Curriculum Vitae

Keewon Sung, Ph.D.

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CONTACT INFORMATION

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EDUCATION

Ph.D. **Seoul National University**, 2017 – 2021
Biophysical Chemistry
Ph.D. Thesis:
"Single-Molecule Dynamics of Protein-Nucleic Acid Interactions: CRISPR-Cas9 Nuclease Engineering and Telomere Maintenance"

M.S. Seoul National University, 2015 – 2017
Physical Chemistry

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

RESEARCH EXPERIENCE

Systems Molecular Biology/High-Throughput Biochemistry 03/2021 – present
- Postdoctoral Fellow
Laboratory of Prof. Hyeshik Chang, School of Biological Sciences, Seoul National University
Center for RNA Research, Institute for Basic Science (IBS)

Single-Molecule Spectroscopy, Enzymology & Protein Engineering 07/2014 – 02/2021
- Graduate Student *& undergraduate research intern*
Laboratory of Prof. Seong Keun Kim, Department of Chemistry, Seoul National University

Single-Cell Molecular Mechanobiology 02/2019 – 04/2019
- Visiting Scientist
Laboratory of Prof. Taekjip Ha, Department of Biophysics and Biophysical Chemistry,
Johns Hopkins University School of Medicine, USA

Biomolecular Engineering 09/2014 – 12/2014
- Undergraduate research course
Laboratory of Prof. Ji-Sook Hahn, Department of Chemical and Biological Engineering,
Seoul National University

Single-Molecule Biophysics 03/2014 – 06/2014
- *Undergraduate research internship*
Laboratory of Prof. Sungchul Hohng, Department of Biophysics and Chemical Biology,
Seoul National University

RESEARCH AREAS

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

- 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

- High-throughput techniques: **Nanopore sequencing**

- 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, **Crosslinking immunoprecipitation** (CLIP)

- Dry lab techniques: **MATLAB, Python,** IDL, and LabVIEW

HONORS & AWARDS

2021 **The Best Ph.D. Thesis Award**
by College of Natural Sciences, Seoul National University

2020 **KAGE Young Researcher Award**
by Korean Association for Genome Editing (KAGE)

2019 Best Poster Award
by the Committee of East Asian Symposium (EAS) on Single-Molecule Biological Sciences

2018 – 2021 **Global Ph.D. Fellowship**
by **National Research Foundation (NRF)** of Korea

2018 Outstanding Oral Presentation Award
by Korean Physical Society (KPS)

2017 – 2018 **Basic Science Fellowship for the Next Generation Research**
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 :

2020 Korean Association for Genome Editing Annual Symposium (Seoul, Korea; 11/2020),
"Mechanisms of Cas9 nuclease specificity revealed by single-molecule analysis"; ***Invited Talk as a Laureate of KAGE Young Researcher Award***.

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 [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***.

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***.

PATENTS

"Novel Cas9 protein variants with improved target specificity and use thereof"
Patent pending; 31/12/2020; Korea (**K. Sung**, Y. Jung, S. Bae, and S. K. Kim).

PUBLICATIONS

7. J. Lee[†], **K. Sung**[†], S. Y. Joo, S. K. Kim*, and H. Lee* **([†]equal contribution)**
"Dynamic interaction of BRCA2 with the telomeric G-quadruplex underlies the telomere replication homeostasis"
To be submitted (2021).

6. S. Y. Bak[†], Y. Jung[†], J. Park[†], **K. Sung**[†], H.-K. Jang, S. Bae*, and S. K. Kim* **([†]equal contribution)**
"Quantitative assessment of Cas9 engineering strategies for target specificity enhancement by single-molecule kinetic analysis"
Manuscript under revision (2021).

5. M. H. Jo, B. C. Kim, **K. Sung**, R. Panettieri Jr., S. An*, J. Liu*, and T. Ha*
"Molecular nanomechanical mapping of histamine-induced smooth muscle cell contraction and shortening"
Manuscript submitted (2021).

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).