

# OZGUR SAHIN

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Professor

Department of Biological Sciences

Department of Physics

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## Education and Training

- Ph.D. Electrical Engineering, Stanford University 2005
- M.S. Electrical Engineering, Stanford University 2003
- B.S. Electrical Engineering, Bilkent University, Turkey 2001

## Appointments

- Professor, Department of Biological Sciences and Department of Physics, Columbia University 07/2022 – present
- Associate Professor, Department of Biological Sciences and Department of Physics, Columbia University 07/2011 – 07/2022
- Scholar in Residence, Wyss Institute for Biologically Inspired Engineering, Harvard University 07/2010 - 07/2011
- Junior Fellow, Rowland Institute at Harvard University 10/2005 – 07/2010

## Honors and Awards

- Young Investigator Award, Office of Naval Research, Dept. of Defense 2016
- Young Scientists Award, The World Economic Forum, Nominated by NIH 2015
- Faculty Mentoring Award, selected by the graduate students at Columbia 2014
- Packard Fellowship, the David and Lucile Packard Foundation 2013
- NIH Director's New Innovator Award 2013
- Department of Energy, Early Career Research Program Award 2012
- Junior Fellowship, Rowland Institute at Harvard 2005

- Grand Prize Winner, Collegiate Inventors Competition, organized by the United States Patent and Trademark Office and the National Inventors Hall of Fame 2004
- Stanford Graduate Fellowship, Stanford University 2001
- Bronze Medalist, International Physics Olympiad 1997

## Journal Publications

1. Harrellson, S.G., DeLay, M.S., Chen, X., Cavusoglu, A-H., Dworkin, J., Stone, H.A. & Sahin, O.\* “Hydration solids”, *Nature*, in press
2. Quijano, J. F. & Sahin, O. “Genetically Intact Bioengineered Spores of *Bacillus subtilis*.” *ACS Synthetic Biology* 10, 778-785 (2021).
3. Kim, Y., Mandriota, N., Goodnight, D. & Sahin, O. “Calibration of T-shaped atomic force microscope cantilevers using the thermal noise method.” *Review of Scientific Instruments* 91 (2020).
4. Mandriota, N., Friedsam, C., Jones-Molina, J.A., Tatem, K.V., Ingber, D.E. and Sahin, O.\* “Cellular nanoscale stiffness patterns governed by intracellular forces” *Nature Materials*, 18, 1071-1077, (2019)
5. Cakmak, O., El-Tinay, H.O., Chen, X. and Sahin, O. “Spore-Based Water-Resistant Water-Responsive Actuators with High Power Density” *Advanced Materials Technologies*, 1800596, (2019)
6. Lohner, J. et al. “Large and reversible myosin-dependent force in rigidity sensing” *Nature Physics*, 15, 689-695, 2019
7. Jayant, K. et al. “Flexible nanopipettes for minimally invasive intracellular electrophysiology in vivo” *Cell Reports* 26:266-278 (2019)
8. Gao, Z., Giovambattista, N. and Sahin, O. “Phase diagram of water confined by graphene” *Scientific Reports* 8, 6228 (2018)
9. Cavusoglu, A-H., Chen, X., Gentine, P. and Sahin, O. “Potential for natural evaporation as a reliable renewable energy source” *Nature Communications* 8:617 (2017) \*corr. author and PI.
10. Jayant, K., Hirtz, J.J., Plante I. J-L., Tsai D.M., De Boer W. D.A.M, Semonche A., Peterka, D.S., Owen, J.S., Sahin, O., Shepard, K.S. and Yuste, R. "Targeted intracellular voltage recordings from dendritic spines using quantum-dot coated nano-pipettes." *Nature Nanotechnology*, 12, 335-342 (2017)
11. Chen, X. Goodnight, D., Gao, Z., Cavusoglu, A.H., Sabharwal, N., DeLay, M., Driks, A. and Sahin, O. Scaling up nanoscale water-driven energy conversion into evaporation-driven engines and generators. *Nature Communications* 6:7346 (2015)  
- Highlighted in The New York Times.

12. Kim, D. and Sahin, O.\* “Imaging and three-dimensional reconstruction of chemical groups inside a protein complex using atomic force microscopy”, *Nature Nanotechnology*, 10, 264-269 (2015) PMID: 25664622
13. Lu, J., Yang, J., Dong, M. and Sahin, O. "Nanomechanical spectroscopy of synthetic and biological membranes" *Nanoscale* 6, 7604-7608 (2014)
14. Chen, X, Mahadevan, L., Driks, A. and Sahin, O. “*Bacillus* spores as building blocks for stimuli-responsive materials and nanogenerators” *Nature Nanotechnology*, 9, 137-141 (2014) \*PI
15. Cronin-Golomb, M. and Sahin, O. "High-resolution nanomechanical analysis of suspended electrospun silk fibers with the torsional harmonic atomic force microscope." *Beilstein Journal of Nanotechnology* 4(1): 243-248 (2013)
16. Sahin, O.\*, Yong, E.H., Driks, A. and Mahadevan, L. “Physical basis for the adaptive flexibility of *Bacillus* spores” *J. of the Royal Society Interface*, 9, 3156-3160 (2012)
17. Dong, M. and Sahin, O. “A nanomechanical interface to rapid single-molecule interactions” *Nature Communications*, 2, 247 (2011) \*PI
18. Husale, S., Persson, H. and Sahin, O. “DNA nanomechanics allows direct digital detection of complementary DNA and microRNA targets” *Nature*, 462, 1075-1078 (2009)
19. Dong, M., Husale, S. and Sahin, O. “Determination of protein structural flexibility by microsecond force spectroscopy” *Nature Nanotechnology*, 4, 514-517 (2009)
20. Sahin, O.\* and Erina, N. “High resolution and large dynamic range nanomechanical mapping in tapping-mode atomic force microscopy” *Nanotechnology*, 19, 445717 (2008) \*corr. author and PI.
21. Sahin, O.\*, Magonov, S., Su, C., Quate, C. F., and Solgaard, O. “An atomic force microscope tip designed to measure time-varying nanomechanical forces” *Nature Nanotechnology*, 2, 507-514 (2007) \*corr. author and co-PI.
22. (invited) Sahin, O. “Accessing Time-Varying Forces on the Vibrating Tip of the Dynamic Atomic Force Microscope to Map Material Composition” *Israel Journal of Chemistry*, 48, 55-63 (2008)
23. Sahin, O. “Time-varying tip-sample force measurements and steady-state dynamics in tapping-mode atomic force microscopy” *Physical Review B*, 77, 115405 (2008)
24. Sahin, O. “Harnessing bifurcations in tapping-mode atomic force microscopy to calibrate time-varying tip-sample force measurements” *Review of Scientific Instruments*, 78, 103707 (2007)
25. Sahin O\*., Yaralioglu G., Grow R., Zappe SF., Atalar A., Quate C., Solgaard O. “High-resolution imaging of elastic properties using harmonic cantilevers.” *Sensors and Actuators A-Physical*, 114, (2-3): 183-190 (2004) \*corr. author
26. Sahin, O.\*, Atalar, A., Quate CF. and Solgaard, O. “Resonant harmonic response in tapping-mode atomic force microscopy” *Physical Review B*, 69, 165416 (2004) \*corr. author

27. Chen, CC., Zappe, S., Sahin, O., Zhang, XJ., Fish, M., Scott, M., Solgaard O. “Design and operation of a microfluidic sorter for Drosophila embryos” *Sensors and Actuators B-Chemical*, 102, (1): 59-66 (2004)
28. Zhang, XJ., Zappe, SF., Bernstein, RW., Sahin, O., Chen, CC., Fish, M., Scott, MP. and Solgaard, O. “Micromachined silicon force sensor based on diffractive optical encoders for characterization of microinjection” *Sensors and Actuators A-Physical*, 114, (2-3): 197-203 (2004)
29. Sahin, O.\* and Atalar, A., “Simulation of higher harmonics generation in tapping-mode atomic force microscopy” *Applied Physics Letters*, 79, 4455 (2001) \*corr. author
30. Sahin, O.\* and Atalar, A., “Analysis of tip-sample interaction in tapping-mode atomic force microscope using an electrical circuit simulator” *Applied Physics Letters*, 78, 2973 (2001) \*corr. author

### **Editorial Contributions and Book Chapters**

1. (Foreword) O. Sahin, *Acoustic Scanning Probe Microscopy*, Springer-Verlag New York, (Editors: F. Marinello, D. Passeri, E. Savio) (2012)
2. O. Sahin, “Chapter: Dynamic nanomechanical characterization using multiple-frequency method” *Scanning Probe Microscopy of Functional Materials*, Springer, 153-178 (2011)
3. M. Dong and O. Sahin, “Quantitative imaging of membrane mechanics with molecular resolution” *Encyclopedia of Analytical Chemistry*, Wiley (2010)
4. (News & Views article) O. Sahin, “Probe microscopy - scanning below the cell surface” *Nature Nanotechnology*, 3, 461-462 (2008)

### **Invited Conference Presentations and Seminars**

1. 2023 Bio-Inspired Green (BIG) Symposium, New York, NY (2023)
2. NanoNeuro 2022, New York, NY (2022) - online
3. Physics and Biological Systems, Paris, France (2021) - online
4. Single-Molecule Sensors and nano-Systems International Conference, Barcelona, Spain (2020) - online
5. 8<sup>th</sup> Multifrequency AFM Conference, Madrid, Spain (2020) - online
6. Royal Microscopical Society SPM Meeting, Leeds, UK (2018)
7. Biophysical Society Annual Meeting, Nanoscale Biophysics Subgroup Meeting, San Francisco, CA (2018)
8. Seminar) Lawrence Berkeley National Laboratory, Molecular Foundry, Berkeley, CA (2016)
9. (Seminar) Department of Biosystems Science and Engineering, ETH-Zurich (2016)

10. 6<sup>th</sup> Multifrequency AFM Conference, Madrid, Spain (2016)
11. (Seminar) Department of Physics, Bilkent University, Turkey (2015)
12. American Vacuum Society, 62<sup>nd</sup> International Symposium (2015)
13. The World Economic Forum, Annual Meeting of the New Champions, China (2015)
14. (Keynote) NY/BIG New York Area *Bacillus* Interest Group Meeting (2015)
15. (Colloquium) Department of Physics, Univ. of Missouri Columbia (2015)
16. 16<sup>th</sup> Annual Linz Winter Workshop, Linz, Austria (2015)
17. Materials Research Society, MRS fall meeting, Boston, MA (2014)
18. 31<sup>st</sup> International Physics Congress of the Turkish Physics Society, Turkey (2014)
19. 5<sup>th</sup> Annual Wyss Symposium: “*Bioinspired Adaptive Materials: From Molecules to Buildings.*” Wyss Institute at Harvard, Boston, MA (2014)
20. 11<sup>th</sup> Annual International Workshop on Nanomechanical Sensing, Spain (2014)
21. (Seminar) Department of Chemistry, University at Albany, SUNY (2013)
22. Materials Research Society, MRS spring meeting, San Francisco, CA (2013)
23. Materials Research Society, Symposium on SPM–Frontiers in Nanotechnology, MRS fall meeting, Boston, MA (2012)
24. 4<sup>th</sup> Multifrequency AFM conference, Madrid, Spain (2012)
25. UPenn Nano/Bio Interface Center Symposium: Local Probes at the Frontiers of Energy Systems and Biotechnology, Philadelphia, PA (2011)
26. 14<sup>th</sup> International Conference on non-contact Atomic Force Microscopy, Lindau, Germany (2011)
27. 7<sup>th</sup> International Workshop on Nanomechanical Cantilever Sensors, Banff, Canada (2010)
28. 17<sup>th</sup> International Colloquium on Scanning Probe Microscopy, Atagawa, Japan (2009)
29. Materials Research Society, Fall Meeting, Boston, MA (2009)
30. IEEE Optical MEMS and Nanophotonics conference, Tampa, FL (2009)
31. 2<sup>nd</sup> Multifrequency AFM conference, Madrid, Spain (2009)
32. Seeing at the Nanoscale VI, Berlin, Germany (2008)
33. 1<sup>st</sup> Multifrequency AFM conference, Madrid, Spain (2008)
34. Stanford center for probing the nanoscale, annual nanoprobes workshop (2008)
35. Seeing at the Nanoscale IV, (2006), Philadelphia, PA
36. The 71<sup>st</sup> Annual Meeting of Israel Chemical Society, Tel-Aviv, Israel (2006)

### **Patents and Licensed Inventions (selected)**

1. O.Sahin “Fluid Responsive Device and Methods.” PCT application filed
2. O. Sahin, X. Chen, and D. Goodnight “Systems and Methods for Stimuli-Responsive Materials.” U.S. Patent Pending

3. D. Kim and O. Sahin “Device and Methods for Determining Molecular Structure.” U.S. Patent Pending
4. O. Sahin. “A Bacterial Spore Based Energy Harvesting System” U.S. Patent 9,234,508
5. O. Sahin, C.F. Quate, O. Solgaard. “Detection of Macromolecular Complexations with Harmonic Cantilevers” U.S. Patent 8,067,169
6. (licensed) O. Sahin, C. F. Quate, O. Solgaard. “Torsional Harmonic Cantilevers For Detection of High Frequency Force Components in Atomic Force Microscopy” U.S. Patent 7,302,833
7. (licensed) O. Sahin, A. Atalar, C. F. Quate, O. Solgaard. “Harmonic Cantilevers and Imaging Methods for Tapping-Mode Atomic Force Microscopy” U.S. Patent 6,935,167

### **Technology Translation, Teaching and Service to the Profession**

1. Developed a new interdisciplinary biophysics course for graduate and advanced undergraduate students. The course explores numerous examples from biological systems where physical principles directly influence important biological functions.
2. Subgroup Chair, Biophysical Society, Nanoscale Approaches to Biology Subgroup (2019)
3. Participated in the PowerbridgeNY program run by the New York State as a Cycle 4 Awardee to facilitate commercialization of an energy technology based on my lab’s research.
4. Participated in the BiomedX biotechnology accelerator program at Columbia University to facilitate commercialization of a drug delivery technology based on my lab’s research.
5. Judging committee member for the Collegiate Inventors Competition (2013-2016)
6. International advisory board: Multifrequency Atomic Force Microscopy conferences, 2008-2011.
7. Developed and contributed to the commercialization of a novel nanomechanical characterization technology: The technology is currently offered by Bruker Corporation under the name “HarmoniX Nanoscale Material Property Mapping”.
8. Ad hoc reviewer for scientific journals.
9. NIH Center for Scientific Review, P41 site visit committee member (2012-2013)
10. Ad hoc reviewer for DOE, ONR, NIH proposals.

### **Works Highlighted in the Media (Selected)**

1. “Energy from evaporating water could rival wind and solar” New Scientist (2017)
2. “Evaporation Gives Spores Energy-Generating Muscle” The New York Times (2015)
3. “Dangling DNA pinpoints a protein’s chemical groups” Physics Today (2015)
4. “Energizer Bacterium” The Wall Street Journal (2014)
5. “Bacteria-Coated Rubber Generates Electricity” Discovery Channel News (2014)
6. “Power-packed bacterial spores generate electricity” ScienceNews (2014)

7. "Rapid probing of single-molecules with a nanomechanical interface" Nanowerk Spotlight (2011)
8. "DNA detection: Without Fuss" Nature Nanotechnology (2009)
9. "Unique nanomechanical response of DNA" Nanowerk Spotlight (2009)
10. "T-shaped probe exposes protein elasticity" Physics World, Nanotechweb (2009)
11. "A new view of materials" Small Times (2008)
12. "The Look and the Feel of Nano" Nature (2007) "Feeling your way through the nanoworld" Nanowerk Spotlight (2007)
13. "Editor's pick" Foresight Institute (2007)
14. "A technique that opens a window onto the nanoscale world" Chemistry World (2007)
15. "Force, Time and Harmony" Scientific American (2005)