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The paraspeckle: the noncoding RNA-centered nuclear body for gene regulation

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The paraspeckle (PS) is a nuclear body built around the specific long noncoding RNA (lncRNA) (PNAS, 2009). NEAT1 lncRNA acts to organize the PS structure by associating with ＞40 PS proteins (PSPs). Seven PSPs essential to PS formation are involved in NEAT1 biogenesis as well as subsequent RNP assembly into intact PS (EMBO J, 2012). The initial PS formation occurs on the NEAT1 chromosome locus in conjunction with NEAT1 biogenesis. We newly identified SWI/SNF chromatin remodeling complexes as additional essential PS factors. SWI/SNF complexes are required for adequate RNAPII-elongation on NEAT1 locus, which may be critical for correct RNP assembly onto the nascent NEAT1 transcripts. NEAT1 is differentially expressed, leading to PS dynamics (JCB, 2011). “Giant PS” is formed by up-regulation of NEAT1 upon proteasome inhibition. The transcription of the PS-target gene, which is negatively regulated by PS under normal condition, is sharply suppressed through sequestration of transcriptional activators into the giant PS. Thus, NEAT1 ncRNA dynamically controls the formation and function of PS for specific gene regulation.