

# Hye Yoon Park, Ph.D.

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Associate Professor

Department of Electrical & Computer Engineering

University of Minnesota

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## **EDUCATION**

<b>Ph.D.</b>	Applied Physics	Cornell University	2007
	Dissertation: Development of a microfluidic mixer and applications to rapid kinetic studies of calmodulin		
<b>M.S.</b>	Applied Physics	Cornell University	2001
<b>B.S.</b>	Physics	Seoul National University	1999

## **PROFESSIONAL POSITIONS**

**Associate Professor**, Department of Electrical & Computer Engineering, University of Minnesota  
2022-present

**Associate Professor**, Department of Physics & Astronomy, Seoul National University  
2018-2022

**Assistant Professor**, Department of Physics & Astronomy, Seoul National University  
2014-2018

**Visiting Scientist**, Janelia Research Campus, Howard Hughes Medical Institute 2013-2014

**Research Fellow**, Albert Einstein College of Medicine (advisor: Robert H. Singer) 2008-2014

**Postdoctoral Associate**, Cornell University (advisors: Lois Pollack & Watt W. Webb) 2007-2008

**Research Assistant**, Cornell University (advisors: Lois Pollack & Watt W. Webb) 2003-2007

**Research Assistant**, Cornell University (advisor: Harold G. Craighead) 2000-2002

## **AWARDS AND HONORS**

**HHMI-Wellcome International Research Scholar Award** 2017-2022  
Howard Hughes Medical Institute (HHMI) and Wellcome Trust

<b>Early Career Award</b> Federation of American Societies for Experimental Biology (FASEB)	2019
<b>Excellent Lecture Award</b> College of Natural Sciences at Seoul National University	2017
<b>Chung-Am Science Young Investigator Fellowship</b> Pohang Iron and Steel Company (POSCO) Chung-Am Foundation	2015-2017
<b>SNU Invitation Program for Distinguished Scholar</b> Seoul National University	2014-2015
<b>Postdoctoral Research Award</b> Association of Korean Neuroscientists	2013
<b>Scholarship for Neurobiology Summer Course</b> Marine Biological Laboratory	2012
<b>Ruth L. Kirschstein National Research Service Awards for Postdoctoral Fellows (F32)</b> National Institute of General Medical Sciences, National Institutes of Health	2009-2011
<b>W. M. Keck Fellowship</b> Cornell University	2000-2001
<b>Sage Fellowship</b> Cornell University	1999-2000

## **OTHER TRAINING**

<b>Neurobiology Summer Course</b> Marine Biological Laboratory, Woods Hole, MA	2012
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## **TEACHING EXPERIENCE**

**Physics**, Seoul National University (Spring 2020)

**Physics I**, Seoul National University (Spring 2019, 2021)

**Introduction to Biological Physics**, Seoul National University (Spring 2015-2017)

*\* Received **Excellent Lecture Award** from the College of Natural Sciences at SNU in 2017.*

**Biological Physics**, Seoul National University (Fall 2015-2017, 2019-2021)

**EE3601 Transmission Lines, Fields and Waves**, University of Minnesota, Twin Cities (Fall 2022)

**EE 5940 Special Topics in Electrical Engineering I: Advanced Topics in Modern Microscopy Techniques**, University of Minnesota, Twin Cities (Spring 2023)

## **PROFESSIONAL ACTIVITIES**

**Biophysical Society**, Member (2004-present)

**Society for Neuroscience**, Member (2010-present)

**Korean Physical Society**, Member (2014-present), Deputy Executive Director for Women's Committee (2021)

**RNA Society**, Member (2014-present), Publications Committee Member (2020-present)

**IEEE**, Senior Member (2022-present)

## **SELECTED INVITED TALKS**

1. Real-Time Visualization of mRNA Synthesis During Memory Formation in Live Animals. Minnesota NeuroSpin Initiative Seminar. On-line, September, 2022.
2. Real-Time Visualization of mRNA Synthesis During Memory Formation in Live Animals. Howard Hughes Medical Institute Science Meeting. On-line, October, 2021.
3. Real-Time Imaging of Arc mRNA During Memory Formation in Live Animals. IMABIO Consortium Meeting. On-line, September, 2021.
4. Dendritic Transport of mRNP Follows an Aging Lévy Walk. Bernstein Conference 2021 Satellite Workshop. On-line, September, 2021.
5. Watching Single Endogenous mRNA in Neurons *in vivo*. Department of Electrical and Computer Engineering Colloquium, University of Minnesota, Minneapolis, MN, February 2019.
6. Activity-Dependent Dynamics of mRNA in Live Neurons Studied at Single Molecule Resolution. IBS Conference on RNA Biology, Seoul, Korea, November, 2018.
7. Watching Single Endogenous mRNA in Neurons *in vivo*. Venice Meeting on Fluctuations in Small Complex Systems IV, Venice, Italy, October, 2018.
8. Watching Single Endogenous mRNA in Live Neurons. 42nd Lorne Conference on Protein Structure and Function, Lorne, Australia, February, 2017.

9. Watching Single Endogenous mRNA in Neurons *in vivo*. 29th Marian Smoluchowski Symposium on Statistical Physics, Zakopane, Poland, September, 2016.
10. Watching Single Endogenous mRNA in Neurons *in vivo*. 26th tRNA Conference, Jeju, Korea, September, 2016.
11. Watching Single Endogenous mRNA in Neurons *in vivo*. F. M. Kirby Neurobiology Center Seminar, Boston Children's Hospital and Harvard Medical School, Boston, MA, March 2014.
12. Watching Single Endogenous mRNA in Neurons *in vivo*. Biological Sciences Training Program Seminar, Yale School of Medicine, New Haven, CT, March 2014.
13. Watching Single Endogenous mRNA in Neurons *in vivo*. Department of Molecular and Integrative Physiology Seminar, University of Illinois Urbana-Champaign, Urbana, IL, February 2014.
14. Watching Single Endogenous mRNA in Neurons *in vivo*. Department of Neurobiology Seminar, Northwestern University, Evanston, IL, January 2014.
15. Imaging Single Endogenous mRNA in Live Mammalian Cells and Tissues. School of Physics and Astronomy Seminar, University of Minnesota, Minneapolis, MN, January 2014.
16. Watching Single Endogenous mRNA in Neurons *in vivo*. Neurobiology Seminar, Duke University, Durham, NC, January 2014.
17. Real-Time Visualization of Single Endogenous mRNA Labeled in Live Mouse. Biomedical Engineering/Biophysics/Physics, Earl Stadtman Symposium, NIH, Bethesda, MD, December 2013.

## **PUBLICATIONS**

1. Lee, C.\*, **Lee, B. H.\***, Jung, H.\*, Lee, C., Sung, Y., Kim, H., Shim, J. Y., Kim, J., Choi, D. I., **Park, H. Y.†**, and Kaang, B.-K.† (2023). Hippocampal Engram Networks for Fear Memory Recruit New Synapses and Modify Pre-existing Synapses *in vivo*. Current Biology 33, 507 (\*co-first authors; †co-corresponding authors).
2. Durang, X.†, **Ahn, H., Shim, J. Y., Park, H. Y. †**, and Jeon, J.-H†. (2023). Accessing Power-Law Statistics Under Experimental Constraints. Physical Review Research 5, 013011 (†co-corresponding authors).
3. Cho, W.-H., Noh, K., **Lee, B. H.**, Barcelon, E., Jun, S. B., **Park, H. Y.** and Lee, S. J. (2022) Hippocampal Astrocytes Modulate Anxiety-Like Behavior. Nature Communications 13, 6536.
4. **Choi, H., Lee, B. H.**, and **Park, H. Y.** (2022) Time-Resolved Analysis of Transcription Kinetics in Single Live Mammalian Cells. Frontiers in Physics 10, 977125.

5. **Lee, B. H.**, Bang, S., Lee, S. R., Jeon, N. L., and **Park, H. Y.** (2022). Dynamics of Axonal  $\beta$ -actin mRNA in Live Hippocampal Neurons. Traffic 23, 496.
6. **Lee, B. H.**, **Shim, J. Y.**, **Moon, H. C.**, **Kim, D. W.**, Kim, J., Yook, J. S., Kim, J., and **Park, H. Y.** (2022). Real-Time Visualization of mRNA Synthesis During Memory Formation in Live Mice. Proceedings of the National Academy of Sciences 119, e2117076119.
7. Kim, Y., Kang, S., **Lee, B. H.**, Song, Y., Kang, S., **Park, H. Y.**<sup>†</sup>, and Lee, Y.<sup>†</sup> (2022). De Novo Generation of a Bright Blue Fluorophore from 2-oxoglutarate in Biological Samples. Chemical Science, 13, 365-372. (<sup>†</sup>Co-corresponding authors).
8. **Song, M. S.**, Baek, H., Lee, K., Yoo, D., Chung, K., Lee, J., **Moon, H. C.**, **Lee, B. H.**, **Park, H. Y.**, and Yi, G.-C. (2021). Intracellular Gallium Nitride Microrod Laser. NPG Asia Materials 13, 32.
9. Hong, Y., Jeong, H., Park, K., Lee, S., **Shim, J. Y.**, Kim, H., Song, Y., Park, S., **Park, H. Y.**, Kim, V. N., and Ahn, K. (2021). STING Facilitates Nuclear Import of Herpesvirus Genome During Infection. Proceedings of the National Academy of Sciences 118, e2108631118.
10. Hwang, S.-Y., Jung, H., Mun, S., Lee, S., Park, K., Baek, S. C., **Moon, H. C.**, Kim, H., Kim, B., Choi, Y., Go, Y.-H., Tang, W., Choi, J., Choi, J. K., Cha, H.-J., **Park, H. Y.**, Liang, P., Kim, V. N., Han, K., and Ahn, K. (2021). L1 Retrotransposons exploit RNA m6A Modification as an Evolutionary Driving Force. Nature Communications 12, 880.
11. **Choi, H.**, **Lee, B. H.**, **Park, H. Y.** (2021). Quantitative Models for Transcriptional Dynamics Monitored Using an MS2-GFP System. Journal of Korean Physical Society 78, 365-372.
12. **Park, S. Y.**, **Moon, H. C.**, and **Park, H. Y.** (2020). Live-Cell Imaging of Single mRNA Dynamics using Split Superfolder Green Fluorescent Proteins with Minimal Background. RNA 26, 101-109.
13. Stueland, M., Wang, T., **Park, H. Y.**, and Mili, S. (2019). RDI Calculator: An Analysis Tool to Assess RNA Distributions in Cells. Scientific Reports 9, 8267.
14. **Kim, S. H.**, **Vieira, M.**, **Kim, H.-J.**, **Kesawat, M. S.**, and **Park, H. Y.** (2019). MS2 Labeling of Endogenous Beta-Actin mRNA Does Not Result in Stabilization of Degradation Intermediates. Molecules and Cells 42, 356.
15. Hwang, D. W., Choi, Y., Kim D., **Park, H. Y.**, Kim, K. W., Kim, M. Y., Park, C.-K., and Lee, D. S. (2019). Graphene Oxide-Quenching-Based Fluorescence *in situ* Hybridization (G-FISH) to Detect RNA in Tissue: Simple and Fast Tissue RNA Diagnostics. Nanomedicine: Nanotechnology, Biology and Medicine 16, 162-172.
16. **Kim, S. H.**, **Vieira, M.**, **Shim, J. Y.**, **Choi, H.**, and **Park, H. Y.** (2019). Recent Progress in Single-Molecule Studies of mRNA Localization *in vivo*. RNA Biology 16, 1108-1118.

17. Das, S., **Moon, H. C.**, Singer, R. H.<sup>†</sup>, and **Park, H. Y.**<sup>†</sup> (2018). A Transgenic Mouse for Imaging Activity-Dependent Dynamics of Endogenous Arc mRNA in Live Neurons. Science Advances 4, eaar3448 (<sup>†</sup>co-corresponding authors).
18. **Song, M. S.**, **Moon, H. C.**, Jeon, J.-H.<sup>†</sup>, and **Park, H. Y.**<sup>†</sup> (2018). Neuronal Messenger Ribonucleoprotein Transport Follows an Aging Lévy Walk. Nature Communications 9, 344 (<sup>†</sup>co-corresponding authors).
19. **Lee, B. H.** and **Park, H. Y.** (2018). HybTrack: A Hybrid Single Particle Tracking Software Using Manual and Automatic Detection of Dim Signals. Scientific Reports 8, 212.
20. Vera, M., Biswas, J., Senecal, A., Singer, R. H., and **Park, H. Y.** (2016). Single Cell and Single-Molecule Analysis of Gene Expression Regulation. Annual Review of Genetics 50, 267.
21. **Lee, B. H.**, **Bae, S.-W.**, **Shim, J. Y.**, **Park, S. Y.**, and **Park, H. Y.** (2016). Imaging Single-mRNA Localization and Translation in Live Neurons. Molecules and Cells 39, 841.
22. **Moon, H. C.** and **Park, H. Y.** (2016). Imaging Single mRNA Dynamics in Neurons and Brains. Methods in Enzymology 572, 51.
23. **Moon, H. C.**, **Lee, B. H.**, **Lim, K.**, **Son, J. S.**, **Song, M. S.**, and **Park, H. Y.** (2016). Tracking Single mRNA Molecules in Live Cells. Journal of Physics D: Applied Physics 49, 233001.
24. Monnier, N., Barry, Z., **Park, H. Y.**, Su, K.-C., Katz, Z., English, B. P., Dey, A., Pan, K., Cheeseman, I. M., Singer, R. H., Bathe, M. (2015). Inferring Transient Particle Transport Dynamics in Live Cells. Nature Methods 12, 838.
25. Buxbaum, A. R., Yoon, Y. J., Singer, R. H., and **Park, H. Y.** (2015). Single-Molecule Insights into mRNA Dynamics in Neurons. Trends in Cell Biology 25, 468.
26. **Park, H. Y.**, Lim, H., Yoon, Y. J., Follenzi, A., Nwokafor, C., Lopez-Jones, M., Meng, X., and Singer, R. H. (2014). Visualization of Dynamics of Single Endogenous mRNA Labeled in Live Mouse. Science 343, 422.  
  
*\* Highlighted in (1) “mRNA, live and unmasked”, **Science**, 343, 375 (2014); (2) “Unmasked: dendritic mRNA dynamics”, **Nature Reviews Neuroscience**, 15, 138 (2014); (3) “Tagging mRNAs in living cells”, **Nature Reviews Genetics**, 15, 144 (2014); (4) “Single-transcript dynamics in a live mouse”, **Nature Methods**, 11, 370 (2014); and (5) **BioTechniques**, **Chemical & Engineering News**, and **Science Daily**.*
27. Katz, Z. B., Wells, A. L., **Park, H. Y.**, Wu, B., Shenoy, S. M., and Singer, R. H. (2012).  $\beta$ -Actin mRNA Compartmentalization Enhances Focal Adhesion Stability and Directs Cell Migration. Genes & Development 26, 1885.
28. **Park, H. Y.**, Treck, T., Wells, A., Chao, J. A., and Singer, R. H. (2012). An Unbiased Analysis Method to Quantify mRNA Localization Reveals Its Correlation with Cell Motility. Cell Reports 1, 179.

29. Trcek, T., Zenklusen, D., Chao, J. A., Larson, D. R., **Park, H. Y.**, and Singer, R. H. (2012). Single mRNA Counting Using Fluorescent In Situ Hybridization in Budding Yeast. Nature Protocols 7, 408.
30. Gu, W., Katz, Z., Wu, B., **Park, H. Y.**, Li, D., Lin, S., Wells, A., and Singer, R. H. (2012). Regulation of Local Expression of Cell Adhesion and Motility-Related mRNAs in Breast Cancer Cells by IMP1/ZBP1. Journal of Cell Science 125, 81.
31. Lionnet, T., Czaplinski, K., Darzacq, X., Shav-Tal, Y., Wells, A. L., Chao, J. A., **Park, H. Y.**, de Turris, V., Lopez-Jones, M., and Singer, R. H. (2011). A Transgenic Mouse for In Vivo Detection of Endogenous Labeled mRNA. Nature Methods 8, 165.
32. **Park, H. Y.**, Buxbaum, A. R., and Singer, R. H. (2010). Single mRNA Tracking in Live Cells. Methods in Enzymology, 472, 387.
33. Lamb, J. S., Kwok, L. W., Qiu, X. Y., Andresen, K., **Park, H. Y.**, and Pollack, L. (2008). Reconstructing Three-dimensional Shape Envelopes from Time-resolved Small-Angle X-ray Scattering Data. Journal of Applied Crystallography 41, 1046.
34. Andresen, K., Qiu, X. Y., Pabit, S. A., Lamb, J. S., **Park, H. Y.**, Kwok, L. W., and Pollack, L. (2008). Mono- and Trivalent Ions around DNA: A Small-Angle Scattering Study of Competition and Interactions. Biophysical Journal 95, 287.
35. Schlatterer, J. C., Kwok, L. W., Lamb, J. S., **Park, H. Y.**, Andresen, K., Brenowitz, M., and Pollack, L. (2008) Hinge Stiffness is a Barrier to RNA Folding. Journal of Molecular Biology 379, 859.
36. Li, L., Pabit, S. A., Lamb, J. S., **Park, H. Y.**, Pollack, L. (2008). Closing the Lid on DNA End-to-End Stacking Interactions. Applied Physics Letters 92, 223901.
37. **Park, H. Y.**, Kim, S. A., Korlach, J., Rhoades, E., Kwok, L. W., Zipfel, W. R., Waxham, M. N., Webb, W. W., and Pollack, L. (2008). Conformational Changes of Calmodulin upon  $\text{Ca}^{2+}$  binding studied with a Microfluidic Mixer. Proceedings of the National Academy of Sciences of the USA 105, 542.
38. Qiu, X. Y., Andresen, K., Kwok, L. W., Lamb, J. S., **Park, H. Y.**, and Pollack, L. (2007). Inter-DNA Attraction Mediated by Divalent Counterions. Physical Review Letters 99, 038104.
39. Lamb, J. S., Cornaby, S., Andresen, K., Kwok, L. W., **Park, H. Y.**, Qiu, X. Y., Smilgies, D. M., Bilderback, D. H., and Pollack, L. (2007). Focusing Capillary Optics for Use in Solution Small-Angle X-ray Scattering. Journal of Applied Crystallography 40, 193.
40. **Park, H. Y.**, Qiu, X. Y., Rhoades, E., Korlach, J., Kwok, L. W., Zipfel, W. R., Webb, W. W., and Pollack, L. (2006). Achieving Uniform Mixing in a Microfluidic Device: Hydrodynamic Focusing Prior to Mixing. Analytical Chemistry 78, 4465.
41. Qiu, X. Y., Kwok, L. W., **Park, H. Y.**, Lamb, J. S., Andresen, K., and Pollack, L. (2006). Measuring Inter-DNA Potentials in Solution. Physical Review Letters 96, 138101.

42. Kwok, L. W., Shcherbakova, I., Lamb, J. S., **Park, H. Y.**, Andresen, K., Smith, H., Brenowitz, M., and Pollack, L. (2006). Concordant Exploration of the Kinetics of RNA Folding from Global and Local Perspectives. Journal of Molecular Biology 355, 282.
43. Andresen, K., Das, R., **Park, H. Y.**, Smith, H., Kwok, L. W., Lamb, J. S., Kirkland, E. J., Herschlag, D., Finkelstein, K. D., and Pollack, L. (2004). Spatial Distribution of Competing Ions around DNA in Solution. Physical Review Letters 93, 248103.

### **Book chapters:**

1. **Park, H. Y.**, Song, M. (2015). Visualizing mRNA Dynamics in Live Neurons and Brain Tissues. 325-334, Methods in Molecular Biology, Springer.
2. Shim, J. Y., Lee, B. H., and **Park, H. Y.** (2019). Visualization of Single mRNA in Live Neurons. 47-61, Methods in Molecular Biology, Springer.

### **RESEARCH GRANTS**

1. Wellcome International Research Scholar Award  
Wellcome Trust  
**“Imaging Gene Expression in Live Brains at Single Molecule Resolution”** 10/2022-05/2023  
PI: Hye Yoon Park  
\$92,763
2. HHMI-Wellcome International Research Scholar Award  
Howard Hughes Medical Institute and Wellcome Trust  
**“Imaging Gene Expression in Live Brains”** 09/2017-08/2022  
PI: Hye Yoon Park  
\$715,000
3. SSTF-BA1602-11  
Samsung Science and Technology Foundation  
**“Imaging Memory Traces in the Living Brain”** 12/2016-11/2021  
PI: Hye Yoon Park  
2 billion in KRW (~\$1,640,000)
4. 2020R1A2C2007285  
National Research Foundation of Korea  
**“Programmable Single RNA Imaging in Live Tissues”** 03/2020-02/2023  
PI: Hye Yoon Park  
600 million in KRW (~\$492,000)
5. Creative-Pioneering Researchers Program  
Seoul National University  
**“Non-invasive Multimodal Imaging of Gene Expression *in vivo*”** 09/2016-08/2021  
PI: Hye Yoon Park  
800 million in KRW (~\$656,000)
6. Chung-Am Science Young Investigator Fellowship  
POSCO TJ Park Foundation  
**“Transport and Localization of Single mRNA for Memory Formation”** 01/2016-12/2017  
PI: Hye Yoon Park  
70 million in KRW (~\$57,000)
7. 2015R1C1A1A02036674  
National Research Foundation of Korea  
**“Real-time Imaging of mRNA Transcription in the Brain”** 07/2015-06/2018  
PI: Hye Yoon Park  
150 million in KRW (~\$123,000)