

Stanford



Roger Kornberg

Mrs. George A. Winzer Professor in Medicine
Structural Biology

Bio

ACADEMIC APPOINTMENTS

- Professor, Structural Biology
- Member, Bio-X

LINKS

- Nobel Prize Press Coverage: <http://mednews.stanford.edu/releases/2006/october/kornberg.html>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our goal is to elucidate the fundamental basis of gene regulation. We study the control of transcription, the first step in the pathway of gene expression. Current work focuses on discovery of the molecular machines involved in transcription, reconstitution of the process with purified components, structure determination of the transcription machinery, and structure-function relationships in chromatin, the natural DNA template for transcription.

Highlights of work from the past three years include:

1. Discovery of a human homolog of the 20-protein yeast Mediator complex. Mediator is the central processing unit of gene regulation, receiving both positive and negative inputs and transducing the information to the transcription machinery.
2. Structure determination of 10-subunit, half million Dalton RNA polymerase II, in the act of transcription, with template DNA and product RNA, by X-ray crystallography at atomic resolution.
3. Structure determination of the entire transcription initiation complex by two-dimensional protein crystallography.
4. Discovery of a stably altered nucleosome produced by a purified chromatin-remodeling complex.

Current work is directed towards the structure of the entire transcription apparatus at atomic resolution and the mechanism of transcription control in living cells.

Teaching

STANFORD ADVISEES

Med Scholar Project Advisor

Suhas Rao

Postdoctoral Faculty Sponsor

Jordan Feigerle

Doctoral Dissertation Advisor (AC)

Andrew Beel, Suhas Rao, Adrian Sanborn

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)
- Structural Biology (Phd Program)

Publications

PUBLICATIONS

- **Real-time observation of the initiation of RNA polymerase II transcription.** *Nature*
Fazal, F. M., Meng, C. A., Murakami, K., Kornberg, R. D., Block, S. M.
2015; 525 (7568): 274-277
- **Uncoupling Promoter Opening from Start-Site Scanning.** *Molecular cell*
Murakami, K., Mattei, P., Davis, R. E., Jin, H., Kaplan, C. D., Kornberg, R. D.
2015; 59 (1): 133-138
- **Role of DNA sequence in chromatin remodeling and the formation of nucleosome-free regions** *GENES & DEVELOPMENT*
Lorch, Y., Maier-Davis, B., Kornberg, R. D.
2014; 28 (22): 2492-2497
- **Nanoparticle imaging. Electron microscopy of gold nanoparticles at atomic resolution.** *Science*
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2014; 345 (6199): 909-912
- **Electron microscopy of gold nanoparticles at atomic resolution** *SCIENCE*
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- **Transcription factors TFIIF and TFIIIS promote transcript elongation by RNA polymerase II by synergistic and independent mechanisms** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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2013; 342 (6159): 709-?
- **Architecture of an RNA polymerase II transcription pre-initiation complex.** *Science*
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- **Formation and Fate of a Complete 31-Protein RNA Polymerase II Transcription Preinitiation Complex** *JOURNAL OF BIOLOGICAL CHEMISTRY*

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- Murakami, K., Calero, G., Brown, C. R., Liu, X., Davis, R. E., Boeger, H., Kornberg, R. D.
2013; 288 (9): 6325-6332
- **RNA polymerase II transcription: Structure and mechanism** *BIOCHIMICA ET BIOPHYSICA ACTA-GENE REGULATORY MECHANISMS*
Liu, X., Bushnell, D. A., Kornberg, R. D.
2013; 1829 (1): 2-8
 - **Structure of the Mediator Head module bound to the carboxy-terminal domain of RNA polymerase II** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Robinson, P. J., Bushnell, D. A., Trnka, M. J., Burlingame, A. L., Kornberg, R. D.
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 - **Trigger loop dynamics mediate the balance between the transcriptional fidelity and speed of RNA polymerase II** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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 - **Tfb6, a previously unidentified subunit of the general transcription factor TFIIF, facilitates dissociation of Ssl2 helicase after transcription initiation** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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 - **Lock and Key to Transcription: sigma-DNA Interaction** *CELL*
Liu, X., Bushnell, D. A., Kornberg, R. D.
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 - **Selective removal of promoter nucleosomes by the RSC chromatin-remodeling complex** *NATURE STRUCTURAL & MOLECULAR BIOLOGY*
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 - **Isolation of an activator-dependent, promoter-specific chromatin remodeling factor** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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Hulkko, E., Lopez-Acevedo, O., Koivisto, J., Levi-Kalisman, Y., Kornberg, R. D., Pettersson, M., Hakkinen, H.
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 - **RNA polymerase II trigger loop residues stabilize and position the incoming nucleotide triphosphate in transcription** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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Lorch, Y., Maier-Davis, B., Kornberg, R. D.
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- **Structure of an RNA Polymerase II-TFIIB Complex and the Transcription Initiation Mechanism** *SCIENCE*
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- **Structural basis of transcription: Role of the trigger loop in substrate specificity and catalysis** *CELL*
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- **Head module control of mediator interactions** *MOLECULAR CELL*
Takagi, Y., Calero, G., Komori, H., Brown, J. A., Ehrensberger, A. H., Hudmon, A., Asturias, F., Kornberg, R. D.
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 - **Structural basis of transcription: An RNA polymerase II-TFIIB cocrystal at 4.5 angstroms** *SCIENCE*
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 - **Purification of defined chromosomal domains** *CHROMATIN AND CHROMATIN REMODELING ENZYMES, PT A*
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