Researchers find function of proteins that can enhance the progression of viruses and cancer cells

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In a discovery that has implications for developing treatments against cancer and potentially deadly viruses, researchers at SUNY Downstate Medical Center have discovered the function of proteins that can enhance the progression of certain viruses and cancer cells. Their findings were published in the journal *Genes and Development*.

According to Tatyana Pestova, PhD, DSc, assistant professor of cell biology, and Christopher Hellen, DPhil, associate professor of cell biology, "The significance of our work is that we have identified proteins (Ligatin, MCT-1 and DENR) that can substitute for the activity of one or more canonical initiation factors in the initiation and ribosome recycling stages of eukaryotic protein synthesis. These factors act either individually (Ligatin) or together (MCT-1 and DENR) to substitute for eIF2 in promoting initiation of translation on a specific subset of mRNAs under conditions when translation is globally repressed. These observations are clinically relevant with respect to (a) viral infections and (b) cancer pathogenesis." Maxim Skabkin, PhD, a research scientist in the Department of Cell Biology, is the lead author of the paper.

The cellular response to counteract viral infection involves activation of pathways that "shut off" translation by phosphorylating eIF2, preventing it from recruiting initiator tRNA to the ribosome. Some viral mRNAs continue to be translated at the same or a reduced rate under these conditions, including those of Hepatitis C virus, human rotaviruses (a

major cause of acute, frequently fatal, gastroenteritis in infants), coronaviruses (including SARS), and alphaviruses (e.g. Sindbis virus).

The authors reported a novel eIF2-independent mode of translation initiation in which Ligatin alone or MCT-1 and DENR together promote binding of initiator tRNA to specific ribosomal initiation complexes, and found that this mechanism functions very efficiently for Sindbis virus and to a lesser extent for Hepatitis C virus and related pathogenic viruses. This novel initiation mechanism is thus a potential target for therapeutic inhibition to counteract viral infection.

This eIF2-independent mode of initiation is likely a cellular mechanism that has been co-opted by viruses. MCT-1 (multiple copies in T-cell lymphoma-1) has previously been reported to act at the translational level to increase cell proliferation and survival and to enhance the invasiveness of cancer cells, but how it functions was not known. It is an oncogene that is over-expressed in lung cancer tissues and has been implicated in the development of human T-cell and B-cell lymphomas.

Dr. Hellen adds, "Our identification of a specific role for MCT-1 in promoting eIF2-independent initiation on specific mRNAs could account for its oncogenic activity by promoting the preferential translation of a subset of cancer-related mRNAs into proteins that promote angiogenesis, tumor cell survival, transformation, and metastasis."

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