

Mobile DNA: Reshaping and Rearranging the Yeast Genome

Mobile DNA sequences are repetitive elements that replicate and insert into new locations. Because repetitive sequences, which are dispersed throughout the genome, can pair and exchange genetic information, they present a considerable challenge to genome stability. Despite this danger, mobile elements accumulate to very high levels (in fact, they comprise ~40% of the human genome). High levels of mobile DNA are detrimental to the cell, and strains of yeast containing elevated numbers of mobile elements suffer a decrease in fitness following experimental evolution. However, when yeast cells are grown under more strenuous conditions, this fitness disadvantage disappears. Indeed, cells with increased levels of mobile DNA contain numerous changes to chromosome structure following evolution. This broader variation in chromosome structure, and consequent increased diversity in the population, appears to be advantageous by enabling adaptation. The abundance of repetitive DNA must therefore be finely tuned so that the benefit of chromosome rearrangements in promoting genome evolution outweighs the potential for lethal damage.

Lisa Scheifele is an Assistant Professor of biology at Loyola University Maryland. She has developed a student-centered research program to study the role of repetitive DNA in genome evolution. She teaches courses in cell and molecular biology, genetics, and synthetic biology, a research-intensive course in which students collaborate on the Synthetic Yeast Genome project at Johns Hopkins. Dr. Scheifele graduated from Messiah College in 1999 with a B.S. in biochemistry and completed her Ph.D. at Penn State University-Hershey Medical Center in 2004. Following a postdoctoral fellowship in the Department of Molecular Biology and Genetics at Johns Hopkins School of Medicine from 2004-2009, she joined the faculty at Loyola University. She is the recipient of an NSF Graduate Research Fellowship and a Postdoctoral Fellowship from the Damon Runyon Cancer Research Foundation.

