Xiaotang Lu, Ph.D.

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As a chemist and materials engineer with deep interdisciplinary expertise, I am committed to expanding the boundaries of our understanding of brain connectivity and its implications for brain functions, neurological disorders, and artificial intelligence. Unraveling the mysteries of the brain requires developing enabling technologies across diverse fields. With the support of the NIH career transition grant, my goal is to lead a multidisciplinary laboratory, fostering collaboration and innovation to pioneer an integrated imaging platform to illuminate the intricate structural and molecular architecture of the brain.

EDUCATION

Postdoctoral Fellow, Harvard University, Cambridge MA 2016-
Advisor: Dr. Jeff W. Lichtman

- Member of the Center for Brain Science and the Conte Center at Harvard
- Principle investigator of BRAIN Initiative K99/R00 award "New Methodologies for Connectomics" **($1M, 2021-2026)**
- Key contributor of NIH UM1 BRAIN CONNECTS grant "MouseConnects: A Center for High-throughput Integrative Mouse Connectomics" **($33M, 2023-2028)**
- Developing methods for fixation, staining, and molecular labeling of biologically relevant and large brain tissue samples
- Addressing connectomic imaging challenges concerning scalability, throughput, resolution, multiplexity, and multimodality
- Invented the permeabilization-free immunostaining methods ((NATIVE and CAptVE) for volumetric correlated light and electron microscopy
- Streamlined the EM imaging workflow for IARPA project "Algorithms for Representation and Inference informed by the Acquisition of Data from Neuroscience Experiments"

Ph. D. in Materials Science and Engineering, the University of Texas at Austin, Austin TX 2015
Advisor: Dr. Brian A. Korgel

- Dissertation: *Silicon and germanium nanostructures: synthesis and in situ TEM study*
- Investigated size- and composition-tunable properties of semiconductor nanomaterials
- Developed nanowire batteries of higher energy density, better power performance, and longer cycle life
- Member of the Energy Frontier Research Center, established extensive internal and external collaborations to advance the understanding of nanomaterials for energy storage application

M. S. in Chemistry, Tsinghua University, Beijing, China 2011
Advisor: Dr. Yadong Li

- Pioneered the synthesis of Wurtzite $CuInS_2$ and $CuZnSnS_2$ nanomaterials and investigated their application in thin-film solar cells

B. Eng. in Chemical Engineering, Nanjing University of Science and Technology, Nanjing, China 2008

- *Summa Cum Laude*

AWARDS & FELLOWSHIPS

Research Award

- NIH K99/R00 BRAIN Initiative Advanced Postdoctoral Career Transition Award 2021

Academic Recognitions

- Intersection Science Associate (ISFS) 2023
- Cornell FIRST Scholar (Cornell University) 2022
- Leading Edge Fellow (HHMI, Janelia Research Campus) 2022

Selected Scholarships

- Dankong Scholarship for Graduate (Tsinghua University) 2010
- Trustees Award for Outstanding Achievement (highest honor of NUST) 2008
- Dean's List with Distinction (NUST) 2007

- Undergraduate Student Merit Award (NUST) 2005

Travel Awards

- Professional Development Award (UT-Austin) 2015

PROFESSIONAL EXPERIENCE

Science Entrepreneurial Fellow, M Ventures (Merck KGaA) 2019-2020

- Led due diligence in SynSense, a neuromorphic intelligence company
- Analyzed technology feasibility and commercialization potential of emerging new technologies, including in-memory AI computing, metasurface optics, and brain-machine interfaces
- Delivered seminars on emerging technologies to Merck's global R&D teams

Independent Reviewer 2014-

- Nano Letters (ACS), Chemistry of Materials (ACS), Scientific Reports (Springer Nature), Nano Research (Springer), New Journal of Chemistry (RSC), RSC Advances (RSC)

Visiting Research Scholar, Pacific Northwest National Laboratory, Richmond WA 2013-2015

- Initiated and led the collaborative project with Dr. Chongming Wang's group at PNNL
- Secured the three-year user grant from the Department of Energy for using advanced TEM for studying energy materials
- Investigated the use of *in situ* TEM technology in analyzing structural and compositional changes of anode nanomaterials during electrochemical cycles to provide rationales for optimizing Li-ion batteries

Core Member of UT Women in Engineering, Austin TX 2012-2015

- Organized Girls Day and Explore UT events for four years
- Mentor of WEP Peer Assistance Leaders

TEACHING & MENTORSHIP

Teaching Assistant

Responsibilities included teaching sections, preparing handout notes, grading assignments, holding weekly office hours, and facilitating discussion sections.

- *CHE 379/384 Nanomaterials Chemistry & Engineering*, UT-Austin Fall 2014
- *Inorganic Chemistry*, Tsinghua University Spring 2010
- *Principles of Chemistry*, Tsinghua University Fall 2009

Mentees

- Yu Xie: current undergraduate student, New York University, 2023
- Ya-Xin Su: current undergraduate student, Boston University, 2023
- Jia-Hao Wen: undergraduate student, University of Melbourne, 2018 summer
- Jing-Lin Zhao: undergraduate student, Hong Kong Baptist University, 2017 summer | current: master student, Rutgers University
- Rebecca McKeever: undergraduate student, UTexas-Austin, 2014 | current: R&D director, Everyday Minerals
- Yue-Guang Chen: undergraduate student, Tsinghua University, 2011 | current: lecturer, Beijing University of Chemical Technology

PRESENTATIONS

BRAIN Initiative Annual Meeting, Bethesda MD 2023

Poster: Scalable Staining Strategy for Whole-Brain Connectomics
Poster: Probe Brain Cell Diversity for Ultrastructural Analysis with Modified Aptamers

Department of Molecular and Cellular Biology's Research Retreat, Cape Cod MA 2022

Nominated speaker: Immunolabels for Permeabilization-free CLEM

Connectomics Conference, Berlin, Germany 2022

Nominated speaker A Scalable Whole Brain Staining Method for Electron Microscopy

NIH/DOE Workshop on Brain Connectivity, virtual 2021

Invited speaker: Sample Preparation for Mammalian Whole Brain Connectomics

Society for Neuroscience, San Diego CA 2018
Poster: Nanobody-Assisted Large Volume Immunostaining for Ultrastructure-Preserved CLEM

American Chemical Society 249th National Meeting, Denver CO 2015
Oral: Colloidal Synthesis of Silicon and Germanium Nanorods and Nanowires

The 46th Silicon Symposium, Davis CA 2015
Oral: Colloidal Synthesis of Luminescent Silicon Nanorods

Materials Research Society Spring Meeting & Exhibit, San Francisco CA 2015
Poster: Synthesis of Silicon and Germanium Nanomaterials

The 3rd International Solvothermal and Hydrothermal Association Conference, Austin TX 2013
Oral: Monophenyl Silane Catalyzed Growth of Germanium Nanowires with Gold and Nickel Seeds

PUBLICATIONS (https://scholar.google.com/citations?user=JMjjQtIAAAAJ&hl=en)

Total citation = 1728

Manuscript under Review

- **X. Lu**[#], Y. L. Wu, R. Schalek, Y. Meirovitch, D. Berger, J. W. Lichtman[#]. ODeCO: A Scalable Whole Mouse Brain Staining Method for Electron Microscopy. **(# corresponding authors)**
    - ♦ Foundation technique for BRAIN CONNECTS UM1 grant ($33M)
- X. Han, **X. Lu**[#], P. Li, Y. Meirovitch, S. Wang, R. Schalek. D. Berger, Y. Wu, T. Fang, E. S. Meral, S. Asraf, V. Jain, J. Trimmer, J. W. Lichtman[#]. Multiplexed Volumetric CLEM Enabled by Antibody Derivatives Provides New Insights into Cytology of Mouse Cerebellar Cortex. **(# corresponding authors)**
    - ♦ Collaboration with the UC Davis/NIH NeuroMab Facility
    - ♦ Link: https://www.biorxiv.org/content/10.1101/2023.05.20.540091v2
- **X. Lu**[#], Y. L. Wu, P. Li, R. Schalek, J. D. Carter, S. Gupta, N. Janjic, J. W. Lichtman[#]. CAptVE: Probing Brain Cell Molecular Diversity and Ultrastructure with Slow Off-Rate Aptamers **(# corresponding authors)**
    - ♦ Long-term strategic collaboration with Prof. Larry Gold and SomaLogic, Inc.

Manuscript in Preparation

- **X. Lu***, N. Dhanyasi*, X. Wang*, J. W. Lichtman. Methods for Connectomics (*co-first authors, invited review by *Nature Reviews Neuroscience*)

Publications (Chronological Order)

23. **X. Lu**[#], X. Han, Y. Meirovitch, E. Sjostedt, R. Schalek. J. W. Lichtman[#]. Preserving Extracellular Space for High-Quality Optical and Ultrastructural Studies of Whole Mammalian Brains, accepted to ***Cell Reports Methods*** 2023, in press **(# corresponding authors)**
    - ♦ Featured in cover
    - ♦ Link: https://doi.org/10.1016/j.crmeth.2023.100520
22. F. Bidel, Y. Meirovitch, R. Schalek, **X. Lu**, E. C. Pavarino, F. Yang, A. Peleg, Y. Wu, T. Shomrat, D. Berger, A. Shaked, J. W. Lichtman, B. Hochner. Connectomics of the Octopus Vulgaris Vertical Lobe Provides Insight into Conserved and Novel Principles of a Memory Acquisition Network, accepted to ***eLife*** 2023, 12:e84257
    - ♦ Link: https://elifesciences.org/articles/84257
21. E. C Pavarino, E. Yang, N. Dhanyasi, M. Wang, F. Bidel, **X. Lu**, F. Yang, M. Br, B. Drescher, B. Hochner, P. S. Katz, M. Zhen, J. W. Lichtman, Y. Meirovitch. mEMbrain: an Interactive Deep Learning Tool for Labeling and Segmenting Electron Microscopy Datasets, accepted to ***Frontiers in Neural Circuits*** 2023, 17:952921
    - ♦ Link: https://www.frontiersin.org/articles/10.3389/fncir.2023.952921/full
20. T. Fang*, **X. Lu***, D. Berger, C. Gmeiner, J. Cho, R. Schalek, H. Ploegh, J. W. Lichtman. Nanobody Immunostaining for Correlated Light and Electron Microscopy with Preservation of Ultrastructure, ***Nature Methods*** 2018, 15, 1029-1032. **(*co-first authors)**

- Reported by Simons Foundation's *Spectrum* (C. Willams "New method exposes structures inside 'rainbow' of brain cells")
- Reported by Harvard University MCB news ("Paint colors on a connectomic map")
- Highlighted by BRAIN Initiative 2.0

19. **X. Lu**, M. de la Mata, J. Arbiol, B. A. Korgel. Colloidal Silicon-Germanium Nanorod Heterostructures. ***Chemistry of Materials*** 2017, 29 (22), 9786-9792.
18. C. J. Stolle, **X. Lu**, Y. X. Yu, R. D. Schaller, B. A. Korgel. Efficient Carrier Multiplication in Colloidal Silicon Nanorods, ***Nano Letters*** 2017, 17 (9), 5580-5586.
17. **X. Lu**, E. R. Emily, Y. He, L. Zhong, L. L. Luo, C. M. Wang, B. A. Korgel. Germanium as a Sodium Ion Battery Material: In Situ TEM Reveals Fast Sodiation Kinetics with High Capacity, ***Chemistry of Materials*** 2016, 28 (4), 1236-1242.
16. **X. Lu**, Y. He, S. Mao, C. Wang, B. A. Korgel. Size Dependent Pore Formation in Germanium Nanowires Undergoing Reversible Delithiation Observed by In Situ TEM, ***Journal of Physical Chemistry C*** 2016, 120 (50), 28825-28831.
15. Y. Yu, **X. Lu**, A. Guillaussier, V. R. Voggu, W. Pineros, M. de la Mata, J Arbiol, D. M. Smilgies, T. M Truskett, B. A. Korgel. Orientationally Ordered Silicon Nanocrystal Cuboctahedra in Superlattice, ***Nano Letters*** 2016, 16 (12), 7814-7821.
14. **X. Lu**, T. D. Bogart, M. Gu, C. Wang, B. A. Korgel. In Situ TEM Observations of Sn-Containing Silicon Nanowires Undergoing Reversible Pore Formation Due to Fast Lithiation/Delithiation Kinetics, ***Journal of Physical Chemistry C*** 2015, 119 (38), 21889-21895.
13. **X. Lu**, K. J. Anderson, P. Boudjouk, B. A. Korgel. Low Temperature Synthesis of Colloidal Silicon Nanorods from Isotetrasilane, Neopentasilane and Cyclohexasilane, ***Chemistry of Materials*** 2015, 27 (17), 6053-6058.
12. **X. Lu**, B. A. Korgel. A Single-Step Reaction for Silicon and Germanium Nanorods, ***Chemistry-A European Journal*** 2014, 20 (20), 5874-5879.
    - Reported by Frontiers in Energy Research Newsletter (K. Schroder "Big Steps Toward Small Materials")
11. T. D. Bogart, D. Oka, **X. Lu**, C. M. Wang, B. A. Korgel. Lithium-Ion Battery Performance of Silicon Nanowires with Carbon Skin, ***ACS Nano*** 2014, 8 (1), 915-922.
10. T. D. Bogart, **X. Lu**, M. Gu, C. Wang, B. A. Korgel. Enhancing the Lithiation Rate of Silicon Nanowires by the Inclusion of Tin, ***RSC Advances*** 2014, 4 (79), 42022-42028.
9. I. Rodriguez, L. Shi, **X. Lu**, B. A. Korgel, R. A. Alvarez-Puebla, F. Meseguer. Silicon Nanoparticles as Raman Scattering Enhancers, ***Nanoscale*** 2014, 6, 5666-5670.
8. **X. Lu**, C. M. Hessel, Y. X. Yu, T. D. Bogart, B. A. Korgel. Colloidal Luminescent Silicon Nanorods, ***Nano Letters*** 2013, 13 (7), 3101-3105.
7. **X. Lu**, J. T. Harris, J. E. Villarreal, A. M. Chockla, B. A. Korgel. Enhanced Nickel-Seeded Synthesis of Germanium Nanowires, ***Chemistry of Materials*** 2013, 25 (10), 2172-2177.
6. L. Shi, J. T. Harris, R. Fenollosa, I. Rodriguez, **X. Lu**, B. A. Korgel, F. Meseguer. Monodisperse Silicon Nanocavities and Photonic Crystals with Magnetic Response in the Optical Region, ***Nature Communications*** 2013, 4, 1904.
5. T. D. Bogart, **X. Lu**, B. A. Korgel. Precision Synthesis of Silicon Nanowires with Crystalline Core and Amorphous Shell, *Dalton Transactions* 2013, 42, 12675-12680.
4. Z. Zhuang, **X. Lu**, Q. Peng, Y. Li. A Facile "Dispersion–Decomposition" Route to Metal Sulfide Nanocrystals, ***Chemistry - A European Journal*** 2011, 17 (37), 10445-10452.
3. **X. Lu**, Z. Zhuang, Q. Peng, Y. Li. Wurtzite Cu_2ZnSnS_4 Nanocrystals: A Novel Quaternary Semiconductor, ***Chemical Communications*** 2011, 47, 3141-3143.
    - Highest cited article of the year (380 citations up to date)

2. **X. Lu**, Z. Zhuang, Q. Peng, Y. Li. Controlled Synthesis of Wurtzite $CuInS_2$ Nanocrystals and Their Side-by-side Nanorod Assemblies, ***CrysEngComm*** 2011, *13* (12), 4039-4045.
    - ♦ Cover article

1. Z. Zhuang, **X. Lu**, Q. Peng, Y. Li. Direct Synthesis of Water-Soluble Ultrathin CdS Nanorods and Reversible Tuning of the Solubility by Alkalinity, ***Journal of the American Chemical Society*** 2010, 132 (6), 1819-1821.