

Mark Bathe, Ph.D.

Curriculum Vitae

Education

2004 Ph.D., Mechanical Engineering, MIT
2001 M.Sc., Mechanical Engineering, MIT
1998 B.Sc., Mechanical Engineering, MIT

Postdoctoral Training

2006–2008 Alexander von Humboldt Postdoctoral Fellow, University of Munich

Professional Experience

2022–present Director, MIT New Engineering Education Transformation
2022 Co-Founder, Cache DNA, Inc.
2022 Co-Founder, Kano Therapeutics, Inc.
2021–present Member, Harvard Medical School Initiative for RNA Medicine
2020–present Professor, Department of Biological Engineering, MIT
2016–2020 Associate Professor with Tenure, Department of Biological Engineering, MIT
2013–2016 Associate Professor, Department of Biological Engineering, MIT
2012–present Associate Member, Broad Institute of MIT & Harvard
2009–2013 Assistant Professor, Department of Biological Engineering, MIT
2006–2008 Alexander von Humboldt Postdoctoral Fellow, University of Munich

Affiliations

Broad Institute of MIT & Harvard
Harvard Medical School Initiative for RNA Medicine
MIT Center for Environmental Health Sciences
MIT Center for Neurobiological Engineering
MIT Department of Mechanical Engineering

Honors & Awards

2019 MIT Class of 1960 Fellow
2014 National Academy of Sciences Frontiers of Science and Engineering Speaker
2015 Joy Cappel Young Investigator Award
2014 MIT Freshman Advising Award
2014 National Academy of Sciences Frontiers of Science and Engineering Speaker
2009 Samuel A. Goldblith Career Development Professorship
2006 Alexander von Humboldt Postdoctoral Research Fellow
2001 National Defense Science and Engineering Graduate Fellow
1998 Elected member of Sigma Xi and Pi Tau Sigma Academic Honor Societies

Research Interests

Nanotechnology
Nucleic Acids
Molecular computing
Therapeutic Nucleic Acid Delivery

Virus-like Particle Vaccines
Quantum Sensing and Computing
Photonic Materials
Optoelectronic Materials

Academic Service

2025	Co-Chair, Gordon Research Conference on RNA Nanotechnology
2023	Vice Co-Chair, Gordon Research Conference on RNA Nanotechnology
2020	NIH Gene Delivery Study Section, Ad Hoc Review Panelist
2019	NIH Nanotechnology Study Section, Review Panelist
2019	NIH BRAIN Initiative Review Panel, Review Panelist
2019	NIH Fellowship Review Panel in Cell Biology, Developmental Biology, and Bioengineering, Ad Hoc Review Panelist
2019–present	Director, MIT New Engineering Education Transformation
2019–2021	Editorial Board Member, Scientific Reports
2018–2020	Chair, MIT Committee on Student Life
2017–2019	MIT New Engineering Education Transformation Committee
2017–2018	Chair, MIT Department of Biological Engineering Graduate Academic Program
2017	NIH, Cellular and Molecular Technologies Study Section, Review Panelist
2017	NIH, Synthetic and Biological Chemistry A Study Section, Review Panelist
2016–present	MIT Department of Biological Engineering Graduate Admissions Committee
2016–present	SRC Roadmap Committee on Synthetic Biology Steering Committee
2015–present	MIT Institute Committee on Community Giving
2015–present	MIT Department of Biological Engineering Teaching Awards Committee
2015–2016	MIT Institute for Medical Engineering & Science Faculty Search Committee
2014–present	MIT Department of Biological Engineering Seminar Series Organizing Committee
2014	MIT Department of Biological Engineering Retreat Organizing Committee
2013–present	MIT Department of Biological Engineering Undergraduate Program Committee
2011–2012	MISTI Global Seed Funds Evaluation Committee
2011–2012	MIT Department of Mechanical Engineering Graduate Admissions Committee
2009–2017	MIT Computational & Systems Biology Graduate Program Admissions Committee
2009–2016	MIT Computational & Systems Biology Graduate Program Committee
2009–2013	MIT Department of Biological Engineering Graduate Admissions Committee
2008–2013	MIT Department of Biological Engineering Graduate Program Committee

Publications

98. Chen, C., Luo, X., Kaplan, A.E.K., Bawendi, M.G., Macfarlane, R.J., **Bathe, M.** (2023) Ultrafast dense DNA functionalization of quantum dots and rods for scalable 2D array fabrication with nanoscale precision. *Science Advances*, 32: eadh8508.
97. Hart, S.M., Gorman, J., **Bathe, M.**, Schlau-Cohen, G.S. (2023) Engineering Exciton Dynamics with Synthetic DNA Scaffolds. *Accounts of Chemical Research*, 56: 2051.

96. Falkovich, R., Danielson, E.W., Perez de Arce, K., Wamhoff, E-C., Strother, J., Lapteva, A.P., Sheng, M., Cottrell, J.R., **Bathe, M.** (2023) A synaptic molecular dependency network in knockdown of autism- and schizophrenia-associated genes revealed by multiplexed imaging. *Cell Reports*, 42: 112430.
95. Wamhoff, E-C., Ronsard, L., Feldman, J., Hauser, B.M., Knappe, G.A., Romanov, A., Lam, E., St Denis, K., Balazs, A.B., Schmidt, A., Lingwood, D., Bathe, M. (2023). Enhancing antibody responses by multivalent antigen display on thymus-independent DNA origami scaffolds. *bioRxiv*, doi: 10.1101/2022.08.16.504128
94. Wamhoff, E-C., Knappe, G.A., Burds, A.A., Du, R.R., Neun, B., Difilippantonio, S., Sanders, C., Edmondson, E., Matta, J.L., Dobrovolskaia, M., **Bathe, M.** (2023). Evaluation of non-modified wireframe DNA origami for acute toxicity and biodistribution in mice. *ACS Applied Bio Materials*, 6: 1960.
93. Sheridan, K., Berleant, J., **Bathe, M.**, Condon, A., Williams, V.V., (2023). Factorization and pseudofactorization of weighted graphs. *Discrete Applied Mathematics*, 337: 81.
92. Berleant, J., Sheridan, K., Condon, A., Williams, V.V., **Bathe, M.** (2023). Isometric Hamming embeddings of weighted graphs. *Discrete Applied Mathematics*, 332: 119.
91. Parsons, M.F., Allan, M.F., Li, S., Shepherd, T.R., Ratanalert, S., Zhang, S., Pullen, K.M., Chiu, W., Rouskin, S., **Bathe, M.** (2023). 3D RNA-scaffolded wireframe origami. *Nature Communications*, 14: 382.
90. Knappe, G.A., Wamhoff, E-C., **Bathe, M.** (2023). Functionalizing DNA origami to investigate and interact with biological systems. *Nature Reviews Materials*, 8: 123.
89. Du, R.R., Cedrone, E., Romanov, A., Falkovich, R., Dobrovolskaia, M.A., **Bathe, M.** (2022). Innate immune stimulation using 3D wireframe DNA origami. *ACS Nano*, 16: 20340.
88. Chen, C., Wei, X., Parsons, M.F., Guo, J., Banal, J.L., Zhao, Y., Scott, M.N., Schlaue-Cohen, G.S., Hernandez, R., **Bathe, M.** (2022). Nanoscale 3D spatial addressing and valence control of quantum dots using wireframe DNA origami. *Nature Communications*, 13: 4935.
87. Wamhoff, E-C., Romanov, A., Huang, H., Read, B.J., Ginsburg, E., Knappe, G.A., Kim, H-M., Farrell, N.P., Irvine, D.J., **Bathe, M.** (2022). Controlling nuclease degradation of wireframe DNA origami with minor groove binders. *ACS Nano*, 16: 8954.
86. Wang, X., Li, S., Jun, H., John, T., Zhang, K., Fowler, H., Doye, J.P.K., Chiu, W., **Bathe, M.** (2022). Planar wireframe 2D origami. *Science Advances*, 8: eabn0039.
85. Lan, T.C.T., Allan, M.F., Malsick, L.E., Woo, J.Z., Zhu, C., Zhang, F., Khandwala, S., Nyeo, S.S.Y., Sun, Y., Guo, J.U., **Bathe, M.**, Näär, A., Griffiths, A., Rouskin, S. (2022).

- Secondary structural ensembles of the SARS-CoV-2 RNA genome in infected cells. *Nature Communications*, 13: 1128.
84. Wei, X., Chen, C., Zhao, Y., Harazinska, E., **Bathe, M.**, Hernandez, R. (2022). Molecular structure of single-stranded DNA on the ZnS surface of quantum dots. *ACS Nano*, 16: 6666.
 83. Wang, X., Jun, H., **Bathe, M.** (2022). Programming 2D supramolecular assemblies with wireframe DNA origami. *Journal of the American Chemical Society*, 144: 4403.
 82. Hart, S.M., Wang, X., Guo, J., **Bathe, M.**, Schlau-Cohen, G.S. (2022). Tuning optical absorption and emission using strongly coupled dimers in programmable DNA scaffolds. *The Journal of Physical Chemistry Letters*, 13: 1863.
 81. Afonin, K.A., Dobrovolskaia, M.A., Ke, W., Grodzinski, P., **Bathe, M.** (2022). Critical review of nucleic acid nanotechnology to identify gaps and inform a strategy for accelerated clinical translation. *Advanced Drug Delivery Reviews* 181: 114081.
 80. Adendorff, M.R., Tang, G.Q., Millar, D.P., **Bathe, M.**, Bricker, W.P. (2022). Computational investigation of the impact of core sequence on immobile DNA four-way junction structure and dynamics. *Nucleic Acids Research* 50: 717.
 79. Lavi, R., **Bathe, M.**, Hosoi, A., Mitra, A., Crawley, E. (2021). The NEET ways of thinking: Implementing them at MIT and assessing their efficacy. *Advances in Engineering Education*.
 78. **Bathe, M.** (2021). Nanoscale 2D and 3D patterning using programmed DNA assemblies. *Novel Patterning Technologies 2021* 11610: 1161012.
 77. Banal, J.L., and **Bathe, M.** (2021). Scalable nucleic acid storage and retrieval using barcoded microcapsules. *ACS Applied Materials & Interfaces* 13: 49729.
 76. Jun, H., Wang, X., Parsons, M.F., Bricker, W.P., John T., Li, S., Jackson, S., Chiu, W., **Bathe, M.** (2021). Rapid prototyping of arbitrary 2D and 3D wireframe DNA origami. *Nucleic Acids Research* 49: 10265.
 75. Knappe, G.A., Wamhoff, E-C., Read, B.J., Irvine, D.J., **Bathe, M.** (2021). *In situ* covalent functionalization of DNA origami virus-like particles. *ACS Nano* 15: 14316.
 74. Tomov, M.L., O'Neil, A., Abbasi, H.S., Cimini, B.A., Carpenter, A.E., Rubin, L.L., **Bathe, M.** (2021). Resolving cell state in iPSC-derived human neural samples with multiplexed fluorescence imaging. *Communications Biology* 4: 786.
 73. Banal, J.L., Shepherd, T.Y., Berleant, J., Huang, H., Reyes, M., Ackerman, C.M., Blainey, P.C., **Bathe, M.** (2021). Random access DNA memory using Boolean search in an archival file storage system. *Nature Materials* 20: 1272.

72. **Bathe, M.**, Hernandez, R., Komiyama, T., Machiraju, R. and Neogi, S. (2021). Autonomous Computing Materials. *ACS Nano* 15: 3586.
71. Hart, S.M., Chen, W.J., Banal, J.L., Bricker, W.P., Dodin, A., Markova, L., Vyborna, Y., Willard, A.P., Häner, R., **Bathe, M.**, Schlau-Cohen, G.S. (2021). Engineering couplings for exciton transport using synthetic DNA scaffolds. *Chem* 7: 752.
70. Danielson, E., Perez de Arce, K., Cimini, B., Wamhoff, E-C., Singh, S., Cottrell, J.R., Carpenter, A.E., **Bathe, M.** (2020). Molecular diversity of glutamatergic and GABAergic synapses from multiplexed fluorescence imaging. *eNeuro* 8: ENEURO.0286-20.2020.
69. Afonin, K.A., Dobrovolskaia, M.A., Church, G., **Bathe, M.** (2020). Opportunities, barriers, and a strategy for overcoming translational challenges to therapeutic nucleic acid nanotechnology. *ACS Nano* 14: 9221.
68. Dobrovolskaia, M.A., **Bathe, M.** (2020). Opportunities and challenges for the clinical translation of structured DNA assemblies as gene therapeutic delivery and vaccine vectors. *WIREs Nanomedicine and Nanobiotechnology* 13: e1657.
67. Pisharady, K.P., Eberly, L.E., Cheong, I., Manousakis, G., Guliani, G., Clark, H.B., **Bathe, M.**, Walk, D., Lenglet, C. (2020). Tract-specific analysis improves sensitivity of spinal cord diffusion MRI to cross-sectional and longitudinal changes in amyotrophic lateral sclerosis. *Communications Biology* 3: 370.
66. Veneziano, R., Moyer, T.J., Stone, M.B., Mukherjee, S. Shepherd, T.R., Das, J., Schief, W.R., Irvine, D.J., **Bathe, M.** (2020). Role of nanoscale antigen organization on B-cell activation probed using DNA origami. *Nature Nanotechnology* 15: 716.
65. Hart, S.M., Banal, J.L., **Bathe, M.**, and Schlau-Cohen, G.S. (2020). Identification of non-radiative decay pathways in CY3. *The Journal of Physical Chemistry Letters* 11: 5000.
64. Jun, H., Wang, X., Bricker, W.P., & **Bathe, M.** (2019). Automated sequence design of 2D wireframe DNA origami with honeycomb edges. *Nature Communications* 10: 5419.
63. Guo, S-M., Veneziano, R., Gordonov, S., Li, L., Danielson, E., Perez de Arce, K., Park, D., Kulesa, A.B., Wamhoff, E-C., Blainey, P.C., Boyden, E.S., Cottrell, J.R., **Bathe, M.** (2019). Multiplexed and high-throughput neuronal fluorescence imaging with diffusible probes. *Nature Communications* 10: 4377.
62. Wamhoff, E-C., Banal, J.L., Bricker, T.R., Parsons, M.F., Veneziano, R., Stone, M.B., Jun, H., Wang, X., **Bathe, M.** (2019). Programming structured DNA assemblies to probe biophysical processes. *Annual Review of Biophysics* 48: 395.
61. Shepherd, T.R., Du, R.R., Huang, H., Wamhoff, E-C., **Bathe, M.** (2019). Bioproduction of pure, kilobase-scale single-stranded DNA. *Scientific Reports* 9: 6121.

60. Kulikov, V., Guo, S-M., Stone, M.B., Goodman, A., Carpenter, A., **Bathe, M.**, Lempitsky, V. (2019). DoGNet: A deep architecture for synapse detection in multiplexed fluorescence images. *PLoS Computational Biology* 15: e1007012.
59. Jun, H., Zhang, F., Shepherd, T., Ratalanert, S., Qi, X., Yan, H., **Bathe, M.** (2019). Autonomously designed free-form 2D DNA origami. *Science Advances* 5: eaav0655.
58. Jun, H., Shepherd, T.R., Zhang, K., Bricker, W.P., Li, S., Chiu, W., **Bathe, M.** (2019). Automated sequence design of 3D polyhedral wireframe DNA origami with honeycomb edges. *ACS Nano* 13: 2083.
57. **Bathe, M.**, Chrisey, L.A., Herr, D.J., Lin, Q., Rasic, D., Woolley, A.T., Zadeegan, R., Zhirnov, V.V. (2019). Roadmap on biological pathways for electronic nanofabrication and materials. *Nano Futures* 3: 012001.
56. Holec, P.V., Berleant, J., **Bathe, M.**, Birnbaum, M.E. (2018). A Bayesian framework for high-throughput T cell receptor pairing. *Bioinformatics* 149: 024905.
55. Bricker, W.P., Banal, J.L., Stone, M.B., **Bathe, M.** (2018). Molecular model of J-aggregated pseudoisocyanine fibers. *The Journal of Chemical Physics* 149: 024905.
54. **Bathe, M.**, Guo, S-M., Li, L., Veneziano, R., Gordonov, S., Cottrell, J.C. (2018). Multiplexed imaging of neuronal synapses using nucleic acid probe exchange. *Protocol Exchange* doi:10.1038/protex.2018.066.
53. Veneziano, R., Shepherd, T., Ratanalert, S., Bellou, L., Tao, C., **Bathe, M.** (2018). In vitro synthesis of gene-length single-stranded DNA. *Scientific Reports* 8: 6548.
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51. Boulais, E., Sawaya, N., Veneziano, R., Andreoni, A., Banal, J.L., Kondo, T., Mandal, S., Lin, S., Schlau-Cohen, G.S., Woodbury, N., Yan, H., Aspuru-Guzik, A., **Bathe, M.** (2018). Programmed coherent coupling in a synthetic DNA-based excitonic circuit. *Nature Materials* 17: 159.
50. Banal, J.L., Kondo, T., Veneziano, R., **Bathe, M.**, Schlau-Cohen, G.S. (2017). Photophysics of J-aggregate-mediated energy transfer on DNA. *The Journal of Physical Chemistry Letters* 8: 5827.
49. Cunningham, P., Bricker, W., Diaz, S., Medintz, I., **Bathe, M.**, and Melinger, J.S. (2017). Optical determination of the electronic coupling and intercalation geometry of Thiazole Orange homodimer in DNA. *The Journal of Chemical Physics* 147: 055101.
48. Pan, K., Bricker, W., Ratanalert, S., **Bathe, M.** (2017). Structure and conformational dynamics of scaffolded DNA origami nanoparticles. *Nucleic Acids Research* 45: 6284.

47. Su, K.C., Barry, Z., Schweizer, N., Maiato, H., **Bathe, M.**, Cheeseman, I. (2016). A regulatory switch alters chromosome motions at the metaphase to anaphase transition. *Cell Reports* 17: 728.
46. Veneziano, R., Ratanalert, S., Zhang, K., Zhang, F., Yan, H., Chiu, W., **Bathe, M.** (2016). Designer nanoscale DNA assemblies programmed from the top down. *Science* 352: 1534.
45. Wang, P., Gaitanaros, S., Lee, S., **Bathe, M.**, Shih, W.M., Ke, Y. (2016). Programming self-assembly of DNA origami honeycomb lattices and plasmonic metamaterials. *Journal of the American Chemical Society* 138: 7733.
44. Katz, Z.B., English, B.P., Lionnet, T., Yoon, Y.J., Monnier, N., Ovryn, B., **Bathe, M.**, Singer, R.H. (2016). Mapping translation 'hot-spots' in live cells by tracking single molecules of mRNA and ribosomes. *eLife* 5: e10415.
43. Dhakal, S., Adendorff, M., Liu, M., Yan, H., **Bathe, M.**, Walter, N. (2016). Rational design of DNA-actuated enzyme nanoreactors guided by single molecule analysis. *Nanoscale* 8: 3125.
42. Hogstrom, L., Guo, S.M., Murugadoss, K., **Bathe, M.** (2016). Advancing multiscale structural mapping of the brain through fluorescence imaging and analysis across length-scales. *Journal of The Royal Society Interface* 6: 20150081.
41. Gordonov, S., Hwang, M.K., Wells, A., Gertler, F.B., Lauffenburger, D., **Bathe, M.** (2016). Time-series modeling of live-cell shape dynamics for image-based phenotypic profiling. *Integrative Biology* 8: 73.
40. Sedeh, R., Pan, K., Adendorff, M., Hallatschek, O., Bathe, K.J., **Bathe, M.** (2016). Computing nonequilibrium conformational dynamics of structured nucleic acid assemblies. *Journal of Chemical Theory & Computation* 12: 261.
39. Monnier, N., Barry, Z., Park, H.Y., Su, K.C., Katz, Z., English, B., Dey, A., Pan, K., Cheeseman, I., Singer, R., **Bathe, M.** (2015). Inferring transient particle transport dynamics in live cells. *Nature Methods* 12: 838.
38. Sun, G., Guo, S.M., Teh, C., Korzh, V., **Bathe, M.**, Wohland, T. (2015). Bayesian model selection applied to the analysis of FCS data of fluorescent proteins in vitro and in vivo. *Analytical Chemistry* 87: 4326.
37. Zhou, Z., Munteanu, E.L., He, J., Ursell, T., **Bathe, M.**, Huang, K.C., Chang, F. (2015). The contractile ring coordinates curvature dependent septum assembly during fission yeast cytokinesis. *Molecular Biology of the Cell* 26: 78.
36. Pan, K., Kim, D.N., Zhang, F., Adendorff, M., Yan, H., **Bathe, M.** (2014). Lattice-free prediction of three-dimensional structure of programmed DNA assemblies. *Nature Communications* 5: 5578.

35. Klingner, C., Cherian, A.V., Diesinger, P.M., Aufschnaiter, R., Maghelli, N., Keil, T., Beck, G., Tolic-Norrelykke, I., **Bathe, M.**, and Wedlich-Soldner, R. (2014). An isotropic acto-myosin network promotes organization of the apical cell cortex in epithelial cells. *The Journal of Cell Biology* 207: 107.
34. Sun, W., Boulais, E., Hakobyan, Y., Wang, W., Guan, A., **Bathe, M.**, Yin, P. (2014). Casting inorganic structures with DNA molds. *Science* 346: 717.
33. Mori, M., Somogyi, K., Kondo, H., Monnier, N., Falk, H., Machado, P., **Bathe, M.**, Nedelec, F., and Lenart, P. (2014). An Arp2/3 nucleated F-actin shell fragments nuclear membranes at nuclear envelope breakdown. *Current Biology* 24: 1421.
32. Oh, H.S., Bryant, K.F., Nieland, T., Mazumder, A., Bagul, M., **Bathe, M.**, Root, D.E. and Knipe, D.M. (2014). Targeted RNAi screen reveals novel epigenetic factors that regulate herpesviral gene expression in U2OS osteosarcoma cells. *mBio* 5: e01086.
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30. Pan, K., Boulais, E., Yang, L., **Bathe, M.** (2014). Structure-based model for light-harvesting properties of nucleic acid nanostructures. *Nucleic Acids Research* 42: 2159.
29. Subramanian, V., Mazumder, A., Surface, L.E., Butty, V., Fields, P.A., Alwan, A., Torrey, L., Thai, K.K., Levine, S., **Bathe, M.**, Boyer, L. (2013). H2A.Z acidic patch couples chromatin dynamics to regulation of developmental gene expression programs during lineage commitment. *PLoS Genetics* 9: e1003725.
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27. Johnson-Buck, A., Nangreave, J., Kim, D.N., **Bathe, M.**, Yan, H., Walter, N. (2013). Super-resolution fingerprinting detects chemical reactions and idiosyncrasies of single DNA pegboards. *Nano Letters* 13: 728.
26. Mazumder, A., Tummler, K., **Bathe, M.**, Samson, L.D. (2013). Single-cell analysis of RNR transcriptional and translational response to DNA damage. *Molecular & Cellular Biology* 33: 635.
25. Krishnan, Y., **Bathe, M.** (2012). Designer nucleic acids to probe and program the cell. *Trends in Cell Biology* 22: 624.
24. Schmidt, J.C., Arthanari, H., Boeszoermenyi, A., Dashkevich, N.M., Wilson-Kubalek, E., Monnier, N., Markus, M., Oberer, M., Milligan, R., **Bathe, M.**, Wagner, G., Grishchuk, E.L., Cheeseman, I.M. (2012). The kinetochore-bound Ska1 complex tracks depolymerizing microtubules by binding to curved protofilaments. *Developmental Cell* 23: 968.

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22. Guo, S.M., He, J., Monnier, N., Sun, G., Wohland, T., **Bathe, M.** (2012). Bayesian approach to the analysis of fluorescence correlation spectroscopy data II: Application to simulated and in vitro data. *Analytical Chemistry* 84: 3880.
21. He, J., Guo, S.M., **Bathe, M.** (2012). Bayesian approach to the analysis of fluorescence correlation spectroscopy data I: Theory. *Analytical Chemistry* 84: 3871.
20. Kim, D.N., Kilchherr, F., Dietz, H., **Bathe, M.** (2012). Quantitative prediction of 3D solution shape and flexibility of nucleic acid nanostructures. *Nucleic Acids Research* 40: 2862.
19. Castro, C.E., Kilchherr, F., Kim, D.N., Lin Shiao, E., Wauer, T., Wortmann, P., **Bathe, M.**, Dietz, H. (2011). A primer to scaffolded DNA origami. *Nature Methods* 8: 221.
18. Mori, M., Monnier, N., Daigle, N., **Bathe, M.**, Ellenberg, J., Lenart, P. (2011). Intracellular transport by an anchored homogeneously contracting F-actin meshwork. *Current Biology* 21: 606.
17. Kim, D.N., Altschuler, J., Strong, C., McGill, G., **Bathe, M.** (2011). Conformational dynamics data bank: a database for conformational dynamics of proteins and supramolecular protein assemblies. *Nucleic Acids Research* 39: D451.
16. Kim, D.N., Nguyen, C.T., **Bathe, M.** (2011). Conformational dynamics of supramolecular protein assemblies. *Journal of Structural Biology* 173: 261.
15. Strehle, D., Schnauss, J., Heussinger, C., Alvarado, J., **Bathe, M.**, Kaes, J., Gentry, B. (2011). Transiently crosslinked F-actin bundles. *European Biophysical Journal* 40: 93.
14. Sedeh, R.S., Fedorov, A.A., Fedorov, E.V., Ono, S., Matsumura, F., Almo, S.C., **Bathe, M.** (2010). Structure, evolutionary conservation, and conformational dynamics of Homo sapiens fascin-1, an F-actin crosslinking protein. *Journal of Molecular Biology* 400: 589.
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7. **Bathe, M.**, Rutledge, G.C., Grodzinsky, A.J., and Tidor, B. (2005). Osmotic pressure of aqueous chondroitin sulfate solution: A molecular modeling investigation. *Biophysical Journal* 89: 2357.
6. **Bathe, M.**, Rutledge, G.C., Grodzinsky, A.J., and Tidor, B. (2005). A coarse-grained molecular model for glycosaminoglycans: Application to chondroitin, chondroitin sulfate, and hyaluronic acid. *Biophysical Journal* 88: 3870.
5. **Bathe, M.**, Grodzinsky, A.J., Tidor, B., and Rutledge, G.C. (2004). Optimal linearized Poisson-Boltzmann theory applied to the simulation of flexible polyelectrolytes in solution. *Journal of Chemical Physics* 121: 7557.
4. Kaazempur-Mofrad, M.R., **Bathe, M.**, Karcher, H., Younis, H.F., Seong, H.C., Shim, E.B., Chan, R.C., Hinton, D.P., Isasi, A.G., Upadhyaya, A., Powers, M.J., Griffith, L.G., and Kamm, R.D. (2003). Role of simulation in understanding biological systems. *Computers & Structures* 81: 715.
3. **Bathe, M.** and Rutledge, G.C. (2003). Inverse Monte Carlo procedure for conformation determination of macromolecules. *Journal of Computational Chemistry* 24: 876.
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1. **Bathe, M.**, and Kamm, R.D. (1999). A fluid-structure interaction finite element analysis of pulsatile blood flow through a compliant stenotic artery. *Journal of Biomechanical Engineering* 121: 361.

Patents

1. Banal, J.L., Berleant, J., Leiserson, C.E., Schardl, T., B., **Bathe, M.** Sequence-controlled polymer storage. US Patent No. PCT/US2022/032831. Jun. 9, 2022.
2. **Bathe, M.**, Veneziano, R., Wamhoff, E.-C., Moyer, T., Read, B., Irvine, D. Nucleic acid nanostructure platform for antigen presentation and vaccine formulations formed therefrom. US Patent No. US 11,419,932 B2. Aug. 23, 2022.
3. Hart, S.M., Wang, X., **Bathe, M.**, Schlau-Cohen, G.S., Guo, J. DNA-dye assembly based single-molecule fluorescence lifetime imaging probes. US Patent No. PCT/US2022/078972. Nov. 1, 2021.
4. Zhang, F., Shepherd, T.R., Veneziano, R., **Bathe, M.**, Slaymaker, I., Zetsche, B. Nucleic

- acid assemblies for use in targeted delivery. U.S. Patent No. WO/2020/051507, published Dec. 3, 2020.
5. Shepherd, T., Du, R., **Bathe, M.** Microbial production of pure single stranded nucleic acids. U.S. Patent No. US10940171B2, filed Nov. 19, 2017, and published March 9, 2021.
 6. Banal, J.L., Berleant, J.D., Shepherd, T., **Bathe, M.** Automated methods for scalable, parallelized enzymatic biopolymer synthesis and modification using microfluidic devices. U.S. Patent Pending US20180362969A1, filed Jun. 19, 2018, and published Dec. 20, 2018.
 7. Veneziano, R., Ratanalert, S., Shepherd, T., Jun, H., **Bathe, M.** Stable nanoscale nucleic acid assemblies and methods thereof. International Patent Pending WO2017189870A1, filed Apr. 27, 2017, and published Nov. 2, 2017.
 8. **Bathe, M.**, Ratanalert, S., Veneziano, R., Banal, J.L., Shepherd, T. Sequence-controlled polymer random access memory storage. International Patent Pending WO2017189914A1, filed Apr. 27, 2017, and published Nov. 2, 2017.
 9. **Bathe, M.**, Pan, K., Kim, D.-H. Techniques for controlling spatial structure of nucleic acid structures based on lattice-free, three-dimensional junction coordinates. U.S. Patent Pending US20160103951A1, filed Oct. 3, 2015, and published Apr. 14, 2016.
 10. **Bathe, M.**, Kim, D.-N., Dietz, H. 2012. Method and apparatus for controlling properties of nucleic acid nanostructures. U.S. Patent US20120166152A1, filed Dec. 22, 2010, and published Jun. 28, 2012.
 11. **Bathe, M.**, He, J., Guo, S.-M., Monnier, N. 2012. Bayesian inference of particle motion and dynamics from single particle tracking and fluorescence correlation spectroscopy. U.S. Patent US20120155725A1, filed Dec. 16, 2011, and published Jun. 21, 2012.

Invited Talks and Seminars

1. Wellcome Centre for Cell Biology, Edinburgh, Scotland, Virtual Seminar, 2023.
2. MIT ILP Seminar to USGA, Cambridge, MA 2023.
3. NIH Pioneer Interview, Virtual, 2023.
4. MIT ILP Seminar to Lonza, Inc., Cambridge, MA 2023.
5. Karolinska Institute, Stockholm, Sweden, 2023.
6. Army Research Office Basic Research Forum, Virtual Seminar, 2023.
7. Department of Chemistry, Rutgers University, Camden, NJ, 2022.

8. PEGS Gene Therapy R&D Analytics, Boston, MA, 2022.
9. OneChemistry, Johns Hopkins University, Virtual Seminar, 2022.
10. National Academy of Sciences, Using Biology for Communication and Information Transmission, Virtual Seminar, 2022.
11. Multivalency in Biology, Copenhagen, Denmark, Virtual Seminar, 2022.
12. ISBioTech Nucleic Acids, Development, Analysis, and Production of mRNA & DNA, Virtual Seminar, 2022.
13. MIT ILP Seminar to Evonik, Inc., Cambridge, MA 2022.
14. DNA Technology Days: Massive Data Workshop, Reston, VA, 2022.
15. Novo Nordisk, Virtual Seminar, 2021.
16. Harvard Medical School Initiative for RNA Medicine, 2021.
17. Northrup Grumman Corporation, Virtual Seminar, 2021.
18. Teach Me in 10 Seminar on Vaccine Technologies, Virtual Seminar, 2021.
19. MIT ILP R&D Conference, Virtual Seminar, 2021.
20. EMBO Conference on Designing Functional Biomolecular Assemblies: Beyond Biology, Virtual Seminar, 2021.
21. IBM Unconventional Computing Paradigms Workshop, Virtual Seminar, 2021.
22. IUPAC CCCE 2021 – 104 Canadian Chemistry Conference, Virtual Seminar, 2021.
23. LBL Molecular Foundry, Virtual Seminar, 2021.
24. SPIE Novel Patterning Technologies, Virtual Seminar, 2021.
25. MIT Biomaking Solutions, Virtual Seminar, 2020.
26. MIT Koch Institute, Virtual Seminar, 2020.
27. MIT Marble Center, Virtual Seminar, 2020.
28. NSF Bioeconomy Distinguished Lecture, Virtual Seminar, 2020.
29. CROI Boston, Virtual Seminar, 2020.
30. 4th Annual Genome Conference, Virtual Seminar, 2020.

31. Intracellular Dynamics of Molecules: Analysis and Models, Bordeaux, France, 2019.
32. MIT Computational Center for Engineering Symposium, Cambridge, MA, 2019.
33. MIT Research and Development Conference, Accelerating Big Impact Innovations, 2018.
34. Cryo-EM Center at MIT.nano Opening Symposium, Cambridge, MA, 2018.
35. 3rd Annual MIT-Skoltech Conference, Moscow, Russia, 2018.
36. 256th ACS National Meeting, Boston, MA, 2018.
37. Department of Pharmaceutical Sciences, Northeastern University, Boston, MA, 2017.
38. Micron School of Materials Science and Engineering, Boise State University, Boise, ID, 2017.
39. Department of Chemical & Biomolecular Engineering, Vanderbilt University, Nashville, TN, 2017.
40. KoreaBIO, Seoul, South Korea, 2017.
41. Applied Math and Computational Science, University of Pennsylvania, Philadelphia, PA, 2017.
42. 72nd New England Complex Fluids Workshop, Brandeis University, Newton, MA, 2017.
43. First Conference on Biomotors, Virus Assembly, and Nanobiotechnology Applications, Ohio State University, Columbus, OH, 2017.
44. Department of Chemistry & Biochemistry, Georgia Institute of Technology, Atlanta, Georgia, 2017.
45. DNATEC, Dresden, Germany, 2017.
46. HYBER Symposium, Helsinki, Finland, 2017.
47. The Future of Integrative Structural Biology Workshop, Clemson University, Clemson, SC, 2017.
48. Frontiers in Imaging Science Workshop, Janelia Research Campus, Ashburn, VA, 2017.
49. Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA, 2017.
50. Non-invasive Delivery of Macromolecules Conference, San Diego, CA, 2017.

51. Gordon Conference on RNA Nanotechnology, Ventura Beach, CA, 2017.
52. Frederick National Laboratory for Cancer Research, Frederick, MD, 2016.
53. SRC/IBM/ONR Workshop on Biological Pathways for Electronic Nanofabrication and Materials, San Jose, CA, 2016.
54. High Content Analysis and 3D Screening Conference, Boston, MA, 2016.
55. Allen Institute for Cell Science in Seattle, WA, 2016.
56. Department of Biology, Boston College, Chestnut Hill, MA, 2016.
57. American Chemical Society Annual Meeting, Philadelphia, PA, 2016.
58. Conference on Excited State Processes, Santa Fe, New Mexico, 2016.
59. U.S. Naval Research Laboratory, Washington, D.C., 2016.
60. Ten Years of DNA Origami Symposium, Caltech, Pasadena, CA, 2016.
61. Modeling and Inference Workshop: From Single Molecules to Cells, Ohio State University, Columbus, OH, 2016.
62. Biozentrum at the University of Basel, Basel, Switzerland, 2015.
63. Department of Chemistry, University of Chicago, Chicago, IL, 2015.
64. Department of Chemistry, University of Michigan, Ann Arbor, MI, 2015.
65. Autodesk Research, Inc., San Francisco, CA, 2015.
66. Department of Biological Engineering, MIT, Cambridge, MA, 2015.
67. DNA21, Harvard University, Cambridge, MA, 2015.
68. Washington University, St. Louis, MO, 2015.
69. Department of Biomedical Engineering, University of Minnesota, Minneapolis, MN, 2015.
70. 14th European Conference on Computational Biology in Strasbourg, France, 2014.
71. Department of Cell & Molecular Biology, Uppsala University, Uppsala, Sweden, 2014.
72. Microscopy Graduate Workshop at Stowers Institute for Medical Research in Kansas City, MO, 2014.

73. 110th International Titisee Conference, Titisee, Germany, 2014.
74. Department of Physics, McGill University, Montreal, Canada, 2014.
75. SIAM Conference on the Life Sciences, Charlotte, NC, 2014.
76. World Congress of Biomechanics, Boston, MA, 2014.
77. World Congress of Biomechanics, Boston, MA, 2014.
78. Curie Institute, Paris, France, 2014.
79. DNATEC14, Dresden, Germany, 2014.
80. Foundations of NanoScience Conference, Snowbird, UT, 2014.
81. GPU Technology Conference, San Jose, CA, 2014.
82. National Academy of Sciences Kavli Frontiers of Science & Engineering Symposium, Rio de Janeiro, Brazil, 2014.
83. Department of Biochemistry & Molecular Biology at Wayne State University School of Medicine, Detroit, MI, 2014.
84. Quantitative Bioimaging Conference at the University of New Mexico, Albuquerque, NM, 2014.
85. Physical Mathematics Seminar Series, MIT, Cambridge, MA, 2013.
86. Department of Physics, University of Maryland, College Park, MD, 2013.
87. Interdisciplinary Symposium on Advanced Nano/Biosystems: Design, Fabrication, and Characterization, University of Illinois at Urbana-Champaign, Champaign, IL, 2013.
88. Department of Chemistry and Biochemistry, Arizona State University, Phoenix, AZ, 2013.
89. National Centre for Biological Sciences TIFR, Bangalore, India, 2013.
90. Janelia Farm Research Campus, Ashburn, VA, 2013.
91. Department of Physics, Technical University of Munich, Munich, Germany, 2013.
92. International Workshop on Macromolecular Structure and Dynamics, Uppsala University, Uppsala, Sweden, 2013.
93. SciLifeLab, The Svedberg Seminar Series, Uppsala University, Uppsala, Sweden, 2013.

94. Department of Biochemistry and Molecular Biology, University of Chicago, Chicago, IL, 2013.
95. 57th Annual Biophysical Society Meeting, Philadelphia, PA, 2013.
96. Boston University, Integrative Systems Biology Seminar Series, Boston, MA, 2012.
97. Materials Research Society, Boston, MA, 2012.
98. NNIN/C Conference, Synergy Between Experiment and Computation in Energy – Looking to 2030, Harvard University, Cambridge, MA, 2012.
99. Ohio State University, Columbus, OH, 2012.
100. Soft Matter Approaches to Biological Physics, KITP UCSB, Santa Barbara, CA, 2011.
101. Foundations of Nanoscience, Snowbird, UT, 2011.
102. Biophysical Society, Baltimore, MD, 2011.
103. Biophysical Society, Baltimore, MD, 2011.
104. EMBO Workshop on Modeling, Microscopy, and Biophysical Methods, EMBL Heidelberg, Heidelberg, Germany, 2010.
105. Department of Biochemistry-Biophysics, Brandeis University, Waltham, MA, 2010.
106. The Cellular Cytoskeleton, Pingree Park, CO, 2010.
107. Harvard Squishy Physics, Harvard University, Cambridge, MA, 2010.
108. MIT Graduate Student Council Alumni Speaker Series, Cambridge, MA, 2009.
109. MIT BMES Undergraduate Students Association, Cambridge, MA, 2009.
110. Annual Meeting of the United States Association for Computational Mechanics, Columbus, OH, 2009.
111. Annual Meeting of the Biophysical Society, Boston, MA, 2009.
112. WAM Seminar Series, Harvard University, Cambridge, MA, 2009.
113. Institute for Biomolecular Science, Gakushuin University, Tokyo, Japan, 2009.
114. 2009 MIT in Japan Conference, Tokyo, Japan, 2009.

Workshops

1. Co-Organizer, SRC/IBM/ONR Workshop on Biological Pathways for Electronic Nanofabrication and Materials in San Jose, CA, 2016.
2. Participant, Army Research Office Workshop on Bioenabled Materials Synthesis & Assembly, Army Research Laboratory, Fort Detrick, MD, 2016.
3. Participant, IARPA/SRC Workshop on DNA-based Massive Information Storage, Arlington, VA, 2016.
4. Participant, DARPA, From One, Many: Engineered Multi-cellularity, Arlington, VA, 2015.
5. Participant, DoD Future Directions in Chemical and Biological Engineering, UT Austin, Austin, TX, 2013.
6. Organizer, Collective Behavior in Biological Systems, MIT, Cambridge, MA, 2013.
7. Instructor, Quantitative Biology Workshop, MIT, Cambridge, MA, 2013.
8. Organizer, MacroMoleculeBuilder Workshop, MIT, Cambridge, MA, 2012.
9. Instructor, Quantitative Biology Workshop, MIT, Cambridge, MA, 2012.
10. Participant, National Academies Keck Workshop on Frontiers in Imaging Science, National Academy of Sciences & Engineering, Irvine, CA, 2010.
11. Instructor, EMBO Workshop on Modeling, Microscopy, and Biophysical Methods, EMBL Heidelberg, Heidelberg, Germany, 2010.

Archival Journal Referee

Accounts of Chemical Research
ACS Nano
Analytical Chemistry
Angewandte Chemie
Biophysical Journal
Biopolymers
Cell
Chemical Reviews
E-life
European Physical Journal
Integrative Biology
Journal of the American Chemical Society
Journal of Biological Chemistry
Journal of Cell Biology
Journal of Cell Science
Journal of Chemical Information and Modeling

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Journal of Chemical Physics
Journal of Computational Chemistry
Journal of Computational and Theoretical Nanoscience
Journal of Visualized Experiments
Nano Letters
Nanoscale
Nature Biotechnology
Nature Communications
Nature Materials
Nature Methods
Nature Nanotechnology
Nucleic Acids Research
Physical Biology
Physical Review E
PLoS Computational Biology
PLoS ONE
PNAS
Science

Teaching

Term	Course Number	Course Title	Role	Course Type
Fall 2023	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2023	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Fall 2022	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2022	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Fall 2021	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2021	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Fall 2020	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture

Spring 2020	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Spring 2019	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Fall 2017	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Fall 2017	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Spring 2017	20.315/20.415	Physical Biology	Lecturer	Lecture
Fall 2016	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2016	20.310	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture
Fall 2015	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Fall 2015	20.416	Topics in Biophysics & Physical Biology	Lecturer	Lecture
Spring 2015	20.415	Physical Biology	Lecturer	Lecture
Fall 2014	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Fall 2014	20.416	Topics in Biophysics & Physical Biology	Lecturer	Lecture
Spring 2014	20.415	Physical Biology	Lecturer	Lecture
Fall 2013	20.416	Topics in Biophysics & Physical Biology	Lecturer	Lecture
Spring 2013	20.416	Topics in Biophysics & Physical Biology	Lecturer	Lecture
Spring 2013	20.415	Physical Biology	Lecturer	Lecture

Fall 2013	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Fall 2012	CSB.100	Topics in Computational & Systems Biology	Lecturer	Lecture
Fall 2012	20.416	Current Research in Biophysics	Lecturer	Lecture
Fall 2012	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2012	20.415	Physical Biology	Lecturer	Lecture
Fall 2011	20.110	Thermodynamics of Biomolecular Systems	Lecturer	Lecture
Fall 2011	20.416	Current Research in Biophysics	Lecturer	Lecture
Fall 2010	20.430	Fields, Forces, & Flows in Biological Systems	Lecturer	Lecture
Spring 2010	20.415	Physical Biology	Lecturer	Lecture
Fall 2009	20.110	Thermodynamics of Biomolecular Systems	Lecturer	Lecture
Spring 2009	20.410	Molecular, Cell, and Tissue Biomechanics	Lecturer	Lecture

Current Graduate Students

Name	Prior University	Training Period	Project Area	Current Position
Beny (Reuven) Falkovich	Technion University	2020–present	Neuronal imaging	Graduate Student
Andy (Hyun-Min) Kim	Caltech	2019–present	DNA nanotechnology	Graduate Student
Grant Knappe	University of Maryland	2019–present	DNA nanotechnology	Graduate Student
Anna Romanov	Georgia Tech	2020–present	DNA nanotechnology	Graduate Student

Past Graduate Students

Name	Prior University	Training Period	Project Area	Current Position
Matthew Adendorff	Rhodes University	2011–2015	DNA nanotechnology	Lead Technologist, Open Data Durban
Matthew Allan	Penn State University	2018–2023	RNA nanotechnology	Postdoctoral research associate, HMS
Zachary Barry	Georgia Institute of Technology	2012–2017	Bayesian analysis of peptidoglycan synthesis	Investigator, Novartis Institutes for Biomedical Research, Inc.
Joseph Berleant	California Institute of Technology	2017–2023	DNA nanotechnology	Postdoctoral research associate, MIT
Philip Bransford	University of Minnesota	2009–2011	Dynamics and evolution of cadherins and actin-bundling proteins	Senior Scientist, Vertex Pharmaceuticals, Inc.
Rebecca Du	California Institute of Technology	2017–2022	DNA nanotechnology	Cell Culture Scientist, Culture Biosciences
Simon Gordonov	Rutgers University (B.Sc.); Cambridge University (M.Phil.)	2012–present	Analysis & modeling of cell migration	Scientist, Vertex Pharmaceuticals, Inc.
Syuan-Ming Guo	National Taiwan University	2009–2016	Bayesian inference and super-resolution imaging of membrane dynamics	Imaging Data Scientist, Chan-Zuckerberg BioHub
Nilah Monnier Ioannidis	Harvard University (B.A.); University of Cambridge (M.Phil.)	2009–2012	Bayesian inference approaches for particle trajectory analysis in cell biology	Assistant Professor, University of California Berkeley

Molly Parsons	Iowa State University	2017–2022	RNA nanotechnology	Postdoctoral research associate, HMS
Sakul Ratanalert	Cornell University	2013–2018	Structural DNA nanotechnology	Lecturer, Johns Hopkins University
Reza Sedeh	Tehran University	2009–2012	Contributions to the analysis of proteins	Senior Data Scientist, Microsoft, Inc.
Kristin Sheridan	MIT	2020–2021	DNA nanotechnology	Doctoral Student, UT Austin
Julia Wu	MIT	2020–2021	Neuronal data analysis	Software Engineer, Google

Current Postdoctoral Research Associates

Name	Doctoral University	Training Period	Project Area	Current Position
Chi Chen	University of Paris Sud	2020–present	DNA-based computing materials	Postdoctoral Associate
Jeffrey Gorman	University of Cambridge	2020–present	Biomimetic light-harvesting materials	Postdoctoral Associate
Xin Luo	McGill University	2022–present	Structural DNA nanotechnology	Postdoctoral Associate

Former Postdoctoral Research Associates

Name	Doctoral University	Training Period	Project Area	Current Position
James Banal	University of Melbourne	2016–2021	Programmable excitonic systems on DNA nanostructures	Co-Founder, Cache DNA, Inc.

Etienne Boulais	École Polytechnique de Montréal	2013–2015	Excitonic properties of DNA-dye assemblies	Radar and Antenna Engineer, Canadian Space Agency
William Bricker	Washington University	2015–2019	Computational modeling of DNA-based excitonic assemblies	Assistant Professor, University of New Mexico
Eric Danielson	Medical College of Wisconsin	2018–2020	Phenotypic profiling of neuronal models of Schizophrenia	Senior Scientist II
Philipp Diesinger	Institute of Theoretical Physics, University of Heidelberg	2010–2011	Quantitative analysis of cytoskeletal dynamics	Head of Global Data Science, Boehringer Ingelheim, Inc.
Floris Engelhardt	TU Munich	2020–2021	Single-stranded DNA design and production	CEO and Co-Founder, KanoTx, Inc.
Changsun Eun	University of California San Diego (Postdoc) - University of North Carolina at Chapel Hill (Ph.D.)	2014–2014	DNA scaffolded multi-enzyme cascades	Research Scientist, LG Chemicals, Inc.
Stavros Gaitanaros	University of Texas at Austin	2014–2015	DNA nanostructure solution shape and mechanics	Assistant Professor, Johns Hopkins University
Syuan-Ming Guo	National Taiwan University	2016–2018	Bayesian inference and super-resolution imaging of membrane dynamics	Machine Learning Scientist, Insitro
Yera Hakobyan	Cornell University	2013–2014	Structure-based mechanical modeling of DNA origami	Data Science Architect, 3M
Jun He	Brown University	2009–2011	Bayesian approach to imaging-based spectroscopy	Data Science Manager, Adobe, Inc.
Torsten John	Leipzig University	2020–2023	DNA-based excitonic materials	Postdoctoral Fellow, Mainz MPI
Hyungmin Jun	Korea Advanced Institute of	2015–2019	Structural DNA nanotechnology	Assistant Professor,

	Science and Technology			Jeonbuk National University
Do-Nyun Kim	MIT	2011–2014	Predicting 3D structure of DNA origami	Professor, Seoul National University
Aprotim Mazumder	NCBS – TIFR Bangalore, India	2009–2014	Single-cell DNA Damage Response	Assistant Professor, TCIS, TIFR
Keyao Pan	Rice University	2011–2016	DNA nanostructure solution shape prediction	Research Data Scientist, Facebook, Inc.
Pramod Pisharady	National University of Singapore	2013–2014	Bayesian reconstruction of structural MRI data	Assistant Professor & CZI Imaging Scientist, University of Minnesota Medical School
Tyson Shepherd	University of Iowa	2015–2018	RNA nanostructures	Research Scientist, Inscripta, Inc.
Mathew Stone	University of Michigan	2017–2018	Quantitative fluorescence imaging of neurons and B-cells	Associate Predictive Modeler, Auto-Owners Insurance
Martin Tomov	Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute / University at Albany-SUNY	2016–2018	Multiplexed fluorescence imaging of stem cell-derived neurons	Postdoctoral Fellow, Emory University
Remi Veneziano	Institute Charles Gerhardt	2014–2018	Membrane-associated biomolecular structure and dynamics	Assistant Professor, George Mason University
Eike Wamhoff	Max Planck Institute of Colloids and Interfaces	2017–2022	DNA nanoparticle vaccines	Research Scientist, BioNTec, GMBH
Xiao Wang	New York University	2018–present	Structural DNA nanotechnology	Assistant Professor, Southeast

				University, China
Jessica Wu	University of California, Irvine, Irvine, CA	2016–2016	Phenotypic profiling of synaptic proteins and mRNAs	Senior Scientist, AbbVie, Inc.
Lun Yang	Carnegie Mellon University	2012–2013	Modeling nanoscale excitonic networks	Quantitative Research Developer, GMO

Doctoral Thesis Committee Reader

2009 BoBae Lee (DMSE), Thesis Committee Member
2011 Ishan Barman (ME), Thesis Committee Member
2011 Fei Liang (BE), Thesis Committee Member
2013 Sungmin Son (ME), Thesis Committee Member
2013 Dimitrios Tzeranis (ME), Thesis Committee Member
2013 Dhiraj Devidas Bhatia (NCBS), Thesis Committee Member
2014 Christopher Negrón (CSB), Thesis Committee Member
2015 Thomas Gurry (CSB), Thesis Committee Member
2015 Chia-Ching Chou (CEE), Thesis Committee Member
2015 Joyce Yang (HMS), Thesis Committee Member
2016 William Hesse (BE), Thesis Committee Chair
2016 Kelly Brock (CSB), Thesis Committee Member
2016 Rotem Gura (CSB), Thesis Committee Member
2016 Kento Masayuma (AA), Thesis Committee Member
2017 Eric Ma (BE), Thesis Committee Chair
2018 Anthony Kulesa (BE), Thesis Committee Chair
2018 Stavros Chatzieleetheriou (NTUA), Thesis Committee Member
2019 Alex Wesselhoeft (Biology), Thesis Committee Member
2019 Aaron Dy (BE), Thesis Committee Chair
2019 Paul Reginato (BE), Thesis Committee Chair
2020 Luke Funk (HST), Thesis Committee Chair
2021 Marjan Omer (Aarhus), Thesis Opponent
2022 Yang Wang (Karolinska), Thesis Opponent

Software and Servers

<https://github.com/lcbb/athena>

Automated sequence design based on 3D CAD modeling environment.

<http://cando-dna-origami.org>

Automated server to predict 3D solution shape of nucleic acid based nanostructures.

<http://daedalus-dna-origami.org>

Automated server to compute DNA sequences needed to fold 3D DNA origami nanoparticles with DX-edges.

<http://metis-dna-origami.org>

Automated server to compute DNA sequences needed to fold 2D DNA origami objects with honeycomb edges.

<http://perdix-dna-origami.org>

Automated server to compute DNA sequences needed to fold 2D DNA origami objects with DX-edges.

<http://talos-dna-origami.org>

Automated server to compute DNA sequences needed to fold 3D DNA origami nanoparticles with honeycomb edges.

<http://fcs-bayes.org>

Software to perform objective Bayesian analysis of fluorescence correlation spectroscopy data of molecular binding and transport processes from living and non-living chemical systems.

<http://hmm-bayes.org>

Software to perform Bayesian model selection of the physical mode of motion of single-particles from single-step resolution trajectories measured from time-lapse sequences of particle positions.

<http://msd-bayes.org>

Software to perform Bayesian model selection of the physical mode of motion of single-particles from mean-square displacement curves measured from time-lapse sequences of particle positions.

<http://sapphire-hcs.org>

Software to perform Bayesian classification of live-cell imaging datasets based on cell shape segmentation and stochastic modeling of transition states using hidden Markov modeling.

Funded Research Awards

MIT CEHS NIH P30-ES002109

Role: Pilot Project PI

MIT CEHS Pilot Project Program/NIH P30 EHSCC

CEHS Pilot: Single-cell Analysis of Transcriptional and Translational Regulation of Genes

Essential for DNA-Damage Response

9/1/2010–3/31/2012

\$40,991

DOD-MURI W911NF-12-1-0420

Role: Co-I (PI Yan)

Arizona State University/Navy-ONR

Translating Biochemical Pathways to Non-Cellular Environments

7/1/2012–8/19/2018

\$624,750

ONR DURIP N00014-13-1-0664

Role: PI (Equipment Grant)

Navy-ONR DURIP

DURIP: High Performance Computing for Nucleic Acids Nanotechnology

6/15/2013–6/14/2014

\$313,969

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Massachusetts Institute of Technology
Department of Biological Engineering
Bathe BioNanoLab
<http://bathebio.org>

NSF DMREF CMMI-1334109

Role: PI (Co-I Yan and Yin)

NSF DMREF

Computational Design Principles for Functional DNA-based Materials
(Subcontracts: Arizona State University and Harvard University)

1/15/2014–12/31/2018

(Total Award) \$1,706,468

(Bathe Portion) \$817,106

NSF PoLS PHY-1305537

Role: PI

NSF PoLS

Inferring the Physics of Living Systems from Dynamic Light Microscopy Data

4/1/2014–3/31/2018

\$540,000

HFSP RGP0029/2014

Role: Co-I (PI Krishnan)

Human Frontier Science Program

Dissecting the Mechanochemistry of Membrane Invagination with Designer DNA-Based Probes

5/1/2014–4/30/2018

\$337,500

ONR N00014-12-1-0621 & N00014-14-1-0609 & N00014-16-1-2181

Role: PI

Navy-ONR

Computer-Aided Engineering for Nucleic Acid-Based Nanotechnology

5/15/2014–8/14/2017

\$1,418,207

NIH U01-MH106011

Role: Co-I (PI Boyden)

NIH BRAIN

Ultra-Multiplexed Nanoscale In Situ Proteomics for Understanding Synapse Types

9/26/2014–11/30/2017

(Total Award) \$2,154,250

(Bathe Portion) \$714,195

Anonymous Foundation

Role: PI (Equipment Grant)

Anonymous Foundation

Purchase of a Light-sheet Fluorescence Microscope for Advanced Multi-scale Imaging at MIT

12/29/2014–12/31/2016

\$650,000

DOE-Chicago DE-SC0001088

Role: Co-I (PI Baldo)

DOE

RLE-Center for Excitonics

8/1/2015–2/28/2017

(Bathe Portion) \$329,893

NSF EAGER CCF-1547999

Role: PI

NSF EAGER

EAGER: Collaborative Research: Algorithmic Design Principles for Programmed DNA
Nanocages

8/1/2015–7/31/2019

\$155,000

ONR DURIP N00014-15-1-2830

Role: PI (Equipment Grant)

Navy-ONR DURIP

DURIP: High Performance Computing for Nucleic Acid Nanotechnology

9/29/2015–9/28/2016

\$179,676

NSF CCF-1564025

4/1/2016–3/31/2021

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Professor
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Building 16, Room 255
Cambridge, MA 02139 USA

Massachusetts Institute of Technology
Department of Biological Engineering
Bathe BioNanoLab
<http://bathebionano.org>

Role: PI \$638,493
NSF CCF
AF: Medium: Collaborative Research: Top-down Algorithmic Design of Structured Nucleic Acid Assemblies

ONR DURIP N00014-16-1-2506 7/15/2016–8/31/2017
Role: PI (Equipment Grant) \$162,843
Navy-ONR DURIP
DURIP: High-throughput Assembly and Characterization Tools for Structural DNA Nanotechnology

ONR N00014-16-1-2953 9/1/2016–8/31/2019
Role: PI (Co-I Chiu) (Total Award) \$786,856
Navy-ONR (Bathe Portion) \$561,856
DNA Origami Scaffolds for Single-particle Cryo-Electron Microscopy of Viral RNA
(Subcontract: Baylor College of Medicine)

Skoltech 1911/R 12/1/2016–11/30/2019
Role: Co-I (PI Lempitsky) (Bathe Portion) \$492,945
Skolkovo Institute of Science and Technology
Deep Learning Toolbox for Cell Image Analysis

NIH R01-MH112694 4/1/2017–2/28/2022
Role: PI (Co-I Cottrell) (Total Award) \$2,018,175
NIH R01 (Bathe Portion) \$1,547,000
Simultaneous Multiplexed in Situ Fluorescence Imaging of Neuronal Proteins and Messenger RNAs
(Subcontract: The Broad Institute)

DOE DE-SC0016353 6/15/2017–6/14/2019
Role: Co-I (PI Yan) (Bathe Portion) \$213,388
Arizona State University/DOE
DNA Nanostructure Directed Designer Excitonic Networks

ONR N00014-17-1-2609 8/1/2017–7/31/2021
Role: PI \$661,663
Navy-ONR
Hierarchical Nanoscale Materials Programmed using Structured DNA Nanoparticles

NSF PHY-1707999 8/15/2017–7/31/2024
Role: PI \$720,000
NSF PoLS
Inferring the Physics of mRNA Trafficking in Neuronal Systems

MIT Deshpande MOU 9/1/2017–2/15/2019
Role: PI \$50,000
MIT Deshpande Center
Structured DNA Nanoparticles as a Therapeutic Delivery Platform

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NSF CBET-1729397 **1/1/2018–12/31/2021**
Role: PI (Co-I Yan and Yin) (Total Award) \$1,600,000
NSF DMREF (Bathe Portion) \$770,500
DMREF: Computational Design of Next-generation Nanoscale DNA-based Materials
(Subcontracts: Arizona State University and Harvard Medical School)

ONR DURIP N00014-18-1-2290 **6/1/2018–5/31/2019**
Role: PI (Equipment Grant) \$364,186
Navy-ONR DURIP
DURIP: DNA Synthesizer for the Development of New Modalities for DNA Nanostructures

NIH R21-EB026008 **8/15/2018–12/20/2022**
Role: PI (Co-I on Supplement Lingwood and Schmidt) (Total Award) \$796,348
NIH R21 and Supplement (Bathe Portion) \$588,303
Structured DNA Nanoparticles Therapeutic mRNA and CRISPR/Cas9 Delivery
NIH R21-EB026008 Revision Supplement - DNA Nanoparticle Vaccine for COVID-19
(Subcontract on Supplement: Ragon Institute)

i-Corps W911NF1810436 **9/10/2018–9/9/2021**
Role: PI \$70,000
Army-ARO
Assessment of Nanoparticle Assemblies for Efficient Gene Therapy Vehicles

NSF CHE-1839155 **9/15/2018–8/31/2023**
Role: PI (Total Award) \$1,000,000
NSF RAISE (Bathe Portion) \$321,772
RAISE-TAQS: Room-Temperature Quantum Sensing and Computation using DNA-based
Excitonic Circuits

UC Santa Barbara Funding under W911NF-19-2-0026 **12/1/2018–11/30/2019**
Role: Seed PI (PI Lauffenburger) \$90,000
UC Santa Barbara/DOD
Programmable DNA-based Meta-materials

ONR DURIP N00014-19-1-2344 **6/1/2019–5/31/2021**
Role: PI (Equipment Grant) \$453,000
Navy-ONR DURIP
DURIP: Combinatorial DNA nanoparticle libraries for structural biology and materials research

DOE DE-SC0019998 **8/1/2019–7/31/2022**
Role: Co-I (PI Schlau-Cohen) (Bathe Portion) \$390,000
DOE
Controlling Exciton Dynamics with DNA Origami for Quantum Information Science

NSF HDR OAC-1940231 **10/1/2019–9/30/2021**
Role: PI \$334,231
NSF HDR

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Collaborative Research: Autonomous Computing Materials

UC Santa Barbara Funding under W911NF-19-2-0026

Role: Co-PI (PI McFarlane)

DOD UARC

Controlling Electromagnetic Properties of DNA-based Metamaterials

12/1/2019–11/30/2023

(Total Award) \$677,844

(Bathe Portion) \$338,922

MIT ISN Seed Funding under W911NF-13-D-0001

Role: Co-PI (PI Irvine)

MIT ISN/DOD

Pilot Project: Enzyme-Encapsulated Nucleic Acid Vaccines

12/1/2019–12/31/2022

(Bathe Portion) \$139,904

ONR N00014-20-1-2084

Role: PI (Co-I Chiu)

Navy-ONR

Synthetic Nucleic Acid Nanoparticles for RNA Structural & Synthetic Biology

(Subcontract: Stanford University)

1/15/2020–1/14/2023

(Total Award) \$798,730

(Bathe Portion) \$639,830

ONR DURIP N00014-20-1-2202

Role: PI (Equipment Grant)

Navy-ONR DURIP

DURIP: Expansion of Combinatorial DNA Nanoparticle Libraries for Materials Research & Structural Biology

4/1/2020–8/1/2023

\$552,061

SPARK Therapeutics, Inc.

Role: PI

SPARK Therapeutics, Inc.

Evaluation of phagemid-produced single-strand DNA

3/11/2020–9/26/2021

\$10,570

Fast Grant Award

Role: PI (Co-I Lingwood and Schmidt)

Mercatus Center at George Mason University

COVID-19 Fast Grant

(Subcontract: Ragon Institute)

4/15/2020–4/30/2021

(Total Award) \$150,000

(Bathe Portion) \$70,000

NSF CCF-1956054

Role: PI

NSF CCF

AF Medium: DNA-based Data Storage and Computing Materials

5/1/2020–4/30/2024

\$900,000

ONR N00014-21-1-4013

Role: PI

Navy-ONR

Hierarchical Nanoscale Materials Programmed using Structured DNA Nanoparticles

11/2/2020–11/1/2023

\$711,687

NIH R01-AI162307

Role: Co-PI (PI Irvine)

NIH R01

8/2/2021–7/31/2025

(Total Award) \$1,551,000

(Bathe Portion) \$705,484

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Investigation of Synthetic DNA-based Viral Particles for Spatially Controlled Antigen Presentation

ACX Grant

Role: PI

Centre for Effective Altruism

Project for novel platform for screening and development of psychiatric drugs, including therapeutic adaptations of psychedelics

1/6/2022–1/6/2025

\$25,000

GanNa Bio, Inc.

Role: PI

GanNa Bio, Inc.

Collaboration with the Bathe Lab at MIT and GanNa Bio, Inc.

3/24/2022–1/31/2023

\$10,430

ONR DURIP N00014-22-1-2317

Role: PI (Equipment Grant)

Navy-ONR DURIP

DURIP: Accelerating the Discovery of DNA Based Materials using High-Performance Computing and Structural Biology

4/1/2022–12/31/2023

\$417,550

Novo Nordisk Agreement

Role: PI

Novo Nordisk

Next-generation gene therapeutic delivery platform using DNA origami

6/29/2022–6/29/2023

\$50,000

NIH R21-MH130624

Role: PI

NIH R21

Investigation of the Synaptic Molecular Network using Multiplexed Imaging

7/1/2022–6/30/2024

\$418,370

DOE DE-SC0019998

Role: Co-I (PI Schlau-Cohen)

DOE

Synthesizing functionality in excitonic systems using DNA origami

8/1/2022–7/31/2024

(Bathe Portion) \$487,500

NSF CMMI-2240309

Role: PI

NSF EAGER

EAGER: Quantum Manufacturing: Bottom-up Molecular Qubit Arrays using DNA Origami

5/1/2023–4/30/2025

(Total Award) \$300,000
(Bathe Portion) \$204,600

MIT ISN-5 Project W911NF2320121

Role: PI

MIT ISN

ISN 5.1: Enzyme-Encapsulation and Performance of Nucleic Acid Nanoparticles

7/1/2023–6/30/2028

\$150,000