Curriculum Vitae

Keewon Sung

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PERSONAL

Department of Chemistry
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EDUCATION

2015 – Present **Ph.D. candidate** in Biophysical Chemistry, 2021
M.Sc. in Chemistry, 2017
Seoul National University
Advisor: Prof. Seong Keun Kim
Ph.D. Thesis Title:
"Single-Molecule Dynamics of Protein-Nucleic Acid Interactions: CRISPR-Cas9 Nuclease Engineering and Telomere Maintenance"

2009 – 2015 **B.S.** in Chemical and Biological Engineering, 2015
Seoul National University
(military service: 2012-2013)
Summa cum laude (*1st-place honor in chemical and biological engineering*)

RESEARCH AREAS

- Topics: 1) **Protein-nucleic acid interactions** for their biological functioning (CRISPR-Cas9; telomere and G-quadruplexes; synthetic nucleic acids such as BNA and LNA; etc.)
  2) Cellular dynamics and intracellular signal/force transduction (cellular adhesion, migration, and contraction)

- Wet lab techniques: [*in vitro*] site-directed mutagenesis, gel electrophoresis, immobilized metal affinity chromatography (IMAC), fast protein liquid chromatography (FPLC)
  [*in cells*] mammalian cell culture

- Spectroscopic techniques: [*in vitro*] **single-molecule fluorescence spectroscopy** (FRET, PIFE, etc.), total internal reflection fluorescence (TIRF) microscopy, alternating laser excitation (ALEX)
  [*in cells*] tension gauge tether (TGT) assays for single-cell mechanobiology

- Dry lab techniques: **MATLAB (skillful)**, IDL, and LabVIEW

RESEARCH EXPERIENCE

Biophysical Chemistry & Biochemistry; Single-molecule enzymology & Protein engineering
Seoul National University 07/2014 – Present
Advisor: Prof. Seong Keun Kim (Department of Chemistry)
(as an undergraduate, M.Sc., and Ph.D. student)

Mechanobiology; Excitation-contraction coupling at the single-cell level 02/2019 – 04/2019
Johns Hopkins University School of Medicine
Advisor: **Prof. Taekjip Ha** (Department of Biophysics and Biophysical Chemistry)
(as a visiting scientist)

Molecular Biology; Recombinant protein expression and purification 09/2014 – 12/2014
Seoul National University
Advisor: Prof. Ji-Sook Hahn (Department of Chemical and Biological Engineering)
(within an undergraduate research course)

Biophysics; Single-molecule spectroscopy 03/2014 – 06/2014
Seoul National University
Advisor: Prof. Sungchul Hohng (Department of Biophysics and Chemical Biology)
(within an undergraduate research internship)

HONORS and AWARDS

2020	**KAGE Young Researcher Award** (will be announced on November 10th) by Korean Association for Genome Editing (KAGE)
2019	Best Poster Award by the Organizing Committee of East Asian Symposium (EAS) on Single-Molecule Biological Sciences
2018 – Present	**Global Ph.D. Fellowship** by **National Research Foundation (NRF)** of Korea
2018	Outstanding Oral Presentation Award by Korean Physical Society (KPS)
2017 – 2018	Fellowship for Future Generations of Foundation Studies by Seoul National University
2015 – 2016	Woosan Scholarship for Graduate Students by Woosan Foundation
2011 – 2015	SNU Tomorrow's Edge Membership (STEM); the Honor Society of Seoul National University by Seoul National University
2009 – 2015	Presidential Science Scholarship by Korea Student Aid Foundation (KOSAF)

CONFERENCE PRESENTATIONS

● International:

64th Annual Meeting of the Biophysical Society (San Diego, CA, USA; 02/2020),
"Characteristic interactions between BRCA2 and G-quadruplex structures for telomere maintenance"; ***Poster***.

2nd East Asian Symposium on Single-Molecule Biological Sciences (Seoul, Korea; 07/2019),
"A regulatory mechanism of CRISPR-Cas9 nuclease specificity revealed from single-molecule structural dynamics"; ***Poster [Awarded]***.

63rd Annual Meeting of the Biophysical Society (Baltimore, MD, USA; 03/2019),
"Structural rearrangement of DNA for CRISPR-Cas9 nuclease specificity regulated by the REC2 domain"; ***Poster***.

2017 SNU-RIKEN Young Investigator Workshop on Molecular Nanospectroscopy (Wako, Japan; 01/2017),
"Structural roles of guide RNAs in the nuclease activity of Cas9 endonuclease"; ***Oral Presentation***.

● Domestic:

2018 Korean Physical Society Fall Meeting (Changwon, Korea; 10/2018),
"Structural dynamics of DNA for CRISPR-Cas9 nuclease specificity regulated by electrostatic interaction with the REC2 domain"; ***Oral Presentation for Molecular & Cellular Biological Physics [Awarded]***.

The 122nd General Meeting of the Korean Chemical Society (Daegu, Korea; 10/2018),
"Target specificity of the CRISPR-Cas9 nuclease regulated by the REC2 domain via structural rearrangement of DNA"; ***Oral Presentation of Young Biological Chemists***.

2017 Korean Physical Society Fall Meeting (Gyeongju, Korea; 10/2017),
"Microscopic mechanism of R-loop expansion for Cas9 nuclease activation"; ***Poster***.

The 118th General Meeting of the Korean Chemical Society (Busan, Korea; 10/2016),
"Single-molecule study on guide RNAs as structural regulators for the activation of Cas9 endonuclease"; ***Poster***.

PUBLICATIONS

10. **K. Sung**, J. Lee, H. Lee, and S. K. Kim*
"The G-triplex-derived intermediate of dynamic G-quadruplexes in the telomere is recognized by BRCA2"
Manuscript in preparation.

9. S. H. Bae, **K. Sung**, and S. K. Kim*
"Linear unmixing analysis for single-molecule FRET spectroscopy of fluorophores with large spectral overlap"
Manuscript in preparation.

8. M. H. Jo†, B. C. Kim†, **K. Sung**, R. A. Panettieri Jr., S. S. An*, and T. Ha* (†equal contribution)
"Repurposing the double helix to physically map the excitation-contraction coupling in human airway smooth muscle cells"
Manuscript in preparation.

7. J. Lee†, **K. Sung†**, S. Y. Joo, S. K. Kim*, and H. Lee* **(†equal contribution)**
"BRCA2 protects the telomeric G-quadruplex for the homeostasis of telomere replication"
To be submitted in Nat. Struct. Mol. Biol. (2020).

6. **K. Sung†**, Y. Jung†, S. Bae*, and S. K. Kim* (†equal contribution)
"Enhanced specificity of Cas9 nuclease by positive charge incorporation on the REC2 domain"
To be submitted in Nat. Chem. Biol. (2020).

5. S. Y. Bak†, Y. Jung†, J. Park, **K. Sung**, H. K. Jang, S. Bae*, and S. K. Kim*
"Two convergent mechanisms of specificity-enhanced Cas9 variants that regulate RNA-DNA duplexation dynamics"
To be submitted in Nucleic Acids Res. (2020).

4. J. Park, **K. Sung**, S. Y. Bak, H. R. Koh*, and S. K. Kim*
"Positive identification of DNA cleavage by CRISPR-Cas9 using pyrene excimer fluorescence to detect a subnanometer structural change"
J. Phys. Chem. Lett. 10, 6208-6212 (2019).

3. **K. Sung**, J. Park, Y. Kim, N. K. Lee, and S. K. Kim*
"Target specificity of Cas9 nuclease via DNA rearrangement regulated by the REC2 domain"
J. Am. Chem. Soc. *(Communication)* 140, 7778-7781 (2018).

2. C. R. Cromwell, **K. Sung**, J. Park, A. R. Krysler, J. Jovel, S. K. Kim, and B. P. Hubbard*
"Incorporation of bridged nucleic acids into CRISPR RNAs improves Cas9 endonuclease specificity"
Nature Commun. 9, 1448 (2018).

1. Y. Lim, S. Y. Bak, **K. Sung**, E. Jeong, S. H. Lee, J.-S. Kim, S. Bae*, and S. K. Kim*
"Structural roles of guide RNAs in the nuclease activity of Cas9 endonuclease"
Nature Commun. 7, 13350 (2016).