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EDUCATION

November 2006	Ph.D. in Biophysics, University of California at Berkeley
June-August 2006	Physiology Course, Wood's Hole Marine Biological Laboratory
June 2001	B.S.E. in Bioengineering, University of Washington
June 1996	Graduate of Early Entrance Program at Halbert and Nancy Robinson Center for Young Scholars (entered college at 14), University of Washington

RESEARCH INTERESTS

Development of new imaging tools to study fast 3D cellular processes at high resolution; super-resolution microscopy; neurodevelopment; light sheet fluorescence microscopy; two photon microscopy; minimally invasive microscopy; inverse imaging problems; deep learning, adaptive optics

EXPERIENCE

2022 – Present	Senior Group Leader, Janelia Research Campus. Continued efforts to further push the boundaries of fluorescence microscopy, with a renewed focus on techniques best equipped for 4D imaging of tissue with high spatiotemporal resolution, particularly in combination with machine learning. Continued effort on mapping brain development in <i>C. elegans</i> , now incorporating volume electron microscopy.
2019-Present	Faculty Member, Applied Mathematics and Statistics, and Scientific Computation (AMSC), University of Maryland
2016 – 2022	Senior Investigator (tenured). Ongoing efforts to improve super-resolution and light-sheet microscopes, particularly for efforts in living samples. Pioneered computational microscopy approaches that provide better spatiotemporal resolution than base microscope. Constructing first 4D metazoan atlas of cell positions and dynamics. Developed computational methods for accelerating post-processing of microscopy datasets more than 1000-fold, to stem the 'data deluge'. Developed deep learning methods for denoising and resolution enhancement; characterized limitations of these methods.
2015-2022	Director, Advanced Imaging and Microscopy Facility at NIH. Founded facility for translating home-built optical technologies developed in intramural labs to the broader NIH community.
2014-Present	Adjunct Assistant Professor, University of Maryland Dept. of Physics

2013 – 2017	Course Director, Optical Microscopy in the Biomedical Sciences (OMIBS), Woods Hole, MA. Supervise and teach ~30 students at 10 day optics/modern fluorescence microscopy course, offered annually in October.
2009 – 2016	Investigator and Chief, Section on High Resolution Optical Imaging, National Institute of Biomedical Imaging and Bioengineering, National Institutes of Health (tenure-track investigator). Built an improved 3D photoactivated localization microscopy (PALM) system for super-resolution imaging in thick samples. Developed a resolution-doubling structured illumination microscope (SIM) that works in samples more than ~10x thicker than can be imaged with existing commercial microscopes and that is ~100x faster than other implementations. Applied this novel SIM technology to the study of multiple biological problems. Built selective plane illumination microscopy (SPIM) system for dynamic studies of <i>C. Elegans</i> embryogenesis. Improved axial resolution of SPIM 5-fold and lateral resolution ~1.4-fold relative to previously existing methods. Increased usability of this SPIM implementation and broadly disseminated use. In collaboration with biologists, applied SPIM to noninvasively image and computationally untwist images of live <i>C. elegans</i> , with the ultimate goal of assembling a 4D atlas of neuronal development with subcellular resolution.
2006- 2009 (Postdoctoral research)	Built first PALM system at Janelia Farm Research Campus. Performed first dual-label PALM experiments on adhesion complexes. Performed first PALM experiments on living cells. Improved and developed PALM technology to make it broadly applicable to cell biologists. Research supervised by Dr. Eric Betzig.
2001-2006 (Ph.D. research)	Developed single molecule sensors of mechanical force based on a fluorescence readout. Built a hybrid magnetic tweezers/total internal reflection fluorescence microscope to calibrate the sensors. Devised a method for synthesis of short (less than 100 bp), highly-bent DNA loops; characterized physical properties of loops with force sensors. Investigated the dependence of Integration Host Factor binding upon forces induced in DNA loops. Research supervised by Professor Jan Liphardt and Professor Carlos Bustamante at the University of California at Berkeley.
1999-2001 (B.S.E. research)	Worked towards experimentally measuring the lift pressure generated by a honeybee in hovering flight. Synthesized pressure sensitive paint, painted bees, performed experiments on paint with phosphorescence lifetime apparatus. Helped design and create the “phosphorescence microphone”, an instrument for the measurement of sound waves with pressure sensitive paints. Research supervised by Professor James Callis at the University of Washington.

HONORS AND AWARDS

2022	Royal Microscopy Society Scientific Achievement Award
2020	Robert Feulgen Prize in Histochemistry

2019	Burton Medal, Microscopy Society of America, for distinguished contributions to microscopy by an individual less than 40 years of age
2018, 2020	Microscopy Today Innovation Award
2017	Fellow of the Marine Biological Laboratory (MBL) at Woods Hole
2017	Bei Shizhang Lecture, Institute of Biophysics, Chinese Academy of Sciences
2017	NHLBI Core Innovation Award, for work in the application of super-resolution imaging
2016	Anne Heidenthal Prize for Fluorescence Research
2016	6 th Annual Seymour Benzer Lecture at National Academy of Sciences
2015	Finalist, 2015 ASCB-Gibco Emerging Leader Prize
2015	NIH Office of the Director Honor Award
2014, 2018, 2020	NIH Director's Award
2014	NICHD Director's Investigator Award
2014	NIBIB Director's Award
2014	Kavli Frontiers of Science Fellow
2013	Woods Hole Physiology Course Imaging Development Scholar
2013-2014	Research Award for conducting summer research at MBL Whitman Center
2011	NIH Director's Challenge Grant
2010	Presidential Early Career Award for Scientists and Engineers (PECASE)
2002 - 2006	Fannie and John Hertz Graduate Fellowship
2001	P.C. Cross Prize in Physical Chemistry, University of Washington Chemistry Dept.
1999 - 2001	Mary Gates Research Training Grant
1998 - 2000	University of Washington Undergraduate Scholar Award
1997 - 2001	University of Washington Undergraduate Honors Program

PUBLICATIONS

103. Rehman, A., Zhovmer, A., Sato, R., Mukouyama, Y., Chen, J., Rissone, A., Puertollano, R., Liu, J., Vishwasrao, H.D., **Shroff, H.**, Combs, C.A., Xue, H. Convolutional neural network transformer (CNNT) for fluorescence microscopy image denoising with improved generalization and fast adaptation. *Scientific Reports* **14** (1), 18184 (2024).

102. Prakash, K., Baddeley, D., Eggeling, C., Fiolka, R., Heintzmann, R., Manley, S., Radenovic, A., Smith, C., **Shroff, H.**, Schermelleh, L. Resolution in super-resolution microscopy – definitions, trade-offs, and perspectives. *Nature Reviews Molecular Cell Biology* **25** 677-682 (2024).

101. Fiore, A., Yu, G., Northey, J.N., Patel, R., Ravenscroft, T.A., Ikegami, R., Kolkman, W., Kumar, P., Grimm, J.B., Dilan, T.L., Ruetten, V.M.S., Ahrens, M.B., **Shroff, H.**, Lavis, L.D., Wang, S., Weaver, V.M., Pedram, K. Imaging the extracellular matrix in live tissues and organisms with a glycan-binding fluorophore. *bioRxiv* (2024).

100. Miyoshi, T., Vishwasrao, H.D., Belyantseva, I.A., Sajeeradathan, M.S., Ishibashi, Y., Adadey, S.M., Harada, N., **Shroff, H.**, Friedman, T.B. *bioRxiv* (2024). Live-cell single-molecule fluorescence microscopy for protruding organelles reveals regulatory mechanisms of MYO7A-driven cargo transport in stereocilia of inner ear cells.

99. Dai, B., Yang, J., **Shroff, H.**, La Riviere, P. Prediction of Cellular Identities from Trajectory and Cell Fate Information. *arXiv* 2401.06182 (2024).

98. Updegrove, T.B., Delerue, T., Anantharaman, V., Cho, H., Chan, C., Nipper, T., Choo-Wosoba, H., Jenkins, L., Zhang, L., Su, Y., **Shroff, H.**, Chen, J., Bewley, C., Aravind, L., Ramamurthi, K.S. Altruistic feeding and

cell-cell signaling during bacterial differentiation actively enhance phenotypic heterogeneity. *Science Advances* in press (2024).

97. Chandler, T., Guo, M., Su, Y., Chen, J., Wu, Y., Liu, J., Agashe, A., Fischer, R.S., Mehta, S.B., Kumar, A., Baskin, T.I., Jamouille, V., Liu, H., Swaminathan, V., Nain, A., Oldenbourg, R., La Riviere, P., **Shroff, H.** Three-dimensional spatio-angular fluorescence microscopy with a polarized dual-view inverted selective-plane illumination microscope (pol-diSPIM), bioRxiv (2024).

96. **Shroff, H.**, Testa, I., Jug, F., Manley, S. Live cell imaging powered by computation. *Nature Reviews Molecular Cell Biology* **25** 443-463 (2024).

95. Chareyre, S., Li, X., Anjuwon-Foster, B.R., Updegrove, T.B., Clifford, S., Brogan, A., Su, Y., Zhang, L., Chen, J., **Shroff, H.**, Ramamurthi, K.S. Cell division machinery drives cell-specific gene activation during bacterial differentiation. *PNAS* **121** (13), e2400584121 (2024).

94. Johnson, C., Guo, M., Schneider, M.C., Su, Y., Khuon, S., Reiser, N., Wu, Y., La Riviere, P., **Shroff, H.** Phase diversity-based wavefront sensing for fluorescence microscopy. *Optica* **11** (6), 806-820 (2024).

93. Guo, M., Wu, Y., Su, Y., Qian, S., Krueger, E., Christensen, R., Kroeschell, G., Bui, J., Chaw, M., Zhang, L., Liu, J., Hou, X., Han, X., Ma, X., Zhovmer, A., Combs, C., Moyle, M., Yemini, E. Liu, H., Liu, Z., La Riviere, P., Colón-Ramos, D., **Shroff, H.** Deep learning-based aberration compensation improves contrast and resolution in fluorescence microscopy. bioRxiv (2023).

92. Reiser, N., Guo, M., **Shroff, H.**, La Riviere, P. Phase Diverse Phase Retrieval for Microscopy: Comparison of Gaussian and Poisson Approaches. arXiv: 2308.00734v1 (2023).

91. Sadhu, R.K., Hernandez-Padilla, C., Eisenbach, Y.E., Zhang, L., Vishwasrao, H.D., Behkam, B., **Shroff, H.**, Iglic, A., Peles, E., Nain, A.S., Gov, N.S. Experimental and Theoretical model for the origin of coiling of cellular protrusions around fibers. *Nature Communications*, **14** (1), 5612 (2023).

90. Ngo, T.B., DeStefano, S., Liu, J., Su, Y., **Shroff, H.**, Vishwasrao, H.D., Sadtler, K. Label-free cleared tissue microscopy and machine learning for 3D histopathology of biomaterial implants. *Journal of Biomedical Materials Research Part A*, **111**(6), 840-850 (2023).

89. Li, X., Wu, Y., Su, Y., Rey-Suarez, I.A., Matthaeus, C., Updegrove, T.B., Wei, Z., Zhang, L., Sasaki, H., Li, Y., Guo, M., Giannini, J.P., Vishwasrao, H.D., Chen, J., Lee, S-J. J., Shao, L., Liu, H., Ramamurthi, K.S., Taraska, J.W., Upadhyaya, A., La Riviere, P., **Shroff, H.** Three-dimensional structured illumination microscopy with enhanced axial resolution. *Nature Biotechnology* **41**(9), 1307-1319 (2023).

88. Lauziere, A., Christensen, R., **Shroff, H.**, Balan, R. An exact hypergraph matching algorithm for posture identification in embryonic *Caenorhabditis elegans*. *PLoS One* **17**(11), e0277343 (2022).

87. Wu, Y. and **Shroff, H.** Multiscale fluorescence imaging of living samples. *Histochemistry and Cell Biology*, **158**(4), 301-323 (2022).

86. Hobson, C.M., Guo, M., Vishwasrao, H.D., Wu, Y., **Shroff, H.**, Chew, T-L. Practical considerations for quantitative light sheet fluorescence microscopy. *Nature Methods* **19**(12), 1538-1549 (2022).

85. Tabler, C.O., Wegman, S.J., Chen, J., **Shroff, H.**, Alhusaini, N., Tilton, J.C. The HIV-1 Viral Protease Is Activated during Assembly and Budding Prior to Particle Release. *Journal of Virology*, **96** (9), e02198-21 (2022).

84. Ardiel, E.L., Lauziere, A., Xu, S., Harvey, B.J., Christensen, R., Nurrish, S., Kaplan, J.M., **Shroff, H.** Stereotyped behavioral maturation and rhythmic quiescence in *C. elegans* embryos. *eLife* **11**, e76836 (2022).

83. Li, Y., Su, Y., Guo, M., Han, X., Liu, J., Vishwasrao, H., Li, X., Christensen, R., Sengupta, T., Moyle, M., Chen, J., Usdin, T.B., Colón-Ramos, D., Liu, H., Wu, Y., **Shroff, H.** Incorporating the image formation process into deep learning improves network performance. *Nature Methods* **19**(11), 1427-1437 (2022).

82. Wheatley, B.A., Rey-Suarez, I., Hourwitz, M.J., Kerr, S., **Shroff, H.**, Fourkas, J.T., Upadhyaya, A. Nanotopography modulates cytoskeletal organization and dynamics during T cell activation. *Molecular Biology of the Cell* mbc.E21-12-0601.
81. Zhao, H., Nguyen, A., Wu, D., Li, Y., Hassan, S.A., Chen, J., **Shroff, H.**, Piszczek, G., Schuck, P. Plasticity in structure and assembly of SARS-CoV-2 nucleocapsid protein. *PNAS Nexus*, **1** (2), pgac049 (2022).
80. Patel, A., Wu, Y., Han, X., Su, Y., Maugel, T.K., **Shroff, H.**, Roy, S. Cytonemes coordinate asymmetric signaling and organization in the *Drosophila* muscle progenitor niche. *Nature Communications* **13** (1), 1-17 (2022).
79. Miyoshi, T., Belyantseva, I.A., Kitajiri, S., Miyajima, H., Nishio, S., Usami, S., Kim, B.J., Choi, B.Y., Omori, K., **Shroff, H.**, Friedman, T.B. Human deafness-associated variants alter the dynamics of key molecules in hair cell stereocilia F-actin cores. *Human Genetics* (2021), 1-20.
78. Wu, Y., Han, X., Su, Y., Glidewell, M., Daniels, J.S., Liu, J., Sengupta, T., Rey-Suarez, I., Fischer, R., Patel, A., Combs, C., Su, J., Wu, X., Christensen, R., Smith, C., Bao, L., Sun, Y., Duncan, L.H., Chen, J., Pommier, Y., Shi, Y.-B., Murphy, E., Roy, S., Upadhyaya, A., Colón-Ramos, D., La Riviere, P., **Shroff, H.** Multiview confocal super-resolution microscopy. *Nature* **600** (7888): 279-284 (2021).
77. Elliott, A.D., Berndt, A., Houpert, M., Roy, S., Scott, R.L., Chow, C.C., **Shroff, H.**, White, B.H. Pupal behavior emerges from unstructured muscle activity in response to neuromodulation in *Drosophila*. *eLife* **10**, e68656 (2021).
76. Sengupta, T., Koonce, N.L., Vazquez-Martinez, N., Moyle, M.W., Duncan, L.H., Emerson, S.E., Han, X., Shao, L., Wu, Y., Santella, A., Fan, L., Bao, Z., Mohler, W.A., **Shroff, H.**, Colón-Ramos, D. Differential adhesion regulates neurite placement via a retrograde zippering mechanism. *eLife* **10** e71171 (2021).
75. Chen, J., Sasaki, H., Lai, H., Su, Y., Liu, J., Wu, Y., Zhovmer, A., Combs, C.A., Rey-Suarez, I., Chang, H., Huang, C.C., Li, X., Guo, M., Nizambad, S., Upadhyaya, A., S-J. J. Lee, Lucas, L.A.G., **Shroff, H.** Three-dimensional residual channel attention networks denoise and sharpen fluorescence microscopy image volumes. *Nature Methods* **18**(6), 678-687 (2021).
74. Campanello, L., Traver, M.K., **Shroff, H.**, Schaefer, B.C., Losert, W. Signaling through polymerization and degradation: Analysis and simulations of T cell activation mediated by Bcl10. *PLOS Computational Biology* **17**(5), e1007986 (2021).
73. Brittin, C.A., Santella, A., Barnes, K., Moyle, M.W., Fan, L., Christensen, R., Kolotuev, I., Mohler, W.*, **Shroff, H.***, Colón-Ramos, D.*, Bao, Z*. Multicellular rosettes organize neuropil formation. bioRxiv (2020).
72. Rey-Suarez, I., Rogers, N., Kerr, S., **Shroff, H.**, Upadhyaya, A. Actomyosin dynamics modulate microtubule deformation and growth during T cell activation. *Molecular Biology of the Cell*, mbc.E20-10-0685 (2021).
71. Han, X., Su, Y., White, H., O'Neill, K.M., Morgan, N.Y., Christensen, R., Potarazu, D., Vishwasrao, H.D., Xu, S., Sun, Y., Huang, S.-Y., Moyle, M.W., Dai, Q., Pommier, Y., Giniger, E., Albrecht, D.R., Probst, R., **Shroff, H.** A polymer index-matched to water enables diverse applications in fluorescence microscopy. *Lab on a Chip* **21**, 1549-1562 (2021).
70. Moyle, M.W., Barnes, K.M., Kuchroo, M., Gonopolskiy, A., Duncan, L.H., Sengupta, T., Shao, L., Guo, M., Santella, A., Christensen, R., Kumar, A., Wu, Y., Moon, K.R., Wolf, G., Krishnaswamy, S.*, Bao, Z.*, **Shroff, H.***, Mohler, W.*, Colón-Ramos, D.*. Structural and developmental principles of neuropil assembly in *C. elegans*. *Nature* **591**, 99-104 (2021).
69. Miyoshi, T., Zhang, Q., Miyake, T., Watanabe, S., Ohnishi, H., Chen, J., Vishwasrao, H.D., Chakraborty, O., Belyantseva, I.A., Perrin, B.J., **Shroff, H.**, Friedman, T.B., Omori, K., Watanabe, N. Semi-Automated Single-Molecule Microscopy Screening of Fast-Dissociating Specific Antibodies Directly from Hybridoma Cultures. *Cell Reports*, **34** 108708 (2021).

68. Curd, A.P., Leng, J., Hughes, R.E., Cleasby, A.J., Rogers, B., Trinh, C., Baird, M.A., Takagi, Y., Tiede, C., Sieben, C., Manley, S., Schlichthaerle, T., Jungmann, R., Ries, J., **Shroff, H.**, Peckham, M. Nanoscale pattern extraction from relative positions of sparse 3D localisations. *Nanoletters* **21**, 1213-1220 (2021).
67. Nogare, D.D., Natesh, N., Vishwasrao, H.D., **Shroff, H.**, Chitnis, A. Zebrafish posterior Lateral Line Primordium migration requires interactions between a superficial sheath of motile cells and the skin. *eLife* **9**:e58251 (2020).
66. Trcek, T., Douglas, T.E., Grosch, M., Yin, Y., Eagle, W.V.I., Gavis, E.R., **Shroff, H.**, Rothenberg, E., Lehmann, R. Sequence independent self-assembly of germ granule mRNAs into homotypic clusters. *Molecular Cell*, **S1097-2765**(20), 30309-9 (2020).
65. Chandler, T., **Shroff, H.**, Oldenbourg, R., La Riviere, P. Spatio-angular fluorescence microscopy III. Constrained angular diffusion, polarized excitation, and high-NA imaging. *Journal of the Optical Society of America A* **37** (9), 1465-1479 (2020).
64. Guo, M., Li, Y., Su, Y., Lambert, T., Dalle Nogare, D., Moyle, M.W., Duncan, L.H., Ikegami, R., Santella, A., Rey-Suarez, I., Green, D., Beiriger, A., Chen, J., Vishwasrao, H., Ganesan, S., Prince, V., Waters, J.C., Annunziata, C.M., Hafner, M., Mohler, W.A., Chitnis, A.B., Upadhyaya, A., Usdin, T.B., Bao, Z., Colon-Ramos, D., La Riviere, P., Liu, H., Wu, Y., **Shroff, H.** Rapid image deconvolution and multiview fusion for optical microscopy. *Nature Biotechnology*, **38**(11), 1337-1346 (2020).
63. Rey-Suarez, I., Wheatley, B.A., Koo, P., Bhanja, A., Shu, Z., Mochrie, S., Song, W., **Shroff, H.**, Upadhyaya, A. WASP family proteins regulate the mobility of the B cell receptor during signaling activation. *Nature Communications*, **11**, 439 (2020).
62. Bhagwat, A., Le Sage, V., Nturibi, E., Kulej, K., Jones, J., Guo, M., Kim, E.T., Garcia, B., Weitzmann, M.D., **Shroff, H.**, Lakdawala, S.S. Quantitative live cell imaging reveals influenza virus manipulation of Rab11A transport through reduced dynein association. *Nature Communications*, **11**, 23 (2020).
61. Peluso, E.A., Updegrove, T.B., Chen, J., **Shroff, H.**, Ramamurthi, K.S. A 2-dimensional ratchet model describes assembly initiation of a specialized bacterial surface. *PNAS*, **16**(43), 21789-21799 (2019).
60. Colón-Ramos, D.A., La Riviere, P., **Shroff, H.**, Oldenbourg, R. Transforming the development and dissemination of cutting-edge microscopy and computation. *Nature Methods* **16**, 667-673 (2019).
59. Chandler, T., **Shroff, H.**, Oldenbourg, R., La Riviere, P. Spatio-angular fluorescence microscopy. II. Paraxial 4f imaging. *Journal of the Optical Society of America A* **36** (8), 1346-1360 (2019).
58. Chandler, T., **Shroff, H.**, Oldenbourg, R., La Riviere, P. Spatio-angular fluorescence microscopy. I. Basic theory. *Journal of the Optical Society of America A* **36** (8), 1334-1345 (2019).
57. Duncan, L.H., Moyle, M.W., Shao, L., Sengupta, T., Ikegami, R., Kumar, A., Guo, M., Christensen, R., Santella, A., Bao, Z., **Shroff, H.**, Mohler, W., Colón-Ramos, D.A. Isotropic light-sheet microscopy and automated cell lineage analyses to catalogue *Caenorhabditis elegans* embryogenesis with subcellular resolution. *JoVE*, 148, e59533 (2019).
56. Vogt, E.-J., Tokuhiko, K., Guo, M., Dale, R., Yang, G., Movilla, M.J., **Shroff, H.**, Dean, J. Anchoring cortical granules in the egg cortex ensures timely trafficking to the plasma membrane for post-fertilization exocytosis. *Nature Communications* **10** (1), 2271 (2019).
55. Wu, Y., **Shroff, H.** Faster, sharper, and deeper: structured illumination microscopy for biological imaging. *Nature Methods* **15**, 1011-1019 (2018).
54. Markwardt, M.L., Snell, N.E., Guo, M., Wu, Y., Christensen, R., Liu, H., **Shroff, H.**, Rizzo, M. A genetically encoded biosensor strategy for quantifying non-muscle myosin II phosphorylation dynamics in living cells and organisms. *Cell Reports* **24**, 1060-1070 (2018).

53. Xu, M., Wu, Y., **Shroff, H.**, Wu, M., Mani, M. A scheme for 3-dimensional morphological reconstruction and force inference in the early *C. elegans* embryo. *PLoS One* **13**(7), e0199151 (2018).
52. Guo, M., Chandris, P., Giannini, J.P., Trexler, A.J., Fischer, R., Chen, J., Vishwasrao, H.D., Rey-Suarez, I., Wu, Y., Wu, X., Waterman, C.M., Patterson, G.H., Upadhyaya, A., Taraska, J., **Shroff, H.** Single-shot super-resolution total internal reflection fluorescence microscopy. *Nature Methods* **15**, 425-428 (2018).
51. Chandler, T., Mehta, S., **Shroff, H.**, Oldenbourg, R., La Riviere, P.J., Single-fluorophore orientation determination with multiview polarized illumination: modeling and microscope design. *Optics Express* **25** (25), 31309-31325 (2017).
50. Zhu, G., Lynn, G.M.,..., **Shroff, H.**, Klinman, D.M., Seder, R.A., Chen, X. Albumin/vaccine nanocomplexes that assemble in vivo for combination cancer immunotherapy. *Nature Communications*, **8** (1), 1954 (2017).
49. Zhu, G., Mei, L., Vishwasrao, H., Jacobson, O., Liu, Y., Wang, Z., Yung, B., Fu, X., Jin, A., Niu, G., Wang, Q., Zhang, F., **Shroff, H.**, Chen, X. Intertwining DNA-RNA nanocapsules loaded with tumor neoantigens as synergistic nanovaccines for cancer immunotherapy. *Nature Communications*, **8** (1), 1482 (2017).
48. Giannini, J.P., York, A.G., **Shroff, H.** Anticipating, measuring, and minimizing MEMS mirror scan error to improve laser scanning microscopy's speed and accuracy. *PLoS One*, **12** (10) e0185849.
47. Wu, Y., Kumar, A., Smith, C., Ardiel, E., Chandris, P., Christensen, R., Rey-Suarez, I., Guo, M., Vishwasrao, H., Chen, J., Tang, J., Upadhyaya, A., La Riviere, P., **Shroff, H.** Reflective imaging improves spatiotemporal resolution and collection efficiency in light sheet microscopy. *Nature Communications*, **8** (1), 1452 (2017).
46. Kieffer-Kwon, K-R.,..., **Shroff, H.**, Lieberman Aiden, E., Casellas, R. Myc Regulates Chromatin Decompaction and Nuclear Architecture during B Cell Activation. *Molecular Cell* **67** (4), 566-578 (2017).
45. Sardo, L., Lin, A., Khakhina, S., Beckman, L., Ricon, L., Elbezanti, W., Jaison, T., Vishwasrao, H., **Shroff, H.**, Janetopoulos, C., Klase, Z.A. Real-time visualization of chromatin modification in isolated nuclei. *J. Cell Sci.* **130**(17), 2926-2940 (2017).
44. Laissue, P.P., Alghamdi, R., Tomancak, P., Reynaud, E., **Shroff, H.** Assessing phototoxicity in live fluorescence imaging. *Nature Methods* **14** (7), 657-661 (2017).
43. Zheng, W., Wu, Y., Winter, P., Fischer, R., Nogare, D.D., Hong, A., McCormick, C., Christensen, R., Dempsey, W., Arnold, D.B., Zimmerberg, J., Chitnis, A., Sellers, J., Waterman, C., **Shroff, H.** Adaptive optics improves multiphoton super-resolution imaging. *Nature Methods*, **14** (9): 869-872 (2017).
42. Ardiel, E., Kumar, A., Marbach, J., Christensen, R., Gupta, R., Duncan, W., Daniels, J.S., Stuurman, N., Colon-Ramos, D., **Shroff, H.** Visualizing calcium flux in freely moving nematode embryos. *Biophysical Journal*, **112**, 1975-1983 (2017).
41. Trcek, T., Lionnet, T., **Shroff, H.**, Lehmann, R. mRNA quantification using single-molecule FISH in *Drosophila* embryos. *Nature Protocols* **12** (7), 1326-1358 (2017).
40. Combs, C, **Shroff, H.** Fluorescence microscopy: a concise guide to current imaging methods. *Current Protocols in Neuroscience*, **79**, 2.1.1-2.1.25 (2017).
39. Ogawa, M., Tomita, Y., Nakamura, Y., Lee, M-J., Lee, S., Tomita, S., Nagaya, T., Sato, K., Yamauchi, T., Iwai, H., Kumar, A., Haystead, T., **Shroff, H.**, Choyke, P., Trepel, J.B., Kobayashi, H., Immunogenic cancer cell death selectively induced by near infrared photoimmunotherapy initiates host tumor immunity. *Oncotarget* **8**(6) 10425-10436 (2017).
38. Wu, Y., Chandris, P., Winter, P.W., Kim, E.Y., Jaumouille, V., Kumar, A., Guo, M., Leung, J.M., Smith, C., Rey-Suarez, I., Liu, H., Waterman, C.M., Ramamurthi, K.S., LaRiviere, P., **Shroff, H.** Simultaneous multi-view capture and fusion improves spatial resolution in wide-field and light-sheet microscopy. *Optica*, **8** 897-910 (2016).

37. Dundon, S.E., Chang, S-S., Kumar, A., Occhipinti, P., **Shroff, H.**, Roper, M., Gladfelter, A.S. Clustered nuclei maintain autonomy and nucleocytoplasmic ratio control in a syncytium. *Molecular Biology of the Cell*, **27** (13) 2000-7 (2016).
36. Kumar, A., Christensen, R., Chandris, P., Guo, M., Duncan, W., Wu, Y., Santella, A., Moyle, M., Winter, P.W., Colon-Ramos, D., Bao, Z., **Shroff, H.** Using stage- and slit-scanning to improve contrast and optical sectioning in dual-view inverted light-sheet microscopy (diSPIM). *The Biological Bulletin*, **231**(1), 26-39 (2016).
35. Christensen, R., Bokinsky, A., Santella, A., Wu, Y., Marquina-Solis, J., Guo, M., Kovacevic, I., Kumar, A., Winter, P.W., Tashakkori, N., McCreedy, E., Liu, H., McAuliffe, M., Mohler, W., Colon-Ramos, D.A., Bao, Z., **Shroff, H.** Untwisting the *Caenorhabditis elegans* embryo. *eLife* 10070 (2015).
34. Curd, A., Cleasby, A., Makowska, A., York, A.G., **Shroff, H.**, Peckham, M. Construction of an instant structured illumination microscope. *Methods pii: S1046-2023 (15)30029-3* (2015).
33. Kumar, A., Colon-Ramos, D.A., **Shroff, H.** Watching a roundworm develop with a sheet of light. *Physics Today* **68** (7) 58-59 (2015).
32. Trcek, T., Grosch, M., York, A., **Shroff, H.**, Lionnet, T., Lehmann, R. *Drosophila* germ granules are structured and contain homotypic mRNA clusters. *Nature Communications*, **6** 7962 (2015).
31. Santella, A., Catena, R. Kovacevic, I., Shah, P., Yu, Z., Marquina-Solis, J., Kumar, A., Wu, Y., Schaff, J., Colon-Ramos, D., **Shroff, H.**, Mohler, W., Bao, Z. WormGUIDES: an interactive single cell developmental atlas and tool for collaborative multidimensional data exploration. *BMC Bioinformatics* **16**(1), 1-9 (2015).
30. Christensen, R., Bokinsky, A., Santella, A., Wu, Y., Marquina, J., Kovacevic, I., Kumar, A., Winter, P., McCreedy E., Mohler, W., Bao, Z., Colon-Ramos, D.A., **Shroff, H.** An imaging and analysis toolset for the study of *Caenorhabditis elegans* neurodevelopment. *SPIE BiOS* (2015).
29. Winter, P.W., Chandris, P., Fischer, R.S., Wu, Y., Waterman, C.M., **Shroff, H.** Incoherent structured illumination improves optical sectioning and contrast in multiphoton super-resolution microscopy. *Optics Express* **23**(4), 5327-5334 (2015).
28. Temprine, K., York, A.G., **Shroff, H.** Three-Dimensional Photoactivated Localization Microscopy with Genetically Expressed Probes, book chapter in 'Advanced Fluorescence Microscopy/Methods in Molecular Biology', 231-261 (2015).
27. Winter, P., York, A.G., Dalle Nogare, D., Ingaramo, M., Christensen, R., Chitnis, A., Patterson, G.H., **Shroff, H.** Two-photon instant structured illumination microscopy improves the depth penetration of super-resolution imaging in thick scattering samples. *Optica*, **1**, 181-191 (2014).
26. Kumar, A., Wu, Y., Christensen, R., Chandris, P., Gandler, W., McCreedy, E., Bokinsky, A., Colon-Ramos, D.A., Bao, Z., McAuliffe, M., Rondeau, G., **Shroff, H.***. Assembly and use of dual-view inverted plane illumination microscope for rapid, spatially isotropic four-dimensional imaging. *Nature Protocols*, **9**, 2555-73 (2014).
25. Eswaramoorthy, P., Winter, P., Wawrzusin, P., York, A., **Shroff, H.**, Ramamurthi, K. Asymmetric Division and Differential Gene Expression during a Bacterial Developmental Program Requires DivIVA. *Plos Genetics*, **10**, e1004526 (2014).
24. Winter, P., **Shroff, H.** Faster fluorescence microscopy: advances in high speed biological imaging. *Current Opinion in Chemical Biology* **20**, 46-53 (2014).
23. Ingaramo, M., York, A.G., Wawrzusin, P., Milberg, O., Hong, A., Weigert, R., **Shroff, H.**, Patterson, G.H. Two photon excitation improves multifocal structured illumination microscopy in thick scattering tissue. *PNAS* **111**, 5254-9 (2014).

22. Lakdawala, S.S., Wu, Y., Wawrzusin, P., Kabat, J., Broadbent, A.J., Lamirande, E.W., Fodor, E., Altan-Bonnet, N., **Shroff, H.***, Subbarao, K. Influenza A Virus Assembly Intermediates Fuse in the Cytoplasm. *Plos Pathogens* **10**, e1003971 (2014).
21. Ingaramo, M., York, A.G., Hoogendoorn, E., Postma, M., **Shroff, H.**, Patterson, G. H. Richardson-Lucy Deconvolution as a General Tool for Combining Images with Complementary Strengths. *Chemphyschem* **15**, 794-800 (2014).
20. Zhao, H., Casillas, E Jr., **Shroff, H.**, Patterson, G.H., Schuck, P. Tools for the quantitative analysis of sedimentation boundaries detected by fluorescence optical analytical centrifugation. *PLoS One*, **8**, e77245 (2013).
19. York, A.G., Chandris, P., Dalle Nogare, D., Head, J., Wawrzusin, P., Fischer, R.S., Chitnis, A., **Shroff, H.** Instant super-resolution imaging in live cells and embryos via analog image processing. *Nat. Methods* **10**, 1122-6 (2013).
18. Wu, Y., Wawrzusin, P., Senseney, J., Fischer, R.S., Christensen, R., Santella, A., York, A.G., Winter, P.W., Waterman, C.M., Bao, Z., Colon-Ramos, D., McAuliffe, M., **Shroff, H.** Spatially isotropic four-dimensional imaging with dual-view plane illumination microscopy. *Nat. Biotechnol.* **31**, 1032-8 (2013).
17. Wu, Y., Christensen, R., Colon-Ramos, D., **Shroff, H.** Advanced Optical Imaging Techniques for Neurodevelopment. *Current Opinion in Neurobiology* **23**, 1090-7 (2013).
16. York, A.G., Parekh, S.H., Dalle Nogare, D., Fischer, R.S., Temprine, K., Mione, M., Chitnis, A.B., Combs, C.A., **Shroff, H.** Resolution Doubling in Live, Multicellular Organisms via Multifocal Structured Illumination Microscopy. *Nat. Methods* **9**, 749-754 (2012).
15. Fischer, R.S., Wu, Y., Kanchanawong, P., **Shroff, H.**, Waterman, C.M. Microscopy in 3D: a biologist's toolbox. *Trends in Cell Biology* **21**, 682-691 (2011).
14. Wu, Y., Ghitani, A., Christensen, R., Santella, A., Du, Z., Rondeau, G., Bao, Z., Colon-Ramos, D., **Shroff, H.** Inverted selective plane illumination microscopy (iSPIM) enables coupled cell identity lineaging and neurodevelopmental imaging in *Caenorhabditis elegans*. *PNAS* **108**, 17708-17713 (2011).
13. York, A.G., Ghitani, A., Vaziri, A., Davidson M.W., **Shroff, H.** Confined activation and subdiffractional localization enables whole-cell PALM with genetically expressed probes. *Nat. Methods* **8**, 327-333 (2011).
12. Frost, N.A., **Shroff, H.**, Kong, H., Betzig, E., Blanpied T.A. Single-molecule discrimination of discrete perisynaptic and distributed sites of actin filament assembly within dendritic spines. *Neuron* **67**, 86-99 (2010).
11. Greenfield, D., McEvoy, A.L., **Shroff, H.**, Crooks, G.E., Wingreen, N.S., Betzig, E., Liphardt, J. Self-Organization of the *Escherichia coli* Chemotaxis Network Imaged with Super-Resolution Light Microscopy. *PLoS Biology* **7** e1000137 (2009).
10. Vaziri, A., Tang, J., **Shroff, H.**, Shank, C.V. Multilayer Three-Dimensional Super-resolution Imaging of Thick Samples. *PNAS* **105**, 20221-20226 (2008).
9. Ji, N., **Shroff, H.**, Zhong, H., Betzig, E. Advances in the speed and resolution of light microscopy. *Current Opinion in Neurobiology* **18**, 605-616 (2008).
8. **Shroff, H.***, White, H., Betzig, E. Photoactivation localization microscopy (PALM) of adhesion complexes. *Current Protocols in Cell Biology* **4.21**, 4.21.1-4.21.27 (2008).
7. **Shroff, H.***, Galbraith, C.G., Galbraith, J.A., Betzig, E. Live-cell photoactivated localization microscopy of nanoscale adhesion dynamics. *Nat. Methods* **5**, 417-423 (2008).

6. Manley, S., Gillette, J.M., Patterson, G.H., **Shroff, H.**, Hess, H.F., Betzig, E., Lippincott-Schwartz, J. High-density mapping of single-molecule trajectories with photoactivated localization microscopy. *Nat. Methods* **5**, 155-157 (2008).
5. **Shroff, H.**, Sivak, D., Siegel, J.J., McEvoy, A., Siu, M., Spakowitz, A., Geissler, P., Liphardt, J. Optical measurement of mechanical forces inside short DNA loops. *Biophys. J.* **94**, 2179-2186 (2008).
4. **Shroff, H.***, Galbraith, C.G., Galbraith, J.A., White, H., Gillette, J., Olenych, S., Davidson, M.W., Betzig, E. Dual-color superresolution imaging of genetically expressed probes within individual adhesion complexes. *PNAS* **104**, 20308-20313 (2007).
3. Pauzauskie, P.J., Radenovic, A., Trepagnier, E., **Shroff, H.**, Yang, P., Liphardt, J. Optical trapping and integration of nanowire assemblies in water. *Nat. Materials* **5**, 97-101 (2006).
2. **Shroff, H.**, Reinhard, B.M., Siu, M., Agarwal, H., Spakowitz, A., Liphardt, J. Biocompatible force sensor with optical readout and dimensions of 6 nm³. *Nano Lett.* **5**, 1509-1514 (2005).
1. McGraw, C.M., **Shroff, H.**, Khalil, G., Callis, J.B. The phosphorescence microphone: a device for testing oxygen sensors and films. *Rev. Sci. Instrum.* **74**, 5260-5266 (2003).

* Corresponding Author; starting from 2009 (heading my independent laboratory), I have made the conscious decision to relinquish corresponding author to the more junior members of the lab to better promote their careers

PATENTS

- 2023 Systems and methods for three-dimensional fluorescence polarization via multiview imaging. H Shroff, A Kumar, SB Mehta, P Jean-La Riviere, R Oldenbourg, Y Wu, T Chandler, US Patent 11,680,903.
- 2021 Systems and methods for multi-view nonlinear optical imaging for improved signal-to-noise ratio and resolution in point scanning multi-photon microscopy, H Shroff, Y Wu, US Patent 11041807
- 2020 Illumination microscopy systems and methods, H Shroff, A York, US Patent 10,656,403 B2
- 2019 Resolution enhancement for line scanning excitation microscopy systems and methods, H Shroff, A York, J. Giannini, A. Kumar, US Patent 10247930
- 2019 Systems and methods for instant total internal reflection fluorescence/structured illumination microscopy, H. Shroff, J. Taraska, J. Giannini, Y. Wu, A. Kumar, M. Guo, US Patent 10520714
- 2019 Resolution enhancement for light sheet microscopy systems and methods, H Shroff, Y Wu, S. Abrahamsson, US Patent 10,401,604 B2
- 2017 Multi-focal structured illumination microscopy systems and methods, H Shroff, A York, US Patent 9,696,534
- 2016 Optomechanical module for converting a microscope to provide selective plane illumination microscopy, H Shroff, Y Wu, G Rondeau, US Patent 9,316,824

INVITED TALKS

- 2024 Imaging Mouse Development biannual conference, EMBL, Heidelberg, Germany, September 3, “Data driven image restoration”
- 2024 Optical Imaging Bootcamp, Janelia Research Campus, August 2, “Synergies between microscopy, computation, and data”, **plenary speaker**
- 2024 ASCB webinar series on data science, virtual, July 23, “Data-driven image restoration”

- 2024 Contextualizing Cellular Physiology workshop hosted by NIDDK, NIH, Bethesda, MD, June 12, “Synergies between microscopy, computation, & data” **keynote speaker**
- 2024 Computational Optics conference at Janelia Research Campus, Ashburn, VA, May 21, “New (& old) methods for improving fluorescence imaging at depth”
- 2024 NHLBI Symposium on AI, NIH, Bethesda, MD, May 17, “Live cell imaging powered by computation”, **keynote speaker**
- 2024 Distinguished Scientist Seminar Series, Georgetown University, Washington DC, May 2, “Mapping embryonic development with microscopy”
- 2024 Seminar at Okinawa Institute of Science and Technology (OIST), Okinawa, Japan, April 3, “Multiscale biological imaging at high spatiotemporal resolution”, **keynote speaker**
- 2023 Seminar to Biology Department at the University of Puerto Rico, Puerto Rico, December 5, “Mapping embryonic development with microscopy”
- 2023 Seminar to Dept. of Systems Biology at UT Southwestern, Dallas, TX, September 12, “Mapping embryonic development with microscopy”
- 2023 Super-Resolution workshop, Leeds, England, July 7, “Perils and Pitfalls in Image Restoration”
- 2023 The Microscience Microscopy Congress, Manchester, England, July 6, Manchester, England, “Multiscale biological imaging at high spatiotemporal resolution”
- 2023 Seminar to Biology Department at UCLA, Los Angeles, CA, June 7, “Multiscale biological imaging at high spatiotemporal resolution”
- 2023 Janelia Junior Scientist workshop on Imaging Techniques and Molecular Tools for Biology, Ashburn, VA, June 1, “Failures in toolmaking”, **plenary speaker**
- 2023 Imaging Cell Dynamics, Lisbon, Portugal, May 15, “Multiscale biological imaging at high spatiotemporal resolution”
- 2023 International Conference on Advanced Biomedical Imaging, IIT Madras (attended virtually), January 11, “Multiscale biological imaging at high spatiotemporal resolution”
- 2022 Optical Imaging Bootcamp, Janelia Research Campus, July 20, “Multiscale biological imaging at high spatiotemporal resolution”, **plenary speaker**
- 2022 Balticon 56 Science Fiction and Fantasy Convention, May 28, “Mapping brain development with microscopy”
- 2022 UNC Chapel Hill Dept. of Neuroscience Seminar, May 19, “Enhancing fluorescence microscopy with computation”
- 2022 Society for Laboratory Automation (SLAS) 2022 Americas Building Biology in 3D Symposium, Virtually, April 27, “Enhancing fluorescence microscopy with computation”
- 2022 Yale University Wu Tsai Institute Seminar, Virtually, March 30, “Multiscale Biological Imaging at High Spatiotemporal Resolution”
- 2022 Janelia Research Campus, Seminar, Virtually, January 24, “Multiscale Biological Imaging at High Spatiotemporal Resolution”
- 2021 Australia National University Advanced Computational and Medical Technologies Seminar Series, Virtually, October 26, “Enhancing fluorescence microscopy with computation”

- 2021 Indian Institute of Technology, Bombay Campus Dept. of Physics Departmental Seminar, Virtually, October 20, “Enhancing fluorescence microscopy with computation”
- 2021 EMBL biannual ‘Seeing is Believing’ imaging conference, Virtually, October 7, “Multiview confocal super-resolution microscopy”
- 2021 Center for Integrated Nanotechnologies Annual Meeting, Virtually, September 23, “Enhancing fluorescence microscopy with computation”, **plenary speaker**
- 2021 Institute of Physics Machine Learning in Biological Physics Conference, Virtually, September 6, “Enhancing fluorescence microscopy with computation”
- 2021 UCSF Gladstone Center for Cell Circuitry Dept. Seminar, Virtually, August 24, “Enhancing Optical Imaging with computation”
- 2021 Society for Developmental Biology 80th Annual Meeting, Virtually, July 13, “Enhancing fluorescence microscopy with computation”
- 2021 Bangalore Microscopy Lectures, Virtually, May 31, “Microfluidics, multiview fusion, and machine learning: new methods for light-sheet fluorescence microscopy”
- 2021 MBL Light-Sheet Fluorescence Microscopy Conference, virtually, May 11, “Microfluidics, multiview fusion, and machine learning: new methods for light-sheet fluorescence microscopy”
- 2021 Seminar to Dept. of Optical Biology, University College London, virtually, April 21, “Enhancing optical imaging with computation”
- 2021 Frontiers Seminar to Emory University Dept. of Neuroscience, virtually, March 5, “Multiscale Biological Imaging at High Spatiotemporal Resolution”
- 2021 Seminar to US Department of Energy Bioimaging Science Program, virtually, February 22, “Enhancing fluorescence microscopy with computation”, **keynote speaker**
- 2021 3rd AI/Microscopy Symposium, Leica Microsystems/DRVision, virtually, February 9, “Enhancing fluorescence microscopy with computation”
- 2021 Royal Microscopy Society/European Microscopy Society Phototoxicity Meeting, virtually, January 19, “Deep learning against phototoxicity”
- 2020 Seminar to Imaging One World seminar series, virtually, November 2, “Unfinished tales: three short stories interrupted by the pandemic”.
- 2020 Seminar to BioOptics World online seminar series, virtually, September 15, “Enhancing fluorescence microscopy with computation”
- 2020 Seminar to Georgetown University Medical Center Dean’s Seminar Series, virtually September 3, “Multiscale Biological Imaging at High Spatiotemporal Resolution”
- 2020 Seminar to The Institute for Photonic Sciences (ICFO) ‘Light for Health’ program, virtually, July 20, “Multiscale Biological Imaging at High Spatiotemporal Resolution”
- 2020 Seminar to FAES Graduate School, virtually, May 28, “Biological Imaging at High Spatiotemporal Resolution (& how I got into this...)”
- 2020 Seminar to NICHD Cell and Structural Biology Affinity Group, NIH, Bethesda, February 10, “Multiscale Biological Imaging at High Spatiotemporal Resolution”

- 2019 Seminar to Dept. of Biology, UNC Chapel Hill, Chapel Hill, November 5, “Biological Imaging at High Spatiotemporal Resolution”
- 2019 Seminar to Icahn School of Medicine at Mt. Sinai, New York, October 17, “Biological Imaging at High Spatiotemporal Resolution”
- 2019 Seminar to Bioengineering Department, EPFL, Lausanne, Switzerland, October 7, “Biological Imaging at High Spatiotemporal Resolution”
- 2019 NIH Research Festival, Bethesda, September 11, “Deep Learning for Better Fluorescence Microscopy”
- 2019 Inaugural Junior Scientist Workshop on Biological Optical Microscopy, Ashburn, September 9, “Accelerating Iterative Deconvolution and Multiview Fusion by Orders of Magnitude”, **plenary speaker**
- 2019 25th anniversary Picoquant meeting on Single Molecule Sensing and Detection, Berlin, Germany, September 4, “Accelerating Iterative Deconvolution and Multiview Fusion by Orders of Magnitude”
- 2019 Seminar to Committee on Medical Physics, University of Chicago, Chicago, May 8, “Biological Imaging at High Spatiotemporal Resolution”
- 2019 Seminar to Department of Cell Biology, Yale University, New Haven, April 30, “Biological Imaging at High Spatiotemporal Resolution”
- 2019 Seminar to Vanderbilt Biophotonic Center, Vanderbilt School of Engineering, Vanderbilt University, Nashville, April 2, “Biological Imaging at High Spatiotemporal Resolution”
- 2018 Seminar to Mechanical Engineering Dept, University of Washington, Seattle, November 13, “Biological Imaging at High Spatiotemporal Resolution”
- 2018 North Atlantic Microscopy Society Inaugural meeting, Princeton University, Princeton, November 1, “Biological Imaging at High Spatiotemporal Resolution”, **keynote speaker**
- 2018 ‘Probefest’, Janelia Research Campus, Ashburn, October 17, “Estimating 3D molecular orientation with multiview polarized fluorescence microscopy”
- 2018 Neuroprobes Conference, Marine Biology Laboratory, Woods Hole, October 11, “Studying neurodevelopment with light-sheet microscopy”
- 2018 Biophysics Seminar, University of Maryland, College Park, September 17, “Biological Imaging at High Spatiotemporal Resolution”
- 2018 Microscopy and Microanalysis 2018 meeting, Baltimore Convention Center, August 8, “Studying neurodevelopment with light sheet microscopy”
- 2018 2018 NIBIB Trainees Meeting, NIH, Bethesda, June 21, “Biological Imaging at High Spatiotemporal Resolution (& how I got into this)”, **plenary speaker**
- 2018 Seminar to Centre for Microscopy and Cellular Imaging, Concordia University, Montreal, Canada, June 8, “Biological Imaging at High Spatiotemporal Resolution”
- 2018 2nd International Conference on Nanoscopy (ICON), University of Bielefeld, Bielefeld, Germany, February 28, “Advances in structured illumination and light sheet microscopy”
- 2018 Frontiers in Microscopy Technologies and Strategies for Bioimaging Centers Networks, Janelia Research Campus, Ashburn, February 25, “Biological Imaging at High Spatiotemporal Resolution”, **keynote speaker**

- 2018 Physics Colloquium, Georgetown University, Washington DC, February 20, “High speed imaging at and beyond the diffraction limit”
- 2018 2018 February Fourier Talks, University of Maryland Norbert Wiener Center, College Park, February 15, 2018, “Towards a dynamic atlas of neurodevelopment”
- 2018 2018 Quantitative BioImaging Conference, Gottingen, Germany, January 6, “Mapping structure, function, and behavior in live *C. elegans* embryos”
- 2017 McDonnell Foundation Imaging Workshop, Marine Biological Laboratory, Woods Hole, November 17, “Challenges and Opportunities in Light Microscopy”
- 2017 Emerging Tools for Acquisition and Interpretation of Whole-Brain Functional Data, Janelia Research Campus, Ashburn, November 7, “Mapping structure, function, and behavior in live *C. elegans* embryos”
- 2017 Physics Colloquium, University of Maine, Orono, October 20, “High speed imaging at and beyond the diffraction limit”
- 2017 Physics Colloquium, University of Oregon, Eugene, October 5, “High speed imaging at and beyond the diffraction limit”
- 2017 Chinese Academy of Sciences, Institute of Biophysics, Beijing, China, June 8, “High speed imaging at and beyond the diffraction limit”
- 2017 Focus on Microscopy, Bordeaux, France, April 10, “High speed imaging at and beyond the diffraction limit”, **plenary speaker**
- 2017 ABRF Meeting, San Diego, March 26, “High speed imaging at and beyond the diffraction limit”, **keynote speaker**
- 2017 Seminar to University of Chicago Biology Department, Chicago, March 2, “High speed imaging at and beyond the diffraction limit”
- 2017 Seminar to Colorado State University’s Depts. of Biomedical Engineering and Molecular, Cellular, and Integrative Neurosciences, Fort Collins, February 6, “High speed imaging at and beyond the diffraction limit”
- 2017 14th annual UC Berkeley Advanced imaging methods (AIM) workshop, Berkeley, January 26, “A neurodevelopmental atlas in *C. elegans*”
- 2016 Seminar to NCI Laboratory of Cellular and Molecular Biology, Bethesda, November 8, “High speed imaging at and beyond the diffraction limit”
- 2016 Seminar to Biology Dept. at Indiana University, Bloomington, November 3, “High speed imaging at and beyond the diffraction limit”
- 2016 Optical Microscopy Symposium at Harvard Medical School, Boston, November 1, “High speed imaging at and beyond the diffraction limit”
- 2016 New Advances in Probing Cell-Extracellular Matrix Interactions (CellMatrix), Berlin, Germany, October 21, “Faster and deeper structured illumination microscopy”
- 2016 Symposium on Advanced Computational Methods in Biomedical Imaging, NIH, Bethesda, October 6, Imaging and Computation for Studying Neurodevelopment in *C. elegans*
- 2016 3rd International Conference on Light Sheet Fluorescence Microscopy, Sheffield, United Kingdom, August 31, “Using light sheet microscopy to study neurodevelopment” (**keynote speaker**)

- 2016 Israeli Society for Microscopy Golden Jubilee, June 2, “High speed imaging at and beyond the diffraction limit” **(plenary speaker)**
- 2016 University of Washington, Seattle, Seminar to Materials Science and Engineering Dept., May 16, “High speed imaging at and beyond the diffraction limit”
- 2016 Rutgers, The State University of New Jersey, Physics Colloquium, May 4, “High speed imaging at and beyond the diffraction limit”
- 2016 Carnegie Mellon University, Pittsburgh, Seminar to Dept. of Biological Sciences, April 13, “High speed imaging at and beyond the diffraction limit”
- 2016 University of Wisconsin, Madison, Biochemistry Colloquium, March 21, “High speed imaging at and beyond the diffraction limit”
- 2016 Monash University, Melbourne, Australia, February 8, “High speed imaging at and beyond the diffraction limit”
- 2016 Max Planck Institute for Neuroscience, Jupiter, Florida, January 14, “High speed imaging at and beyond the diffraction limit”
- 2016 University of Pittsburgh, Department of Microbiology and Molecular Genetics, January 6, “High speed imaging at and beyond the diffraction limit”
- 2015 University of Vermont, Department of Molecular Physiology and Biophysics, December 7, “High speed imaging at and beyond the diffraction limit”
- 2015 NIH Intramural Campus, Frontiers in Light Microscopy, Bethesda, MD, November 17, “Mapping neurodevelopment in the *C. elegans* embryo”
- 2015 Thorlabs Research Campus, Sterling, Virginia, November 6, “High speed imaging at and beyond the diffraction limit”
- 2015 Janelia Farm Research Campus ‘Emerging Tools for Acquisition and Interpretation of Whole-Brain Functional Data’, Ashburn, Virginia, November 2, “Mapping neurodevelopment in the *C. elegans* embryo”
- 2015 EMBL ‘Seeing is Believing’, Heidelberg, Germany, October 7, “Towards a dynamic atlas of neurodevelopment (or how the living connectome is built)”
- 2015 NIH Technology Development Symposium at Research Festival, Bethesda, September 16, “Towards a dynamic atlas of neurodevelopment (or how the living connectome is built)”
- 2015 MBL, Woods Hole, August 8, “Imaging nervous system structure and function in live nematode embryos with light sheet microscopy”
- 2015 Seminar at National Institute of Standards and Technology (NIST), Gaithersburg, June 12, “Sharper, Faster, Deeper, Gentler: 4D Imaging Technologies for Interrogating Live Cells and Embryos”
- 2015 Yale University Annual Microscopy Workshop, New Haven, June 3, “Sharper, Faster, Deeper, Gentler: 4D Imaging Technologies for Interrogating Live Cells and Embryos”
- 2015 The 15th International ELMI Meeting, Barcelona, Spain, May 21, “Imaging Biology at High Spatiotemporal Resolution”
- 2015 University of Maryland, Baltimore, May 14, “Sharper, faster, deeper, longer: New techniques for 4D imaging in biology”
- 2015 University of Pennsylvania Single Cell Symposium, Philadelphia, April 30, “Imaging Biology at High Spatiotemporal Resolution”
- 2015 Rockefeller University Neuroscience Seminar, New York, April 23, “Imaging Biology at High Spatiotemporal Resolution”
- 2015 Cornell Biophysics Colloquium, Ithaca, March 25, “Imaging Biology at High Spatiotemporal Resolution”

- 2015 Cambridge MRC Super-Resolution Microscopy Meeting, Cambridge, England, February 6, “High Speed Imaging Beyond the Diffraction Limit”
- 2015 University of Chicago Imaging Workshop, Chicago, January 24, “Imaging at High Spatiotemporal Resolution: New 4D Microscopy for Biology”
- 2014 National Cancer Institute Physical Sciences in Oncology Steering Committee, Shady Grove, December 3, “Advanced 4D Imaging Technologies for Visualizing Cells and Embryos”
- 2014 26th Annual Kavli Frontiers of Science Symposium, Irvine, November 17, “Towards a Dynamic Atlas of Neurodevelopment (or how the living connectome is built)”
- 2014 University of Michigan, Ann Arbor, November 7, “Imaging Biology at High Spatiotemporal Resolution”
- 2014 Webinar sponsored by Photonics Media, October 29, “Imaging Biology at High Spatiotemporal Resolution”
- 2014 NIH-Japan Symposium, Bethesda, October 24, “Advanced 4D Imaging Technologies for Visualizing Cells and Embryos”
- 2014 National Center for Biological Sciences, Bangalore, India, September 25 and 26, “Light Sheet Fluorescence Microscopy” and “Faster, Sharper, Deeper and More Gently: New Live Imaging Techniques for Visualizing Biology”
- 2014 University of Heidelberg and Bioquant, Heidelberg, Germany, July 29, “Faster, Sharper, Deeper and more Gently: New Live Imaging Techniques for Visualizing Biology”
- 2014 Microscopy of Infectious Disease Agents Symposium at Rocky Mountain Labs, Hamilton, Montana, July 25, “Faster, Sharper, Deeper and more Gently: New Live Imaging Techniques for Visualizing Biology” (**keynote speaker**)
- 2014 Super-resolution Imaging Workshop, Leeds, England, July 4, “Home-built systems for high resolution: SIM and SPIM systems from the Shroff lab (2011-2014)”
- 2014 The Microscience Microscopy Congress, Manchester, England, July 1, “Super-resolution imaging at 100 frames per second”
- 2014 Crick symposium, New Frontiers in Optical Microscopy, London, England, June 9, “Faster, Sharper, Deeper, and More Gently: New Imaging Techniques for Visualizing Biology” (**keynote speaker**)
- 2014 Histochemical Society Meeting at Experimental Biology, San Diego, April 27, “Sharper, Faster, and more Gently: New Technologies for 4D Imaging”
- 2014 Annual Single Cell Analysis Meeting, Bethesda, MD, April 22, “(Towards an) Integrated System for Systematic Single-Cell Analysis of Complex Tissues *in vivo*”
- 2014 Trends in Microscopy, Freiburg, Germany, March 29, “Sharper, faster, and gentler: improved 4D imaging for cells and embryos”
- 2014 Seminar to the University of Vienna, CSF Advanced Microscopy Center, Vienna, Austria, February 26, “Faster and Sharper: New Technologies for 4D Imaging”
- 2014 Seminar to Dept. of Physics at New York University, New York, February 19, “Faster and Sharper: New Technologies for 4D Imaging”
- 2013 Seminar to the Dept. of Cell Biology at Johns Hopkins University, Baltimore, December 5, “Imaging Sharp and Fast: New Technologies for 4D Imaging”
- 2013 Structured Illumination: Biomedical Applications and Future Developments, The Wellcome Trust, London, England, October 22, “Instant Structured Illumination Microscopy”
- 2013 iBio Seminar, “Dual-view inverted selective plane illumination microscopy”, www.ibioseminars.org
- 2013 EMBO Superresolution and single molecule microscopies in living cells, Centre de Biochimie Structurale, Montpellier, France, “Beholding the subcellular world in the PALM of your hand” (May 13) and “Faster and Sharper: New Technologies for 4D Imaging” (May 17)

- 2013 Advanced Quantitative Light Microscopy Course, Marine Biological Laboratory, Woods Hole, May 8, "Light Sheet Fluorescence Microscopy"
- 2013 Single Cell Analysis meeting, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY, March 9, "High speed, high resolution, and minimally invasive optical microscopy for 4D imaging of live cells and embryos"
- 2013 Department of Biology, University of Southern California, Los Angeles, CA, March 1, "Faster and Sharper: New 3D Imaging Technologies for Use in Biology"
- 2013 Institute of Neurobiology, University of Puerto Rico, San Juan, Puerto Rico, January 15, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 University of Manitoba 'Edge of Science' Lecture Series, Winnipeg, Manitoba, November 26, "Sharper and Faster: New Imaging Technologies for Use in Biology"
- 2012 Lewis-Sigler Institute/Princeton University Quantitative and Computation Biology Lecture Series, Princeton, NJ, November 19, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 Janelia Farm Research Campus Proteins and Biosensors III, Ashburn, VA, November 6, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 Applied Scientific Instrumentation Webinar, November 1, "High spatiotemporal imaging of cells and embryos with inverted selective plane illumination microscopy (iSPIM)"
- 2012 Catholic University of America Physics Seminar, Washington DC, October 10, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 Optical Microscopy in the Biomedical Science Horizon's lecture, Woods Hole, MA, October 3, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 International Society for Neurochemistry 5th Special Conference, Buenos Aires, September 13, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 University of Maryland Biophysics Seminar, College Park, MD, May 14, "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 Superresolution Microscopy Workshop, Institute of Medical Biology A* Star, Singapore, March 27, "Beholding the subcellular world in the PALM of your hand" and "Sharper and Faster: New 3D Imaging Technologies for Use in Biology"
- 2012 The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, March 15, "Beholding the subcellular world in the PALM of your hand"
- 2012 AAAS Science Magazine Imaging Webinar, February 22, "Super-resolution Optical Imaging in Biology" (**> 2000 registrants**)
- 2012 American Physical Society, Boston, MA, February 19, "Beholding the subcellular world in the PALM of your hand"
- 2011 American Society of Cell Biology, December 5, "Pointillist Super-resolution for Biological Imaging"
- 2011 Massachusetts General Hospital Dept. of Medicine, Nephrology Division, October 18, "Sharper and Faster: 3d Imaging Technologies for Cells and Embryos"
- 2011 Trends in Microscopy 2011: New Advances in Fluorescence Imaging and Fluorescent Probes, Wuerzburg, Germany, October 5, "Sharper and Faster: 3d Imaging Technologies for Cells and Embryos"
- 2011 Cell Press/Leica Superresolution webinar, September 8 (**2013 registrants, 955 participants**)
"Pointillist Methods for Super-resolution Imaging"
- 2011 Yale University 6th Annual Microscopy workshop, New Haven, CT, June 7,
"3D PALM with Photoactivatable Fluorescent Proteins"
- 2011 University of Utah Center for Cell and Genome Science, Salt Lake City, UT, May 24,
"Sharper and Faster: New 3d Imaging Technologies for Cells and Embryos"

- 2011 Super-Resolution Light Microscopy Workshop, Indiana University, Bloomington, IN, May 18, "Pointillism Superresolution Methods for Biological Imaging"
- 2011 Frontiers in Quantitative Biology Lecture Series, Stanford University, Menlo Park, CA, May 5, "Sharper and Faster: New 3D Imaging Technologies for Cells and Embryos"
- 2011 Janelia Farm/NIH Young Investigators Meeting, NIH, Bethesda, MD, April 1, "Fast, long term studies of neural development in *C. elegans*"
- 2010 Immunocytochemistry, *In Situ* Hybridization, Super-Resolution and Live Cell Imaging Course, Cold Spring Harbor Laboratories, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY, October 18, "Pointillist Superresolution Methods"
- 2010 NIH Research Festival, Bethesda, MD, October 5, 2010, "Three Dimensional Photoactivated Localization Microscopy"
- 2010 Optical Imaging for Cell and Developmental Biology Lecture Series, Institute of Medical Biology A* Star, Singapore, July 22: "Photoactivated Localization Microscopy: Theory and Practice", July 24: "3D Imaging Technologies for Cells and Embryos"
- 2010 Discovery Lecture Series, Olympus Canada and University of British Columbia, Vancouver BC, Canada, May 6, "A Primer on PALM"
- 2009 Immunocytochemistry and Live Cell Imaging Course, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY, November 8, "A Primer on PALM"
- 2009 Short Course Speaker at Society for Neuroscience Meeting, Chicago, Illinois, October 16, "A Primer on PALM"
- 2009 University of Maryland Biophysics Seminar, College Park, MD, October 5, "Pushing the Envelope in Biological Imaging"
- 2009 4th European Optical Society Topical Meeting on Advanced Imaging Techniques, Jena, Germany, June 11, "Pushing the Envelope in Biological Imaging"
- 2009 Advanced Quantitative Light Microscopy Course, Marine Biological Laboratory, Woods Hole, May 11, Massachusetts, "An Introduction to PALM"
- 2009 Physical Chemistry Seminar, Boston University, Boston, Massachusetts, March 4, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar to NIBIB/NIH, Bethesda, MD, December 15, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar to Stanford University Bioengineering Department, December 9, "Pushing the Envelope in Biological Imaging"
- 2008 Microscopy Workshop at Stowers Institute for Medical Research, Kansas-City, Missouri, September 11, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar to Cell Biology Department at Yale School of Medicine, September 3, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar to Tetrad Dept. at University of California at San Francisco, August 19, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar at Lawrence Livermore National Laboratory, August 18, "Pushing the Envelope in Biological Imaging"
- 2008 Seminar to Bioengineering Dept. at EPFL, Lausanne, Switzerland, June 23, "Pushing the Envelope in Biological Imaging"
- 2008 'Imaging the Cell', Montpellier, France, June 20, "Pushing the Envelope in Biological Imaging"
- 2008 Conference on Lasers and Electro-Optics, San Jose, California, May 9, "Technical and Biological Applications of PALM"

- 2008 Focus on Microscopy Annual Meeting (**Keynote Speaker**), Osaka, Japan, April 14, “Technical and Biological Applications of PALM”
- 2008 Experimental Biology Annual Meeting, Epithelial Transport Group Symposium, San Diego, California, April 6, “Technical and Biological Applications of PALM”
- 2008 Advanced Imaging Methods Workshop, University of California at Berkeley, January 17, “Recent advances in PALM”
- 2007 High Resolution Fluorescence Workshop (sponsored by Carl Zeiss, Inc.), American Society for Cell Biology Annual Meeting, Washington D.C., December 3, “An Introduction to PALM”
- 2007 96th Annual Titisee Conference, Germany, November 17, “Technical and Biological Applications of PALM”
- 2007 Raschke Group Meeting, University of Washington, August 15, “PALM: Recent Progress and Future Challenges”

CONFERENCE TALKS

- 2011 18th Annual International *C. Elegans* Meeting, Los Angeles, CA, “Selective plane illumination microscopy for high-speed, long-term *C. elegans* embryogenesis studies”
- 2008 Janelia Farm Research Campus, Novel Approaches to Bio-Imaging, “Technical and Biological Applications of PALM”
- 2007 Janelia Farm Research Campus, Fluorescent Proteins and Biological Sensors, “Photoactivated Localization Microscopy”
- 2007 Annual Biophysical Society Meeting, Platform Talk, “Direct Optical Measurement of Stresses Inside Circularized DNA Loops”
- 2006 Annual Biophysical Society Meeting, Platform Talk, “DNA Behavior Under Tight Bending”
- 2005 Annual Biophysical Society Meeting, Platform Talk, “Nanoscale sensors of mechanical force”
- 2001 Northwest Regional Meeting of the American Chemical Society, “Detecting sound waves with a phosphorescence-based microphone.”

SCIENTIFIC SERVICE

- Co-organizer, Computational Optics conference, Janelia Research Campus, Ashburn, VA, 2024
- Co-organizer, 4DCP Annual conference, Janelia Research Campus, Ashburn, VA, 2024
- Co-organizer, Junior Scientist workshop on Imaging Techniques and Molecular Tools for Biology, Janelia Research Campus, Ashburn, VA, 2023
- Member, Central Tenure Committee, National Institutes of Health, 2021 - 2022
- Co-organizer, Virtual Super-resolution Workshop, Royal Microscopy Society Microscience Microscopy Congress 2021
- Chair, Scientific Steering Group for Brain Initiative Optimization of Transformative Technologies for Large Scale Recording and Modulation in the Nervous System (U01), 2021-2023
- Reviewer, Department of Energy Bioimaging Grant Proposals, 2021
- Chair, NLM Tenure track search committee, 2020-2021
- Chan Zuckerberg Initiative, Visual Proteomics, reviewer, 2021

- Chan Zuckerberg Initiative, call for Imaging and Data Scientists, reviewer, 2018, 2020
- Arnold and Mabel Beckman Foundation, call for Advanced Light Sheet Microscopy and Data Science proposals, reviewer, 2020
- Advisory Committee Member, 5-year plan for NIBIB, 'Engineering the Future of Health', 2019-2020
- Intramural NIAID Senior Scientist/Branch Chief Search Committee, 2019-2021
- HHMI Janelia Research Campus Group Leader Review, 2019
- Earl Stadtman Tenure-Track Search Committee in Biophysics/Bioengineering, 2010/2012/2013/2016/2018/2020
- Lecturer, FAES Course on Super-Resolution Microscopy, 2014-2019, 2021
- Intramural NICHD Neuroscience Site Review, 2015
- MBL Collaboratorium Advisory Board, 2015
- South Dakota BioSNTR Advisory Board, 2014-2016
- NIAMS Advisory Board to the Director, 2014
- Director, Trans-NIH Advanced Imaging and Microscopy Facility, 2015-
- Reviewer, Cell, Computational, and Molecular Biology SBIR/STTR Study Section, 2015
- Reviewer, F32 postdoctoral fellowships, 2010
- Reviewer, *Cell*, *Nature*, *Science Advances*, *Nature Methods*, *Nature Biotechnology*, *Nature Photonics*, *PLoS Computation Biology*, *Biomedical Optics Express*, *J. R. Soc. Interface*, *PNAS*, *Optical Nanoscopy*, *Nature Protocols*, *Light: Science and Applications*, *Methods in Applied Fluorescence*, *Journal of Microscopy*, *Biophysical Journal*, *Optica*, *eLIFE*, *Developmental Cell*, *Nanophotonics*, *Journal of Cell Science*, *Philosophical Transactions of the Royal Society*, *Lab on a Chip*, *Communications Biology*

TEACHING EXPERIENCE

September 2023	Faculty, Bangalore Microscopy Course, National Center for Biological Sciences, Bangalore, India
May 2023	Faculty, Advanced Quantitative Light Microscopy Course, Marine Biological Laboratory at Woods Hole
April 2019	Faculty, Quantitative Imaging: From Acquisition to Analysis, Cold Spring Harbor Laboratory, Cold Spring Harbor, New York
August 2016	Faculty, EMBO Practical Course on Light Sheet Microscopy, Dresden, Germany
July 2016-2019	Faculty, Neurobiology course, Marine Biological Laboratory, Woods Hole
April 2016	International School of Biophysics <<Antonio Borsellino>> 43 rd Course, Nanoscale Biophysics: Focus on Methods and Techniques, Erice, Sicily
September 2014	Faculty, 6 th Bangalore Microscopy Course, National Center for Biological Sciences, Bangalore, India
July 2014	Lecturer, Neurobiology course, Marine Biological Laboratory, Woods Hole

April 2014	Faculty, Quantitative Imaging Course, Cold Spring Harbor Laboratories
June 2013	Faculty, Physiology Course, Marine Biological Laboratory, Woods Hole
May 2013	Lecturer and Lab Instructor, EMBO Superresolution and single molecule microscopies in living cells, Centre de Biochimie Structurale, Montpellier, France
May 2013	Lecturer and Lab Instructor, Advanced Quantitative Light Microscopy Course, Woods Hole
June 2012	Lecturer and Lab Instructor, Single Cell Analysis Course, Cold Spring Harbor Laboratories
October 2010	Lecturer and Lab Instructor, Immunocytochemistry, <i>In Situ</i> Hybridization, Super-Resolution and Live Cell Imaging Course, Cold Spring Harbor Laboratories
November 2009	Lecturer and Lab Instructor, Immunocytochemistry and Live Cell Imaging Course, Cold Spring Harbor Laboratories
May 2009	Course Instructor at Advanced Quantitative Light Microscopy Course, Marine Biological Laboratory, Woods Hole
Summer 2007	Teaching Assistant at Woods Hole Marine Biological Laboratory Physiology Course
Spring 2001	Teaching Assistant in the Department of Bioengineering at the University of Washington