Human cells can copy not only DNA, but also RNA

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Single-molecule sequencing technology has detected and quantified novel small RNAs in human cells that represent entirely new classes of the gene-translating molecules, confirming a long-held but unproven hypothesis that mammalian cells are capable of synthesizing RNA by copying RNA molecules directly. The findings were reported in *Nature* by researchers from the University of Pittsburgh School of Medicine, Helicos Biosciences Corp., Integromics Inc., and the University of Geneva Medical School.

"For the first time, we have evidence to support the hypothesis that human cells have the widespread ability to copy RNA as well as DNA," said co-author Bino John, Ph.D., assistant professor, Department of Computational and Systems Biology, Pitt School of Medicine. "These findings emphasize the complexity of human RNA populations and suggest the important role for single-molecule sequencing for accurate and comprehensive genetic profiling."

Scientists had thought that all RNA in human cells was copied from the DNA template, Dr. John explained. The presence of mechanisms that copy RNA into RNA, typically associated with an enzyme called RNA-dependent RNA polymerase, has only been documented in plants and simple organisms, such as yeast, and implicated in regulation of crucial cellular processes. Since thousands of such RNAs have been detected in human cells and because these RNAs have never before been studied, further research could open up new fronts in therapeutics, particularly diagnostics, Dr. John said.

In the study, the researchers profiled small RNAs from human cells and tissues, uncovering several new classes of RNAs, including antisense termini-associated short RNAs, which are likely derived from messenger RNAs of protein-coding genes by yet uncharacterized, pervasive RNA-copying mechanisms in human cancer cell lines.

"This class of non-coding RNA molecules has been historically overlooked because available sequencing platforms often are unable to provide accurate detection and quantification," said Patrice Milos, Ph.D., chief scientific officer at Helicos Biosciences. "Our technology provides the platform capability to identify and quantify these RNAs and reinforces the potential clinical advantages of our single molecule-sequencing platform."

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