

Arginine methylation in RNA Polymerase II CTD regulates specifically snRNAs and snoRNAs

Department of Molecular
Epigenetics

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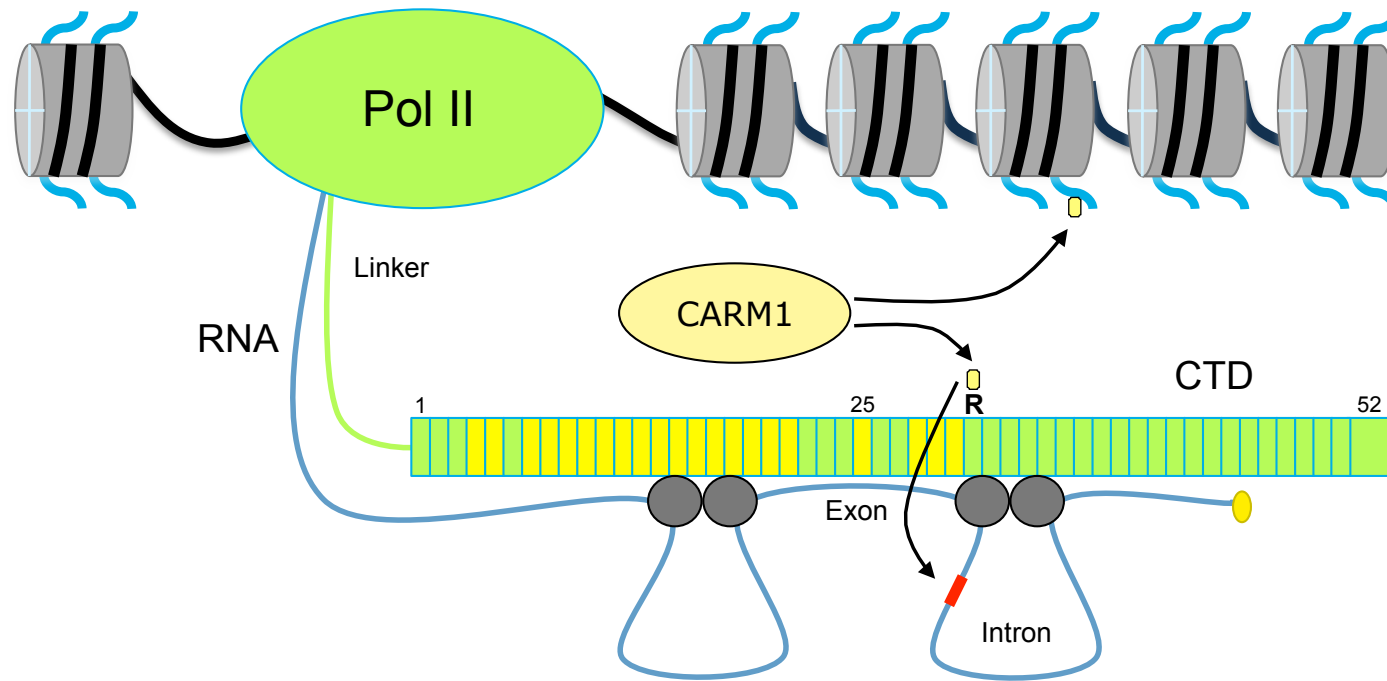
Sims III, R.J., Rojas, L.A., Beck, D., Bonasio, R., Schüller, R., Drury III, W.J., Eick, D., and Reinberg, D. (2011)
Science, 332, 99-103

The carboxy-terminal domain (CTD) of RNA polymerase II (RNAPII) in mammals undergoes extensive posttranslational modification, which is essential for transcriptional initiation and elongation. Here, we show that the CTD of RNAPII is methylated at a single arginine (R1810) by the coactivator-associated arginine methyltransferase 1 (CARM1). Although methylation at R1810 is present on the hyperphosphorylated form of RNAPII in vivo, Ser2 or Ser5 phosphorylation inhibits CARM1 activity toward this site in vitro, suggesting that methylation occurs before transcription initiation. Mutation of R1810 results in the misexpression of a variety of small nuclear RNAs and small nucleolar RNAs, an effect that is also observed in *Carm1(-/-)* mouse embryo fibroblasts. These results demonstrate that CTD methylation facilitates the expression of select RNAs, perhaps serving to discriminate the RNAPII-associated machinery recruited to distinct gene types.

1. Sims III, R.J., Rojas, L.A., Beck, D., Bonasio, R., Schüller, R., Drury III, W.J., Eick, D., and Reinberg, D.
The C-terminal domain of RNA polymerase II is modified by site-specific methylation.
Science, **332**, 99-103 (2011)
2. Koch, F., Fenouil, R., Gut, M., Cauchy, P., Albert, T.K., Zaccharias-Cabeza, J., Spicuglia, S., Lamy de la Chapelle, A., Heidemann, M., Hintermair, C., Eick, D., Gut, I., Ferrier, P., Andrau, J.C.
Transcription initiation platforms and GTF recruitment at tissue specific enhancers and promoters.
Nature Structural & Molecular Biology, **18**, 956-963 (2011)
3. de Almeida, S.F., Grosso, A.R., Koch, F., Fenouil, R., Carvalho, S., Andrade, J., Levezinho, H., Gut, M., Eick, D., Gut, I., Andrau, J.C., Ferrier, P., and Carmo-Fonseca, M.
Splicing enhances recruitment of methyltransferase HYPB/Setd2 and methylation of histone H3 lysine 36.
Nature Structural & Molecular Biology, **18**, 977-983 (2011)

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— snoRNA

○ Methyl-

Y S P T S P S Consensus-Heptad-Peptide

R

CARM1 is a histone and CTD specific arginine methylase and regulates cellular levels of snRNAs and snoRNA