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2016- Present	Professor, Ulsan National Institute of Science and Technology
2008~2016	Associate Research Scientist, Columbia University, USA
2006~2008	Research professor, Korea University
2006 PhD	Seoul National University
1999~2003	Samsung SDI
1999 MS	Seoul National University
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Research Interests:

DNA damage repair, chromatin dynamics, DNA replication, transcription, single-molecule imaging

Selected Publications:

1. Hwang WC†, Park K†, Park S†, Cheon NY†, **Lee JY**†, Hwang T, Lee S, Lee J-M, Ju MK, Lee JR, Kwon Y-R, Jo W-L, Kim M, Kim Y-J & Kim H, Impaired binding affinity of YTHDC1 with METTL3/METTL14 results in R-loop accumulation in myelodysplastic neoplasms with DDX41 mutation. ***Leukemia 2024***; 38: 1-12.

2. Kim S, Shin WH, Kang Y, Kim H, and **Lee JY**, Direct visualization of replication and R-loop collision using single-molecule imaging. ***Nucleic Acids Res 2024***; 52: 259-273.

3. Kang Y†, Han YG†, Khim KW, Choi WG, Ju MK, Park K, Choi JH*, Kim H*, and **Lee JY***, Alteration of replication protein A binding mode on single-stranded DNA by NSMF potentiates RPA phosphorylation by ATR kinase. ***Nucleic Acids Res 2023***; 51: v7936-7950.

4. Oh J-M†, Kang Y†, Park J, Sung Y, Kim D, Seo Y, Lee EA, Ra JS, Amarsanaa, E, Park YU, Hwang, JM, Kim H, Scharer OD, Cho SW, Lee C, Takata K, **Lee JY***, and Myung K*, MSH2-MSH3 promotes DNA end resection during HR and blocks TMEJ through interaction with SMARCAD1 and EXO1. ***Nucleic Acids Res 2023***; 51: 5584-5602

5. HJ†, Cheon NY†, Park H, Jeong GW, Ye BJ, Yoo EJ, Lee JH, Hur JH, Lee EA, Lee K, Choi SY, Lee-Kwon W, Myung K*, **Lee JY***, and Kwon HM*, TonEBP recognizes R-loops and initiates m6A RNA methylation for R-loop resolution. ***Nucleic Acids Research. 2021***; 49: 269-284.

Direct visualization of replication and R-loop collision using single-molecule imaging

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Abstract

R-loops are three-stranded nucleic acid structures that can cause replication stress by blocking replication fork progression. However, detailed mechanism underlying the collision of DNA replication forks and R-loop remains elusive. To investigate how R-loops induce replication stress, we use single-molecule fluorescence imaging to directly visualize the collision of replicating Phi29 DNA polymerase (DNAp), the simplest replication system, and R-loops. We demonstrate that a single R-loop can block replication and the blockage is more pronounced when an RNA-DNA hybrid is on the nontemplate strand blocks. We show that this asymmetry results from secondary structure formation on the nontemplate strand, which impedes the progression of Phi29 DNAp. We also show that G-quadruplex formation on the displaced single-stranded DNA in an R-loop enhances the replication stalling. Moreover, we observe the collision between Phi29 DNAp and RNA transcripts synthesized by T7 RNA polymerase (T7 RNAp). RNA transcripts cause more stalling because of the presence of T7 RNAp. Our work provides insights into how R-loops impede DNA replication at single molecule resolution.

1. Kim S, Shin WH, Kang Y, Kim H, and Lee JY, Direct visualization of replication and R-loop collision using single-molecule imaging. ***Nucleic Acids Res 2024***; 52: 259-273.