

Researchers find key to messenger RNA control

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Researchers at McGill University have successfully used a class of tiny nucleic acids called microRNAs to control messenger RNA, one of the major gene regulators in life, outside the confines of a living cell for the first time.

In research led by McGill postdoctoral fellows Geraldine Mathonnet and Marc Fabian, Dr. Nahum Sonenberg, James McGill Professor of Biochemistry, Dr. Thomas Duchaine, assistant professor in biochemistry at the McGill Cancer Centre, and several colleagues have discovered the biological process by which small gene-controlling molecules, microRNAs, inhibit the expression of messenger RNA in mammals. Their findings were published Thursday, July 26, in the journal *Science*.

Messenger RNA acts as a living cell's duplicating mechanism, copying the blueprint to construct new proteins from DNA. Though previous researchers have successfully inhibited messenger RNA with microRNAs in other biological systems such as flies, doing so in the test tube with mammalian systems has been a longstanding goal.

"Until now, all the research on microRNAs was done in the cell," explains Sonenberg. "But in the cell, the investigator has limited abilities to control the reaction, which caused considerable controversy on how microRNAs control gene expression. Working in a test tube, you can add and remove whatever you want and you are in control of the process. That's what was missing, and that's what we have created now."

Ribonucleic acid, or RNA, is a single-stranded nucleic acid similar to the familiar double-stranded DNA, or deoxyribonucleic acid. DNA contains within it the genetic code for the construction of proteins from amino acids, but it is RNA, and more specifically the messenger RNA (mRNA), that actually does the heavy lifting. Like a biological photocopy machine, RNA transcribes the amino

acid assembly instructions from the DNA and transports them to the appropriate place in the cell where the proteins are generated, a process known as translation. While mRNAs encode genetic information, microRNAs control its flow. MicroRNAs are a class of small RNA molecules that pair to mRNAs and control their expression, but exactly how this happens remained unclear until now.

"There are about 25,000 genes in the human genome, and a third of them are regulated by microRNA," says Sonenberg. "This means a lot and it has relevance to many diseases, especially cancer. MicroRNAs are important for cancer progression, in cardiac disease, in pancreatic disease, and many others. They control the genes that are important for our very survival."

Other researchers contributing to this study are based at the University of Eastern Piedmont, Case Western Reserve University, Warsaw University and the Friedrich Miescher Institute for Biomedical Research in Basel, Switzerland.

Source: McGill University

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