Christopher J. Obara, Ph.D.

Assistant Professor, Departments of Pharmacology, Chemistry & Biochemistry, UC San Diego
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EDUCATION

2014 **Ph.D. in Microbiology & Immunology**
Georgetown University (Graduate Partnership Program with the NIH)
Dissertation: *Towards understanding the stoichiometric requirements for antibody-mediated enhancement and neutralization of flaviviruses*. Thesis Advisor: Theodore C. Pierson, Ph.D.

2009 **B.A. in Physics** (cum laude)
University of Florida

2009 **B.S. in Entomology & Nematology** (cum laude)
University of Florida

RESEARCH EXPERIENCE

2024-present **Assistant Professor, Departments of Pharmacology, Chemistry & Biochemistry, UC San Diego**

My lab at UCSD is well equipped to take on the challenge of performing true quantitative cell biology at the molecular scale. We combine highly specialized tools to make fundamental discoveries: custom engineering of systems for conventional light, superresolution, or electron microscopy; correlative pipelines for electron microscopy and cryoelectron microscopy; many-color flow cytometry and probe/sensor design. This potent combination, when used with computational modeling and classic techniques in cell biology and biochemistry, allows us to study the molecular machines that drive living systems directly in the dynamic, nanoscale environment where they naturally execute their functions.

2014-2024 **Postdoctoral Research, HHMI Janelia Research Campus + National Institutes of Health**

Advisor: Jennifer Lippincott-Schwartz, Ph.D.

Primarily focused on the development and application of advanced technologies in superresolution imaging and quantitative cytometry to address fundamental questions in cell biology, immunology, and neuroscience. Major projects include:

Design and characterization of a novel, high-speed correlative single molecule approach for studying proteins in the internal compartments of living cells. At present, this is being used to study molecular behavior at organelle contact sites, the role of curvature in ER protein diffusion and function, and to identify the mechanical properties of the ER lumen during cargo sorting and retention (PMID: 38267577).

Construction of a family of modified TIRF-SIM/superresolution/confocal microscopes designed to correlate single molecule trajectories for molecular analysis within super-resolved structures and for high-speed correlative photoactivation and tracking.

Employed a variety of emerging superresolution imaging approaches including point accumulation for imaging in nanoscale topography (PAINT) and total internal reflection fluorescence-structured illumination microscopy (TIRF-SIM) in both live and fixed cells to better understand the distinct morphologies and dynamics of the ER. (PMID: 27789813). (Collaboration with Jonny Nixon-Abell and Aubrey Weigel).

2010-2014 **Doctoral Research, National Institutes of Health**

Advisor: Theodore C. Pierson, Ph.D.

Demonstrated that the cellular expression level of conventional attachment factors for West Nile virus (WNV) and dengue virus (DENV) does not affect the neutralizing potency of antibodies. (PMID: 23312596).

Investigated the role of expression level, distribution, and affinity of non-classical attachment factors in mediation of antibody-dependent enhancement of flavivirus infection, using a novel quantitative cytometry and microscopy-based approach.

2008-2009 Undergraduate Research, Quantum Theory Project

Advisor: David Micha, Ph.D., D.Sc.

Generated a program to calculate the transition dipole moments in silicon surfaces under unidimensional quantum confinement. Developed a numerical model for quantum confinement that revealed that parity is a good quantum number in real systems if two dimensions are expanded to classical physical dimensions. Confirmed that theoretically generated data qualitatively matched data from experimental silicon surfaces.

LEAD AUTHOR PUBLICATIONS

Dora M*, **Obara CJ***, Lippincott-Schwartz J, Holcman D. Simultaneous photoactivation and high-speed structural tracking reveal diffusion-dominated motion in the endoplasmic reticulum. ***Proc. Nat. Acad. Sci.*** [in revision].

Obara CJ*, Nixon-Abell J*, et al. Motion of VAPB molecules reveals ER-mitochondria contact site subdomains. ***Nature,*** 2024 Feb 1; (626)169–176.

Obara CJ, Moore AS, Lippincott-Schwartz J. Structural Diversity within the Endoplasmic Reticulum—From the Microscale to the Nanoscale. ***CSH Perspectives in Biology***, 2022 doi:10.1101/cshperspect.a041259.

Reilly WM, **Obara CJ**. Advances in confocal microscopy and selected applications. ***Meth. Molecular Biology*** 2021 May 25.

Nixon-Abell J*, **Obara CJ***, Weigel A* et al. Increased spatiotemporal resolution reveals highly dynamic dense tubular matrices in the peripheral ER**.** ***Science*** 2016 Oct 28; 354(6311).

Obara CJ, Dowd KA, Ledgerwood JE, Pierson TC. Impact of viral attachment factor expression on antibody-mediated neutralization of flaviviruses. ***Virology*** 2013 Mar 1;437(1):20-7.

Obara CJ, Kilin DS, Micha DA. Electronic confinement effects and optical properties of multilayer slabs of silicon: Numerical model studies. ***Proc. SPIE.*** 2009. (7396):73960O.

*-equal contribution

CONTRIBUTIONS TO PUBLICATIONS

Nakamura K, Aoyama-Ishiwatari S, Nagao T, Paaran M, **Obara CJ**, Sakurai-Saito Y, Johnston J, Du Y, Suga S, Tsuboi T, Nakakido M, Tsumoto K, Kishi Y, Gotoh Y, Kwak C, Rhee H, Seo JK, Kosako H, Potter C, Carragher B, Lippincott-Schwartz J, Polleux F, Hirabayashi Y. Mitochondrial protein FKBP8 captures PDZD8 to form mitochondria-ER contacts. ***Nature Comm.*** [in revision].

Zhang Y, Rózsa M, Liang Y, Bushey D, Wei Z, Zheng J, Reep D, Broussard GJ, Tsang A, Tsegaye G, Narayan S, **Obara CJ**, Lim JX, Patel R, Zhang R, Ahrens MB, Turner GC, Wang SSH, Korff WL, Schreiter ER, Svoboda K, Hasseman JP, Kolb I, Looger LL. Fast and sensitive GCaMP calcium indicators for imaging neural populations. ***Nature*** 2023 Mar 23; 615, 884-891.

Sun Y*, Yu Z*, **Obara CJ**, Mittal K, Lippincott-Schwartz J, Koslover EF. Unraveling trajectories of diffusive particles on networks. ***Phys Rev Research*** 2022 Jun 6; 4(023182).

Zheng P, **Obara CJ**, Szczesna E, Nixon-Abell J, Mahalingan KK, Roll-Mecak A, Lippincott-Schwartz J, Blackstone C. ER proteins decipher the tubulin code to regulate organelle distribution. ***Nature*** 2022 Mar 23; 601, 132-138.

Speiser A, Müller LR, Hoess P, Matti U, **Obara CJ**, Legant ER, Kreshuk A, Macke JH, Ries J, Turaga SC. Deep learning enables fast and dense single molecule localization with high accuracy. ***Nature Methods*** 2021 Sep 3; 18, 1082-1090.

Moore AS, Coscia SM, Simpson CL, Ortega FE, Wait EC, Heddleston JM, Nirschl, JJ, **Obara CJ**, Guedes-Dias P, Boecker CA, Chew TL, Theriot JA, Lippincott-Schwartz J, Holzbaur ELF. Actin cables and comet tails organize mitochondrial networks in mitosis. ***Nature*** 2021 Mar 3; 591 (7851), 659-664.

Mohr MA, Kobitski AY, Sabater LR, Nienhaus K, **Obara CJ**, Lippincott-Schwartz J, Nienhaus GU, Pantazis P. Rational Engineering of Photoconvertible Fluorescent Proteins for Dual-Color Fluorescence Nanoscopy Enabled by a Triplet-State Mechanism of Primed Conversion. ***Angew Chem Int Ed Engl.*** 2017 Sep 11; 56(38):11628-11633.

Bardina SV, Michlmayr D, Han YW, Hoffman KW, **Obara CJ**, Sum J, Charo IF, Lu W, Pletnev AG, Lim JK. Differential roles of chemokines CCL2 and CCL7 in monocytosis and leukocyte migration during West Nile virus encephalitis. ***J Immunol.*** 2015 Nov 1; 195(9):4306-18.

Lim JK, **Obara CJ**, Rivollier A, Pletnev AG, Kelsall BL, Murphy PM. Chemokine receptor CCR2 is required for monocyte accumulation and survival in West Nile virus encephalitis. ***J Immunol.*** 2011 Jan 1;186(1):471-8.

GRANTS AND AWARDS

2016-present	HHMI Janelia Research Campus, ineligible for additional funding by contract.
2014-2015	Intramural AIDS research fellowship, NIH Office of AIDS Research. ($47,960)
2009-2010	Intramural AIDS research fellowship, NIH Office of AIDS Research. ($47,960)
2008-2009	Hetrick Scholarship for Excellence in Entomology Research. ($2000)
2005-2009	National Merit Scholar. (~$22,000)

PRESENTATIONS

Lectures by invitation:

2024 Navigating without a map: how single proteins find their way through complex organelle landscapes. Invited, MitoCare, Thomas Jefferson University; April 2; Philadelphia, PA, USA.

2024 Integrating dynamic and cryogenic imaging technologies to map the landscape of organelle membranes. Invited, UC Berkeley Department of Molecular and Cell Biology, March 25, Berkeley, CA, USA.

2024 Correlative approaches to understanding dynamic interorganelle tethering and communication. Invited, Fusion Meeting on Membrane Contact Sites; February 8; Cancun, Mexico.

2022 Navigating without a map: how single proteins find their way through complex organelle landscapes. Invited, UT Southwestern Department of Biophysics, October 11, Dallas, TX, USA.

2022 Motion of single molecular tethers reveals dynamic subdomains at organelle contact sites. Invited, University of Bergen; September 23; Bergen, Norway.

2018 High speed single molecule imaging in the endoplasmic reticulum. Invited talk, Salk Institute for Biological Studies, December 14, La Jolla, CA, USA.

2018 Single molecule and ensemble dynamics in the endoplasmic reticulum. Invited, Society of Biological Imaging: High Content 2018; September 19; Boston, MA, USA.

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2017 High speed superresolution microscopy reveals dynamic, complex structures in the endoplasmic reticulum. Invited talk, i3s Imaging Facility, Porto, Portugal.

2017 Superresolution microscopy as a tool to study dynamic biological events in the endoplasmic reticulum. Plenary Lecture, CYTO2017: Annual Meeting of the International Association for the Advancement of Cytometry; June 14; Boston, MA, USA.

2016 Increased spatiotemporal resolution reveals highly dynamic dense tubular matrices in the peripheral ER. NIH Protein Trafficking Interest Group Seminar Series; November 8; Bethesda, MD, USA.

2016 High-speed structured illumination microscopy in living cells reveals intricate, highly dynamic structures in the peripheral endoplasmic reticulum. MIT workshop on superresolution microscopy; September 19; Boston, MA, USA.

Minisymposia, Microsymposia, Selected Talks:

Motion of single molecular tethers reveals dynamic subdomains at ER-mitochondria contact sites. Selected Talk, Seeing is Believing, **2023**, EMBL, Heidelberg, Germany.
Motion of single molecular tethers reveals dynamic subdomains at ER-mitochondria contact sites. Selected Talk, CSH Single Biomolecules **2022**, Cold Spring Harbor, NY, USA.

Motion of single molecular tethers reveals dynamic subdomains at ER-mitochondria contact sites. Selected Talk, ASCB Annual Meeting **2022**, Washington DC, USA.

Single molecule and ensemble dynamics in the endoplasmic reticulum. Selected Talk, Seeing is Believing, **2019** EMBL, Heidelberg, Germany.

High speed, single molecule imaging in the mammalian endoplasmic reticulum. ASCB/EMBO Joint Annual Meeting; **2019** December 7-11; Washington, DC.

High speed, single molecule imaging in the mammalian endoplasmic reticulum. ASCB/EMBO Joint Annual Meeting; **2018** December 2-6; San Diego, CA.

Single molecule and ensemble dynamics in the endoplasmic reticulum. Selected Talk, Cold Spring Harbor Meeting on Single Biomolecules; **2018** August 29; Cold Spring Harbor, NY

Single molecule and ensemble dynamics of the endoplasmic reticulum. ASCB/EMBO Joint Annual Meeting; **2017** December 2-6; Philadelphia, PA.

Towards understanding host factors that influence antibody-dependent enhancement and neutralization of flaviviruses. 10th Annual NIH Graduate Student Research Symposium; **2014** January 14; Bethesda, MD.

Investigating the stoichiometric requirements for antibody-dependent enhancement of flavivirus infection. The American Society of Tropical Medicine and Hygiene 62nd Annual Meeting; **2013** November 14-17; Washington, DC.

Investigating the stoichiometric basis of antibody-dependent enhancement of flavivirus infection. The American Society for Virology 32nd Annual Meeting **2013**; July 19-24; State College, PA.

Investigating the stoichiometric requirements for CD32 expression during antibody-dependent enhancement of flavivirus infection. The American Society for Virology 31st Annual Meeting; **2012** July 21-25; Madison, WI.

Investigating the molecular basis for the cell-type dependence of neutralization of flaviviruses. NIH Graduate Partnership Program Retreat; **2011** July 19-20; Cumberland, MD.

TEACHING EXPERIENCE

2022 Course Instructor, Introduction to single molecule imaging, University of Bergen, Norway.

2021	Guest Lecturer, FAES BioTech Super Resolution Microscopy Course, NIH.
2021	Guest Lecturer, FAES BioTech Quantitative Imaging Microscopy Course, NIH.
2019	Guest Lecturer, FAES BioTech Super Resolution Microscopy Course, NIH.
2018	Course Facilitator, Physiology Course, Marine Biological Laboratory at Woods Hole.
2018	Guest Lecturer, FAES BioTech Super Resolution Microscopy Course, NIH.
2017	Course Facilitator, Physiology Course, Marine Biological Laboratory at Woods Hole.
2017	Guest Lecturer, FAES BioTech Super Resolution Microscopy Course, NIH.
2016	Teaching Assistant, Physiology Course, Marine Biological Laboratory at Woods Hole.
2016	Invited Lecturer, Superresolution Microscopy Course, MIT.
2015	Teaching Assistant, Physiology Course, Marine Biological Laboratory at Woods Hole.

PROFESSIONAL MEMBERSHIPS

2014-present	The American Society for Cell Biology, General Member
2017-present	Biophysical Society, General Member
2023-present	American Society for Biochemistry and Molecular Biology, General Member

References

Jennifer Lippincott-Schwartz, Senior Group Leader, Howard Hughes Medical Institute, Janelia Research Campus. lippincottschwartzj@janelia.hhmi.org

Luke Lavis, Senior Group Leader, Howard Hughes Medical Institute, Janelia Research Campus. lavisl@janelia.hhmi.org

Craig Blackstone, Chief, Movement Disorders Division, Massachusetts General Hospital and Harvard Medical School. cblackstone@mgh.harvard.edu

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