World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:12, No:02, 2018

Cdk1 Gates Cell Cycle-Dependent tRNA Synthesis by Regulating RNA Polymerase III Activity

Authors : Maricarmen Herrera, Pierre Chymkowitch, Joe Robertson, Jens Eriksson, Jorrit Enserink

Abstract : tRNA genes are transcribed by RNA polymerase III. During recent years, it has become clear that tDNA transcription fluctuates during the cell cycle. However, the mechanism by which the cell cycle controls the amplitude of tDNA transcription remains unknown. We found that the cyclin Clb5 recruits the cyclin dependent kinase Cdk1 to tRNA genes to sharply increase tRNA synthesis during a brief interval in the cell cycle. We show that Cdk1 promotes the interaction of TFIIIB with TFIIIC, that it stimulates the recruitment of TFIIIC to tRNA genes, that it prevents the formation of an overly stable TFIIIB-tDNA complex and that it augments the dynamics of RNA polymerase III. Furthermore, we identify Bdp1 as a novel Cdk1 substrate, and phosphorylation of Bdp1 is required for the cell cycle-dependent increase in tDNA transcription. In addition, we show that phosphorylation of the Cdk1 substrate Nup60 mediates formation of a Nup60-Nup2 complex at tRNA genes, which is also required for cell cycle-dependent tDNA transcription. Together, our findings indicate that Cdk1 activity gates tRNA synthesis by regulating the dynamics of the TFIIIB-TFIIIC-RNAPIII complex, and that it may promote the formation of a nuclear pore microenvironment conducive to efficient tDNA transcription.

Keywords : Cdk1, cell cycle, RNAPIII machinery, tRNA
Conference Title : ICECT 2018 : International Conference on Epigenetics, Chromatin and Transcription
Conference Location : London, United Kingdom
Conference Dates : February 15-16, 2018