Investigation of RNA binding by the eIF4B translation initiation factor, and dynamics studies of proteins utilizing NMR and other biophysical techniques

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Chemistry Seminar on RNA binding and protein dynamics

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Abstract: Eukaryotic initiation factor 4B (eIF4B) is a multidomain protein with a range of activities that serve primarily to promote the association of messenger RNA to the 40S ribosomal subunit during the translation initiation process. Deletion and site-directed mutagenesis studies have identified a few functional domains within eIF4B, two of which are involved in RNA binding and are implicated in linking mRNA to the 40S ribosomal subunit during translation initiation. An N-terminal RNA recognition motif (RRM; residues 97-175) has been shown to bind the 18S rRNA of the 40S ribosomal subunit in the earlier report. However, it has not been completely explored except for the RRM domain from eIF4B. A second RNA binding domain is located toward the C-terminus (residues 367-423) and has been termed the basic domain (BD) since it contains two arginine-rich motifs (ARMs). This region, which has not been assigned to a particular structural family, binds RNA nonspecifically but with high affinity and has been proposed to bind mRNA during initiation. In addition, eIF4B has been reported to bind several proteins related to translation, ribosomal RNA, and mRNA, but again only in a few studies. More than three-quarters of the eIF4B protein is intrinsically disordered and tends to display phase separation, attributing the reason why eIF4B has not been explored in depth, except for the RRM domain. We have utilized NMR spectroscopy and other biophysical techniques (smFRET, ITC, CD, Fluorescence, etc.) to address RNA binding properties from different constructs from the C- and N- terminus of eIF4B and addressed the phase separation behavior from the C-terminal domain of eIF4B. In addition, I will briefly discuss studies on various protein dynamics utilizing NMR spectroscopic techniques and other biophysical methods.

About the speaker: Dr. Mondal grew up in Birbhum, India and went to Indian Institute of Science, Bangalore for his PhD (Aug 2010-July 2016). His thesis was entitled, 'Structural and dynamic studies of protein-nanomaterial interactions.' After finishing his PhD, he had two post-doctoral stints, first in UCL, UK (April 2017 - Aug 2019) and a second one in INSERM, France (Dec 2019-Nov 2021), respectively. Currently he is working on a project entitled 'The sequence and structural requirements of RNA binding to the picornavirus 3C protein utilizing NMR and other biophysical techniques' as a Postdoctoral Research Scientist at Pennsylvania State University

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