

RNA Polymerase Cooperation with the Ribosome during Translation Initiation

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Protein synthesis begins by forming a ribosome-mRNA complex. In bacteria, the 30S ribosomal subunit is recruited to many mRNAs through base pairing with the Shine Dalgarno (SD) sequence and RNA binding by ribosomal protein bS1. Translation can initiate on nascent mRNAs and RNA polymerase (RNAP) can promote recruitment of the pioneering 30S subunit. Here we examined ribosome recruitment to nascent mRNAs using cryo-EM, single-molecule fluorescence co-localization, and in-cell crosslinking mass spectrometry. We show that bS1 delivers the mRNA to the ribosome for SD duplex formation and 30S subunit activation. Additionally, bS1 mediates the stimulation of translation initiation by RNAP. Together, our work provides a mechanistic framework for how the SD duplex, ribosomal proteins and RNAP cooperate in 30S recruitment to mRNAs and establish transcription-translation coupling.