

CURRICULUM VITAE

Chirlmin Joo

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The Netherlands		

APPOINTMENTS AND CAREERS

Sep 2018 – Co-Director, Kavli Institute of Nanoscience Delft

Jan 2016 – Associate Professor (UHD), Department of BioNanoScience, Delft University of Technology (*Principle Investigator*)

Jan 2014 – Dec 2015 Assistant Professor (UD1), Department of BioNanoScience, Delft University of Technology (*Principle Investigator*)

Jan 2011 – Dec 2013 Assistant Professor (UD2), Department of BioNanoScience, Delft University of Technology (*Principle Investigator*)

Jun 2009 – Dec 2010 Research Professor, School of Biological Sciences, Seoul National University, Korea (P.I.: Dr. V. Narry Kim)

Sep 2007 – May 2009 Post-Doctoral Fellow, School of Biological Sciences, Seoul National University, Korea (Mentor: Dr. V. Narry Kim)

May 2007 – Aug 2007 Post-Doctoral Fellow, Depts. of Bioengineering & Physics, University of Illinois, USA (Mentors: Drs. Y. Wang and T. Ha)

Feb 1997 – Apr 1999 Military Service (mandatory), Republic of Korea Army

EDUCATION

Ph.D. University of Illinois at Urbana-Champaign, USA (physics, May 2007)
Single-Molecule FRET Study on the RecA-Mediated DNA Repair (Advisor: Dr. Taekjip Ha)

B.S. Seoul National University, South Korea (physics, *summa cum laude*, Feb 2002)
Microcanonical Monte Carlo Simulation of Fermions and Bosons (Advisor: Dr. Insuk Yu)

PUBLICATIONS (RESEARCH ARTICLES)

* *corresponding authorship*

V. Globyte, S. H. Lee, T. Bae, J.-S. Kim*, **C. Joo***, "CRISPR Cas9 searches for a protospacer adjacent motif by one-dimensional diffusion" *EMBO Journal* e99466 (2018)

- Presented in Dutch Biophysics Meeting by Globyte (2017)

I. Severins, M. Szczepaniak*, **C. Joo*** "Multiplex single-molecule DNA barcoding using an oligonucleotide ligation assay" *Biophysical Journal* 115(6):957-967 (2018)

L. Loeff, S. J. J. Brouns*, **C. Joo*** "Repetitive DNA reeling by the Cascade-Cas3 complex in nucleotide unwinding steps" *Molecular Cell* 70(3):385-394 (2018)

- Presented in Annual Meeting of the RNA Society by Loeff (2018)

- Presented in CRISPR Conference in Montana (2017)

- Presented in Zing Conferences (nucleic acids) (2016)

J. van Ginkel, M. Filius, M. Szczepaniak, P. Tulinski, A. S. Meyer*, **C. Joo*** "Single-molecule peptide fingerprinting" *Proceedings of the National Academy of Sciences* 27;115(13):3338-3343 (2018)

- Presented in Single-Molecule Protein Sequencing Conference by Filius (2017)

- Presented in Biophysical Society Meeting (2017)

M. Fareh, J. van Lopik, I. Katechis, A. W. Bronkhorst, A. C. Haagsma, R. P. van Rij*, **C. Joo*** "Viral suppressors of RNAi employ a rapid screening mode to discriminate viral RNA from cellular small RNA" *Nucleic Acids Research* 46(6):3187-3197 (2018)

S. M. Klum, S. D. Chandradoss, N. T. Schirle, **C. Joo***, I. J. MacRae* "Helix-7 in Argonaute2 shapes the microRNA seed region for rapid target recognition" *EMBO Journal* 37(1):75-88 (2017)

- Presented in Dutch Biophysics Meeting (2017)

S. H. Kim, T. Ahn, T. J. Cui, S. Chauhan, J. Sung, **C. Joo**, D. Kim "RecA filament maintains the structural integrity using ATP-driven internal dynamics" *Science Advances* 3(9):e1700676 (2017)

L. Restrepo-Pérez, S. John, A. Aksimentiev*, **C. Joo***, C. Dekker*, "SDS-Assisted Protein Transport Through Solid-State Nanopores" *Nanoscale* 9(32):11685-11693 (2017)

- Presented in Biophysical Society Meeting by Restrepo (2017)

- Presented in Nanopore Conference in Bremen by Restrepo (2017)

D. C. Swarts, M. Szczepaniak, G. Sheng, S. D. Chandradoss, Y. Zhu, E. M. Timmers, Y. Zhang, J. Lou, Y. Wang*, **C. Joo***, J. van der Oost* "Autonomous generation and loading of DNA guides by bacterial Argonaute", *Molecular Cell*, 65(6):985-998.e6 (2017)

M. Fareh, K.-H. Yeom, A. C. Haagsma, S. Chauhan, I. Heo, & **C. Joo*** "TRBP ensures efficient Dicer processing of precursor microRNA in RNA crowded environments" *Nature Communications*, 7:13694 (2016)

- Presented in SignalLife Conference by Fareh (2018)
- Presented in Keystone Symposium by Fareh (2017)
- Presented in Annual Meeting of the RNA Society by Fareh (2016)
- Presented in IBS-CNRS Symposium in Seoul (2016)

N. T. Schirle, J. Sheu-Gruttadauria, S. D. Chandradoss, **C. Joo***, & I. J. MacRae* "Water-mediated recognition of t1-adenosine anchors Argonaute2 to microRNA targets." *eLife*, doi: 10.7554/eLife.07646 (2015)

Y. Yao, M. Docter, J. van Ginkel, D. de Ridder* and **C. Joo*** "Computational assessment of single-molecule protein fingerprinting", *Physical Biology*, 12(5):055003 (2015)

- Presented in Single-Molecule Protein Sequencing Conference (2017)
- Presented in Biophysical Society Meeting (2017)

S. D. Chandradoss, N. T. Schirle, M. Szczepaniak, I. J. MacRae*, & **C. Joo*** "A Dynamic Search Process Underlies MicroRNA Targeting" *Cell*, 162(1):96-107 (2015)

- Featured by *Molecular Cell*
- Presented in Gordon Conference (Single-molecule) (2016)
- Presented in EMBL Symposium (Non-coding genome) (2015)
- Presented in Gordon Conference (Nucleic Acids) by Chandradoss (2015)
- Presented in Microsymposium by Chandradoss (2014)

B. Kim, M. Ha, L. Loeff, H. Chang, D. K. Simanshu, S. Li, M. Fareh, D. J. Patel, **C. Joo***, & V. N. Kim* "TUT7 controls the fate of precursor microRNAs by using three different uridylation mechanisms" *EMBO Journal*, 34(13):1801-15 (2015)

- Presented in Annual Meeting of the RNA Society by B. Kim (2015)

T. R. Blosser, L. Loeff, E. R. Westra, M. Vlot, T. Künne, M. Sobota, C. Dekker, S. J. J. Brouns,* & **C. Joo*** "Two distinct DNA binding modes guide dual roles of a CRISPR-Cas protein complex" *Molecular Cell*, 58(1):50-60 (2015)

- Presented in Quantitative BioImaging by Loeff (2016)
- Presented in Annual Meeting of the RNA Society (2015)
- Presented in CRISPR New York by Loeff (2015)
- Presented in Biophysical Society Meeting by Blosser (2014)

T. J. Kim, **C. Joo**, J. Seong, R. Vafabakhsh, E. L. Botvinick, M. W. Berns, A. E. Palmer, N. Wang, T. Ha, E. Jakobsson, J. Sun, Y. Wang "Distinct mechanisms regulating mechanical force-induced Ca²⁺ signals at the plasma membrane and the ER in human MSCs" *eLife*, 4:e04876 (2015)

S. H. Kim, J. Park, **C. Joo**, D. Kim, T. Ha "Dynamic Growth and Shrinkage Govern the pH Dependence of RecA Filament Stability" *PLoS One*, 10(1):e0115611 (2015)

S. H. Kim, K. Rangunathan, J. Park, **C. Joo**, D. Kim, T. Ha " Cooperative conformational transitions keep RecA filament active during ATPase cycle" *Journal of the American Chemical Society*, 136(42):14796-800 (2014)

S. H. Kim, **C. Joo**, T. Ha, D. Kim "Molecular mechanism of sequence-dependent stability of RecA filament" *Nucleic Acids Research*, 41(16):7738-44 (2013)

K. Rangunathan, **C. Joo**, T. Ha "Real time observation of strand exchange reaction with high spatiotemporal resolution" *Structure*, 19, 1064-1073 (2011)

- Featured article in *Structure*

- Preview by *Structure*

- Selected in Faculty of 1000

K. H. Yeom, I. Heo, J. Lee, S. Hohng, V. N. Kim*, **C. Joo*** "Single molecule approach to immunoprecipitated protein complexes: insights into miRNA uridylation" *EMBO Reports*, 12, 690-696 (2011)

- Featured by *Nature Biotechnology*

- Presented in Zing Conferences (nucleic acids) (2012)

- Presented in Microsymposium (2012)

- Presented in Biophysical Society Meeting (2011)

J. Lee, S. Lee, K. Rangunathan, **C. Joo**, T. Ha, S. Hohng "Single-molecule four-color FRET" *Angewandte Chemie*, 49(51), 9922-5 (2010)

I. Heo[#], **C. Joo**[#], **Y.-K. Kim**[#], M. Ha, M.-J. Yoon, J. Cho, K.-H. Yeom, J. Han and V. N. Kim "TUT4 in concert with Lin28 suppresses microRNA biogenesis through pre-microRNA uridylation" *Cell* 138, 696-708. ([#]equal contribution) (2009)

- Featured by *Nature Reviews: Molecular and Cellular Biology*

- Selected in Faculty of 1000

- Presented in Annual Meeting of the RNA Society (2009)

I. Heo[#], **C. Joo**[#], J. Cho, M. Ha, J. Han and V. N. Kim "Lin28 mediates the terminal uridylation of let-7 precursor MicroRNA" *Molecular Cell* 32, 276-284 ([#]equal contribution) (2008)

- Featured article in *Molecular Cell*

- Selected in Faculty of 1000

I. Cissé, B. Okumuş, **C. Joo** and T. Ha "Fueling protein-DNA interactions inside porous nanocontainers" *Proc Natl Acad Sci USA* 104, 12646-12650 (2007)

S. A. McKinney, **C. Joo** and T. Ha "Analysis of single-molecule FRET trajectories using hidden Markov modeling" *Biophysical Journal* 91, 1941-1951 (2006)

C. Joo, S. A. McKinney, M. Nakamura, I. Rasnik, S. Myong and T. Ha "Real-time observation of RecA filament dynamics with single monomer resolution" *Cell* 126, 515-527 (2006)

- Presented in Biophysical Society Meeting (2006)

S. Myong, I. Rasnik, **C. Joo**, T. M. Lohman and T. Ha "Repetitive shuttling of a motor protein on DNA" *Nature* 437, 1321-1325 (2005)

- *News & Views by Nature* (2005)

S. Hohng, **C. Joo** and T. Ha "Single-molecule three-color FRET" *Biophysical Journal* 87, 1328-1337 (2004)

- Highlighted by *Biophotonics* (2004)

C. Joo, S. A. McKinney, D. M. J. Lilley and T. Ha "Exploring rare conformational species and ionic effects in DNA Holliday junctions using single-molecule spectroscopy" *Journal of Molecular Biology* 341, 739-751 (2004)

PUBLICATIONS (REVIEW ARTICLES, PROTOCOL, BOOK CHAPTER)

L. Restrepo-Pérez, **C. Joo***, C. Dekker* "Paving the way to single-molecule protein sequencing" *Nature Nanotechnology*, 13(9):786-796 (2018)

V. Globyte, S. H. Kim, **C. Joo***, "Single-molecule view of small RNA-guided target search and recognition" *Annual Review of Biophysics*, 47:569-593 (2018)

M. Klein, S. D. Chandradoss, M. Depken*, **C. Joo*** "Why Argonaute is needed to make microRNA target search fast and reliable" *Seminars in Cell & Developmental Biology*, 65:20-28 (2017)

M. Fareh, L. Loeff, M. Szczepaniak, A. C. Haagsma, K. H. Yeom, **C. Joo***, Single-molecule pull-down for investigating protein–nucleic acid interactions, *Methods*, 105:99-108 (2017)

S. D. Chandradoss, A. C. Haagsma, Y. K. Lee, J. H. Hwang, J. M. Nam, and **C. Joo***, Surface Passivation for Single-molecule Protein Studies. *Journal of Visualized Experiments* (86), e50549, doi:10.3791/50549 (2014)

C. Joo, M. Fareh, and V. N. Kim "Bringing single-molecule spectroscopy to macromolecular protein complexes" *Trends in Biochemical Sciences*, 38(1): 30-37 (2013)

J. Diao, Y. Ishitsuka, H. Lee, **C. Joo**, Z. Su, S. Syed, Y. K. Shin, T. Y. Yoon, T. Ha "A single vesicle-vesicle fusion assay for in vitro studies of SNAREs and accessory proteins" *Nature Protocols*, 7(6), 921-34 (2012)

C. Joo, H. Balci, Y. Ishitsuka, C. Buranachai and T. Ha "Advances in single-molecule fluorescence methods for molecular biology" *Annual Review Biochemistry* 77, 51-76 (2008)

C. Joo and T. Ha "Single molecule FRET with total internal reflection microscopy" In '*Single Molecule Techniques: A Laboratory Manual*' (ed P. Selvin and T. Ha) *Cold Spring Harbor Laboratory Press* (2008)

PROFESSIONAL ACTIVITIES

- Co-director of *Kavli Institute of NanoScience Delft* (2018–2012)
- Head organizer of *Single-Molecule Protein Sequence* conference (2017)
- Project leader of vrije FOM consortium (six research groups) (since 2017)
- Management team of Department of BioNanoScience (2015–2018)
- NWO-CW studygroup (since 2015)
- Advisory committee member of *Kavli Institute of Nanoscience Delft* (2013–2015)
- President of *Korean Scientists & Engineers Association in the Netherlands* (2014–2015)
- Organizer of Quo Vadis seminar series in Department of Bionanoscience (since 2012)
- External committee member of MasterStudyTour (2012–2014)
- Reviewer of Nature journals (Nature, NSMB, Communications, Chemical Biology, Genetics, ...)
- Reviewer of Cell Press journals (Cell, Molecular Cell, Immunity, ...)
- Reviewer of Science
- Reviewer of PNAS
- Reviewer of EMBO journals
- Reviewer of Nucleic Acids Research
- Reviewer of ACS journals
- Reviewer of Angewandte Chemie
- Editorial Board of Scientific Reports
- Reviewer of ERC grants / FOM grants

TEACHING ACTIVITIES

Applied Physics

- Minor projects (2014 – present)
- Electronic instrumentation (2014 – 2015)
- Research practicum (2011 – 2016)
- Orientation on physics research (2012 – 2015)
- Statistical mechanics (Matlab exercise, 2012)
- Guest lectures (Nanotechnology, Introduction to Biophysics, etc.) (2011 – present)

Nanobiology

- Biophysics (2017 – present)
- Minor projects (2014 – present)
- Physics (2013 – present)
- Guest lectures (Faculty seminars, 2012 – present)
- An external guest lecture (Seoul National University, 2015)

SUPERVISION OF JUNIOR SCIENTISTS (As of August 2016)

- Supervision of ten bachelor projects and eleven master projects (2013 – Aug 2016)
- Supervision of a Honours project (2015 – Aug 2016)
- Supervision of eight Ph.D. students (2009 – 2016)
- Supervision of seven post-doctoral fellows (2011 – 2016)
- Member of three Ph.D. dissertation committees (2010 – June 2015)

INVITED SEMINARS (As of September 2017)

- Max Planck Institute, Goettingen, Germany (2017)
- University of Utah, Salt Lake City, USA (2017)
- Hubrecht Institute, Utrecht, Netherlands (2017)
- Wageningen UR, Wageningen, Netherlands (2017)
- Institute of Biophysics, Beijing (2016)
- Tianjin University (Precision Instrument and Opto-Electronic Engineering, 2016)
- Nankai University (State Key Laboratory of Medical Chemical Biology, 2016)
- NetRNA consortium (Institut de Biologie Moléculaire et Cellulaire, CNRS, 2016)
- Delft University of Technology (Imaging Science and Technology, 2016)
- Emory University (Physics, 2015)
- Georgia Institute of Technology (Physics, 2015)
- University of Illinois at Urbana-Champaign (Institute for Genomic Biology, 2015)
- Seoul National University (Biology, 2015)
- Kunkuk University (Physics, 2015)
- Gwangju Institute of Science and Technology (Biology, 2015)
- Radboud Institute (Molecular Life Sciences, 2014)
- Seoul National University (Biology, 2014)
- Korea Advanced Institute of Science and Technology (Physics, 2014)
- Université de Nice Sophia-Antipolis (INSERM, 2012)
- Delft University of Technology (Imaging Science and Technology, 2012)
- Delft University of Technology (Kavli Institute, 2011)
- Delft University of Technology (Electrical Engineering, 2011)
- Leiden University (Physics of Life Processes, 2011)
- Royal Netherlands Academy of Arts and Sciences (KNAW, 2011)
- University of Massachusetts Medical School (Biochemistry & Molecular Pharmacology, 2010)
- Harvard Medical School (Biological Chemistry & Molecular Pharmacology, 2010)
- Seoul National University (Physics, 2010 / Chemistry, 2010 / Nano Systems Institute, 2010)
- Korea Advanced Institute of Science and Technology (Physics, 2010)
- Pohang University of Science and Technology (Bioscience & Bioengineering, 2010)
- University of Illinois at Urbana-Champaign (Center for the Physics of Living Cells, 2009)

ORAL PRESENTATIONS IN CONFERENCES (As of September 2017)

- Dutch Biophysics Meeting, Veldhoven, the Netherlands (plenary, 2017)
- CRISPR, Montana, USA (2017)
- SignalLife, Nice, France (keynote, 2017)
- Biophysical Society Meeting, New Orleans, USA (2017)
- Zing Conferences (nucleic acids), Tampa, USA (invited, 2016)
- Gordon Conference (single-molecule approaches to biology), Hong Kong (invited, 2016)
- IBS-CNRS RNA Symposium, Seoul, Korea (invited, 2016)
- EMBL Symposium (Non-coding genome), Heidelberg, Germany (2015)
- RNA 2015 (Annual Meeting of the RNA Society), Madison, WI, USA (plenary, 2015)
- US-Korea Conference, Atlanta (2015)
- EU-Korea Conference, Strasbourg, France (invited, 2015)
- NanoFront Winter Retreat (plenary, 2015)
- BiKiE, Bio Korea in Europe (keynote, 2015)
- Joint Meeting of Dutch and German Biophysicists, Hunfeld, Germany (invited, 2015)
- Chemistry for Innovations of Materials and Bio-Medicine, London, UK (invited, 2014)
- European Biophysics Congress, Lisbon, Portugal (invited, 2013)
- EU-Korea Conference, Brighton, UK (2013)
- Chemistry in Relation to Biology and Medical Sciences, Veldhoven, the Netherlands (2013)
- Dutch Biophysics Meeting, Veldhoven, the Netherlands (2013)
- Zing Conferences (nucleic acids), Xcaret, Mexico (2012)
- Microsymposium, Basel, Switzerland (invited, 2012)
- Dutch Biophysics Meeting, Veldhoven, the Netherlands (2011)
- Second Frontiers in Biophysics, Seoul, Korea (invited, 2011)
- Biophysical Society Meeting, Baltimore, MD, USA (2011)
- First Frontiers in Biophysics, Seoul, Korea (contributed, 2010)
- RNA 2009 (Annual Meeting of the RNA Society), Madison, WI, USA (2009)
- Single-Molecule Biophysics Workshop, Daejeon, Korea (2009)
- Seoul RNA Symposium, Seoul National University, Seoul, Korea (2009)
- International Weber Symposium, Kauai, Hawaii, USA (invited, 2008)
- Korean Physical Society Meeting, Daejeon, Korea (invited, 2008)
- American Chemical Society, Boston, MA, USA (2007)
- Annual Cell and Mol. Biology & Mol. Biophysics Symposium, Univ. of Illinois, USA (2006)
- Annual Biophysics and Computational Biology Symposium, Univ. of Illinois, USA (2006)
- Biophysical Society Meeting, Salt Lake City, UT, USA (2006)

HONORS AND AWARDS

- Teacher of the Year (finalist) (Delft University of Technology, Nanobiology, 2015)

- Teacher of the Year (finalist) (Delft University of Technology, Nanobiology, 2014)
- International Travel Award (Biophysical Society, San Francisco, USA, 2010)
- Weber International Prize (finalist) (International Weber Symposium, Hawaii, USA, 2008)
- Best Oral Presentation (Annual CMB & MBP Research Symposium, University of Illinois at Urbana-Champaign, USA, 2006)
- Recognition by Ministry of Science & Technology of Korea for Excellent Work (Korea, 2006)
- Drickamer Award for Significant Ability at Research (Fellowship, Department of Physics, University of Illinois at Urbana-Champaign, 2006)
- Excellent Student Scholarship (Seoul National University, Korea, 2001)
- Seoul National University Fellowship (Seoul National University, Korea, 2000-2001)

FUNDING SOURCES

- European Research Council
 - Consolidator Grant (€1,800k, 2019–2023)
 - Starting Grant (€1,500k, 2012–2017)
- Netherlands Organisation for Scientific Research
 - FOM (€2,341k, 2017–2021; project leader)
 - VIDI (€800k, 2015–2020)
 - FOM (€550k, 2015–2018; shared with Broun's group)
 - FOM (€550k, 2012–2016; shared with Meyer's group)
 - ALW Open Programme (€334k, 2012–2016)
 - NanoFront (Zwaartekracht, 2013–2020)