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Structural Basis of Eukaryotic Transcription: Nucleotide Addition and the Role of TFIIB in Initiation. David Bushnell, Ken Westover, Ralph Davis, Roger Kornberg, Dept. of Structural Biology, Stanford Univ., Stanford, CA, 94305-5126.

RNA polymerase II (pol II) assembles with five general transcription factors and Mediator at every promoter prior to the initiation of transcription (Table 1). This giant complex of 50 or more polypeptides, with a total mass in excess of 2.5 million Daltons, recognizes promoter DNA, responds to regulatory information, and synthesizes the first dozen residues of the RNA transcript. Elucidation of the structure and mechanism of the initiation complex is crucial for understanding transcriptional regulation. We took a first step in this direction with the X-ray structure determination of pol II, itself a complex of 12 polypeptides and mass of 0.5 Mdal. We also determined the structure of pol II in the act of transcription, revealing the template unwound in a “transcription bubble” and the transcript in a DNA-RNA hybrid. We now report the structure of a cocrystal of pol II with general transcription factor IIB (TFIIB), the critical component for both assembly and disassembly of the transcription initiation complex.