

## Structural basis for bacterial transcription activation

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### **Abstract**

For most genes in most bacteria, the key regulatory step that modulates gene expression seems to be mediated by transcription factors (TFs), initiation  $\sigma$  factors, and RNA polymerase. The activating TFs increase gene expression by making direct interactions with promoter DNA, initiation  $\sigma$  factors, and/or RNAP. However, the underlying structural basis and molecular mechanism are largely unknown. We have solved cryo-EM structures of transcription activation complexes comprising bacterial RNA polymerase, initiation  $\sigma$  factors, promoter DNA, and three representative activating TFs. The structures visualize the global architecture of transcription machinery and TFs engaged with promoter DNA, and provide structural basis for understanding bacterial transcription activation.

### **Brief Biography**

Yu Zhang is a principal investigator in Key laboratory of Synthetic Biology, Shanghai Institute of Plant Physiology and Ecology, Chinese Academy of Sciences (SIPPE, CAS). He joined the SIPPE, CAS in 2015 and leads a laboratory studying structural basis and molecular mechanism of bacterial transcription and transcription regulation.

### **Brief CV**

#### **Yu Zhang, Ph.D.**

Key laboratory of Synthetic Biology, Shanghai Institute of Plant Physiology and Ecology, Chinese Academy of Sciences.

#### **Education:**

B.S. Biology, Fudan University, China, 2000

Ph.D. Drug design, Shanghai Institute of Materia Medica, CAS, China, 2004

#### **Research Interests:**

1. Microbial Gene Regulation
2. RNA Polymerase Structure–Function
3. Discovery of novel bactericidal antibiotics

## Selected publications

1. Linlin You, Jing Shi, Liqiang Shen, Lingting Li, Chengli Fang, Chengzhi Yu, Wenbo Cheng, Yu Feng\*, **Yu Zhang\***. Structural basis for transcription antitermination at bacterial intrinsic terminator. *Nature communications* 2019. 10(1) :3048
2. Chengli Fang<sup>#</sup>, Lingting Li<sup>#</sup>, Liqiang Shen, Jing Shi, Sheng Wang\*, Yu Feng\*, **Yu Zhang\***. Structures and mechanism of transcription initiation by bacterial ECF factors. *Nucleic Acids Research* 2019. 47(13):7094
3. Lingting Li<sup>#</sup>, Chengli Fang<sup>#</sup>, Ningning Zhuang, Tiantian Wang, **Yu Zhang\***. Structural basis for transcription initiation by bacterial ECF  $\sigma$  factors. *Nature Communications* 2019. 10(1) :1153
4. Xiaoxian Wu<sup>#</sup>, Diane L. Haakonsen<sup>#</sup>, Allen G. Sanderlin, Yue J, Liu, Liqiang Shen, Ningning Zhuang, Michael T. Laub\*, **Yu Zhang\***. Structural insights into the unique mechanism of transcription activation by *Caulobacter crescentus* GcrA. *Nucleic Acids Research* 2018. 46 (6): 3245-3256.
5. Sonia I. Maffioli<sup>#</sup>, **Yu Zhang\***, David Degen<sup>#</sup>, . . . , Stefano Donadio\*, and Richard H. Ebright\*. Antibacterial nucleoside-analog inhibitor of bacterial RNA polymerase: pseudouridimycin. *Cell* 2017, 15;169(7):1240-1248.e23
6. Jeremy G. Bird<sup>#</sup>, **Yu Zhang\***, Yuan Tian, Natalya Panova, Ivan Barvík, Landon Greene, Min Liu, Brian Buckley, Libor Krásný, Jeehiun K. Lee, Craig D. Kaplan, Richard H. Ebright\*, Bryce E. Nickels\*. The mechanism of RNA 5' capping with NAD<sup>+</sup>, NADH, and desphospho-CoA. *Nature* 2016, 535(7612): 444-447.
7. **Yu Zhang**, Yu Feng, Sujoy Chatterjee, Steve Tuske, Mary X Ho, Eddy Arnold, Richard H Ebright\*. Structural basis of transcription initiation. *Science* 2012, 338 (6110), 1076-1080