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RNA polymerases: transcription and beyond

RNA polymerases are large macromolecular assemblies that transcribe the genome in all organisms. Because RNA polymerases work on the chromatin, their activity is connected to other cellular processes such as DNA repair and DNA integration. Eukaryotic RNA polymerases I and III (Pol I and Pol III) synthesize untranslated RNAs that mediate protein synthesis, regulate gene activity or catalyze chemical reactions. In this talk, I will present results on the roles of Saccharomyces cerevisiae Pol I and Pol III in transcription, DNA lesion detection and retrotransposon integration. On one hand, Pol I transcription is regulated through enzyme hibernation (eLife 2017), a mechanism that was later shown to operate in other RNA polymerases. On the other hand, detection of DNA lesions by Pol I depends on its intrinsic RNA cleavage activity and differs from other RNA polymerases (PNAS 2018; unpublished data). Finally, Pol III mediates integration of yeast retrotransposon Ty1 upstream of transfer RNA genes, a mechanism that ensures insertion at safe genome locations (Nat Commun. 2023). Altogether, our results underscore the prominent role of RNA polymerases in chromatin-associated cellular processes.

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