Researchers shed new light on regulation of repetitive DNA sequences

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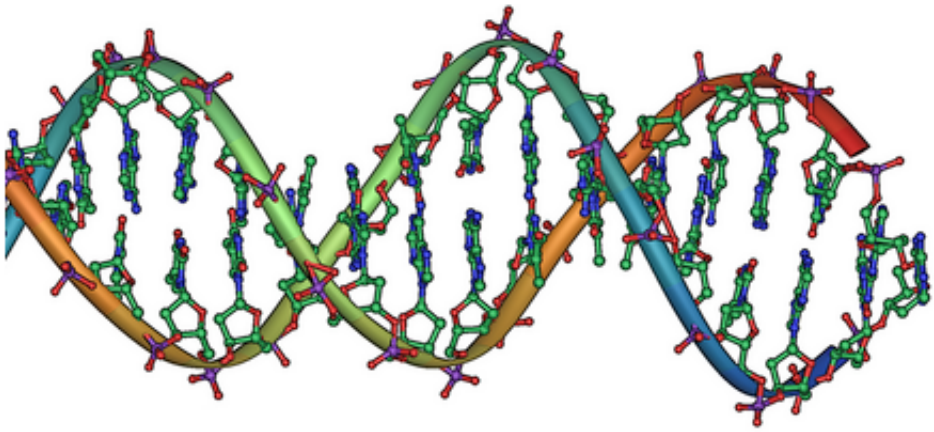

DNA double helix. Credit: public domain

A pair of studies by a team of scientists has shed new light on the nature of a particular type of DNA sequences—tandem DNA repeat arrays—that play important roles in transcription control, genome organization, and development.

This process is of interest to researchers because misregulation of tandem DNA repeats can lead to chromosome missegregation, genome instability, and a variety of diseases, including muscular dystrophy and

cancer. However, because all repeats of a tandem array have the same DNA sequence, distinguishing individual repeats from each other represents a major experimental challenge. As a result, tandem DNA sequences are among the most poorly understood structures in the genome.

In these papers, published in the journal *Cell Reports*, New York University biologists and their colleagues examined the regulation of tandem DNA repeats in different forms of yeast— budding yeast (to study ribosomal DNA repeats) and fission yeast (to study repeats flanking the centromere, a part of a chromosome that links sister chromatids and drives chromosome segregation during cell division).

To look within these repeat arrays, the scientists inserted unique identifier tags, which served as markers in tracing the movement and, with it, the function of individual DNA repeats.

In both studies, findings revealed that gene expression among different repeats varies substantially and depends on the position within the array. Such position effects are present in the tandem DNA repeats of both types of yeast, suggesting a commonality among these repeats.

Moreover, these results provide key information about DNA architecture in cells.

"Our observations suggest that, although the repeats in the tandem array share the same sequence, each is organized into a specific three-dimensional structure," notes Fei Li, an assistant professor in NYU's Department of Biology and a co-author of one of the studies.

Although the ultimate structures resulting from these processes likely vary between the two organisms, the experiments showed that the position effects in both instances are regulated by the protein condensin,

which is essential for the packaging of chromosomes during cell division.

Moreover, the findings point to the central role of chromosome architecture in regulating these sequences.

"Together, this work adds to a growing body of evidence that position effects are inherent to the structural organization of repetitive DNA arrays," observes Andreas Hochwagen, an assistant professor in NYU's Department of Biology and a co-author of both papers. "Our research now provides a powerful experimental tool to investigate this poorly understood part of the genome."

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