Researchers publish study on neuronal RNA targeting

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SUNY Downstate scientist Ilham Muslimov, MD, PhD, along with senior author Henri Tiedge, PhD, professor of physiology and pharmacology and of neurology, published a study suggesting that cellular dysregulation associated with certain neurodegenerative disorders may result from molecular competition in neuronal RNA transport pathways.

The paper appeared in the Journal of Cell Biology, titled, "Spatial Code Recognition in Neuronal RNA Targeting: Role of RNA-hnRNP A2 Interactions." The article was highlighted in an accompanying editorial, "RNA Targeting Gets Competitive."

Dr. Tiedge notes, "In contrast to DNA, in which information coding is one-dimensional (i.e. linear), RNA can encode information in three-dimensional architectural motifs. Dr. Muslimov has now identified RNA motifs that act as spatial codes in nerve cells, directing RNA to dendrites and synapses." A synapse is a junction that allows a neuron (nerve cell) to pass an electrical or chemical signal to another cell, and dendrites are the branched processes of neurons that act to conduct electrochemical stimulation to the neuronal cell body.

He adds, "Just like number 7 on a New York subway train is a code for the destination 'Times Square,' Dr. Muslimov's RNA motifs are codes for the dendrite and synapse destinations. They make sure RNAs are delivered to cellular sites where they are supposed to operate."

"Sometimes, an RNA may express an inappropriately high number of targeting motifs, with the result that the resources of the transport system become overwhelmed. It is as if too many passengers are trying to enter trains at the same time, exceeding system capacity. We have congestion, and transport is disrupted."

Dr. Tiedge explains that Dr. Muslimov's work indicates that in nerve cells, excessive competition for common transport resources may result in compromised dendritic delivery of RNA. "In the example Dr. Muslimov studied, the culprit is an RNA that contains the genetic information for the fragile X mental retardation protein. Once the number of motifs structures in this RNA exceeds a threshold (usually around 55), the RNA becomes excessively competitive and begins to commandeer, at the expense of other RNAs, common resources of the cellular transport system."

"Dr. Muslimov's data raise the possibility that the resulting neurodegenerative disease, the fragile X-associated tremor/ataxia syndrome, is precipitated by a neuronal transport problem," Dr. Tiedge concludes.

Provided by SUNY Downstate Medical Center