomenon, known as phenotypic robustness, presents an apparent contradiction: if biological systems are so resistant to variation, how do they diverge and adapt through evolutionary time?"

To identify genes that buffer environmental and genetic variation, which may influence how novel traits evolve, the researchers examined Saccharomyces cerevisiae, a species of budding yeast. They investigated the molecular mechanisms that underlie its phenotypic robustness and

how these mechanisms can be broken to produce differences in physical appearance within the species.

Siegal and Levy sought to identify genes that contribute to phenotypic robustness in yeast by analyzing the differences in their phenotypes in a comprehensive collection of single-gene knockout strains—that is, they removed these genes to determine if the resulting phenotypes were more variable from cell to cell.

They determined that approximately 5 percent of yeast genes, or approximately 300 genes, break phenotypic robustness when knocked out. These genes tend to interact genetically with a large number of other genes, and their products tend to interact physically with a large number of other gene products. When they are absent, the cellular networks built from their interactions are disrupted and physical differences in the species result. In nature, the researchers hypothesized, some individuals might then have physical features that yield an advantage over the others.

"If so, the loss of phenotypic robustness could actually serve an adaptive role during evolution," Siegal explained.

Source: New York University