Call Stephen Michnick a gene grammarian

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While life on Earth didn't originate from a blueprint, Stephen Michnick is helping the scientific community uncover the basic architecture of living things. A Université de Montréal biochemistry professor and Canada Research Chair in Integrative Genomics, Dr. Michnick has developed novel technologies that have enabled him to examine how proteins interact within cells.

Dr. Michnick's new ways of seeing living cells promises to reduce big chunks of analysis to understand how our genomic blueprint translates into complex life. The raison d'être of his work is to understand the fundamental chemistry of life, pinpoint where diseases begin and map out where they can be stopped – killer illnesses such as cancer and Alzheimer's.

"We think of genes and proteins interact in the same manner as people process sentences," says Dr. Michnick. "Living cells do something similar with genes – proteins read DNA sequence from beginning to end and translate this information in turn into new protein, which are essentially molecules that build the cells structure and control biochemical processes. But like language, there's much more to it than a simple grammatical problem; there are more abstract processes at the heart of reading genes that we need to understand."

Learning how to read genes

Dr. Michnick, who was recruited to the Université de Montréal from Harvard University, routinely collaborates with top scientists in his quest

to know where life began. In a recent study published in the journal *PLoS Biology*, led by Harvard University's Fred Winston, the University of Toronto's Tim Hughes, Dr. Michnick and the Université de Montréal's Christian Landry helped identify genes that code for proteins that in turn control the reading of genes.

"Our team found that when these proteins are destroyed, genes are sometimes read from somewhere in the middle, which is comparable to a defective printer that transcribes only the last words of a sentence," Dr. Michnick says. "In a living cell, such misinterpretation of genes might be thought to have devastating effects, but we found that under some conditions, misreading genes might be useful."

In the PLoS study, the researchers identified proteins they described as gene grammarians. Simply put, gene grammarians are linked to a larger complex of proteins that determine whether a gene can be read – or not – based on DNA structure. The scientists found gene grammarians can determine whether cells have different functions and can identify the different levels of susceptibility – or resistance – individuals could have to specific diseases.

The study provides insight into the fundamental mechanisms of epigenetic control – gene expression that are controlled by heritable but potentially reversible changes in DNA – which provides a new avenue towards understanding environmental effects on the human genome.

"Epigenetic control is needed to direct the development of an embryonic stem cell, for instance, into a brain as opposed to a kidney cell," Dr. Michnick says. "Control of genes is subject to both inherited and environmental factors, so that genes may be read differently and up to what a person eats or even what their grandmother ate."

Source: University of Montreal