OMB No. 0925-0001 and 0925-0002 (Rev. 03/2020 Approved Through 02/28/2023)

# BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.

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NAME: Zeev Rosenzweig

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

|  |  |  |  |
| --- | --- | --- | --- |
| INSTITUTION AND LOCATION | DEGREE  *(if applicable)* | Completion Date MM/YYYY | FIELD OF STUDY |
| The Hebrew University of Jerusalem, Israel | B.Sc. | 06/1986 | Chemistry |
| The Hebrew University of Jerusalem, Israel | Ph.D. | 06/1992 | Physical Chemistry |
| Iowa State University | Postdoctoral | 09/1992 | Analytical Chemistry |
| University of Michigan | Postdoctoral | 07/1994 | Chemistry |

# Personal Statement

Following eight years of Federal service as NSF Program Director between 2005 and 2013, I rejoined academia as Professor and Chair of the Department of Chemistry and Biochemistry at the University of Maryland Baltimore County in January 2014. My research program focuses on molecular level interactions between luminescent nanoparticles and model membrane and living organisms. We focus primarily on the synthesis, characterization, and the interactions of luminescent semiconductor quantum dots, gold nanoparticles, and semiconducting polymer nanoparticles with biological/environmental systems. Of particular interest is the impact of the nanoparticle surface chemistry, for example ligand type and charge, on these interactions. The goal of our research is to use our newly acquired knowledge of the interactions between nanoparticles and macromolecules to enable the development and use of safe and sustainable nanomaterials in biological research and medical applications. Research in my laboratory provide interdisciplinary training opportunities to postdoctoral fellows, graduate students and undergraduate students. I strive to maintain a highly diverse group of junior researchers with respect to gender, ethnicity and academic background. I strive to provide a supportive environment to all students especially for students from underrepresented groups. Postdoctoral fellows and students in my research group publish their results in leading peer review journals, present their research in conferences extensively, and travel to collaborators’ laboratories in the US and abroad to advance their research and training. Since the beginning of my academic career in 1995 I graduated 18 PhD students and 12 MSc students, and advised 9 postdoctoral fellow, all went on to pursue professional careers in academia, US Government laboratories and industry. Since joining UMBC in 2014 I have mentored 8 PhD students (4 Female, 2 URM, 4 graduated and 4 are in various stages of their PhD research), and 2 MsC students (2 Female, 2 graduates). I also mentored 18 undergraduate students (12 female11 URM) of whom 6 went on to graduate or medical school.

# Positions and Honors

|  |  |
| --- | --- |
| 1995-1999 | Assistant Professor, Department of Chemistry, University of New Orleans, LA |
| 1999-2001 | Associate Professor, Department of Chemistry, University of New Orleans, LA |
| 2001-2007 | Professor, Department of Chemistry, University of New Orleans, New Orleans, LA |

2005-2013 Program Director, Division of Chemistry, NSF, Arlington, VA

2007-2013 Adjunct Professor, Department of Chemistry, University of New Orleans, LA

2014-2020 Professor and Department Chair, Department of Chemistry and Biochemistry, University of Maryland Baltimore County, Baltimore, MD

2020-Present Professor, Department of Chemistry and Biochemistry, University of Maryland Baltimore County, Baltimore, MD

# Other Experience and Professional Memberships

1995-Present Member, American Chemical Society

1998-2004 Editorial Board Member, Journal of Analytical and Bioanalytical Chemistry 2004 Vice Chair, Gordon Research Conference on Bioanalytical Sensors 2004-2006 Founder of NSCR Biotechnologies (a startup company)

2006 Chair, Gordon Research Conference on Bioanalytical Sensors

# Honors

1997 NSF CAREER award

2009 NSF Director Superior Accomplishment Award for the establishment of the International Collaboration in Chemistry Program at NSF.

# Contributions to Science

* 1. *We modified the surface of luminescent quantum dots and gold nanoparticles with molecular ligands and cationic polymers and showed that the membrane activity of nanoparticles depends greatly on the surface chemistry, specifically surface coverage, and charge density. We also showed that cadmium-containing quantum dots have a higher membrane disruption activity than their cadmium-free counterparts in model membranes and environmentally relevant bacterial cells. We advanced molecular level understanding of the interactions between synthetic nanomaterials and model membranes, cells, and whole organisms in the environment and develop cadmium-free quantum dots for bioimaging. We developed a new class of near infrared emitting polymer dots (Pdots) for bioimaging applications in plant cells and tissues where high autofluorescence and light scattering precludes the use of fluorescent probes that emit in the visible range of the electromagnetic spectrum.*
     1. Connor Riahin, Kushani Mendis, Brandon Busick, Marcin Ptaszek, Mengran Yang, Gary Stacey, Amar Parvate, James E. Evans, Jeremiah C. Traeger, Dehong Hu, Galya Orr, and Zeev Rosenweig. “Near Infrared Emitting Semiconductor Polymer Dots For Bioimaging and Sensing.” Sensors 2022, 22(19), 7218. <https://doi.org/10.3390/s22197218>
     2. Connor Riahin, Adam Meares, Nopondo N. Esemoto, Marcin Ptaszek, Michael LaScola, Narendra Pandala, Erin Lavik, Mengran Yang, Gary Stacey, Dehong Hu, Jeremiah C. Traeger, Galya Orr, and Zeev Rosenweig. “Hydroporphyrin-Doped Near-Infrared-Emitting Polymer Dots for Cellular Fluorescence Imaging.” ACS Appl. Mater. Interfaces 2022, 14, 18, 20790-20801. <https://doi.org/10.1021/acsami.2c02551>
     3. Denise N. Williams, Julia S. Saar, Vera Bleicher, Sibylle Rau, Karen Lienkamp, and Zeev Rosenzweig, Poly(oxanorbornene)-coated CdTe Quantum Dots as Antibacterial Agents, *ACS Appl. Bio Mater.* 2020, 3, 2, 1097–1104, [*DOI: 10.1021/acsabm.9b01045*](https://doi.org/10.1021/acsabm.9b01045)
     4. Richard P. Brown, Miranda J. Gallagher, D. Howard Fairbrother, and Zeev Rosenzweig, Synthesis and Degradation of Cadmium-Free InP and InPZn/ZnS Quantum Dots in Solution, *Langmuir* 2018 [*DOI:*](https://pubs.acs.org/doi/10.1021/acs.langmuir.8b02402)[*10.1021/acs.langmuir.8b02402*](https://pubs.acs.org/doi/10.1021/acs.langmuir.8b02402)
     5. Denise N. Williams, Sunipa Pramanik, Richard P. Brown, Bo Zhi, Eileen McIntire, Natalie V. Hudson-Smith, Christy L. Haynes, and Zeev Rosenzweig, Adverse Interactions of Luminescent Semiconductor Quantum Dots with Liposomes and Shewanella oneidensis, *ACS Applied Nano Materials* 2018 [DOI:](https://pubs.acs.org/doi/abs/10.1021/acsanm.8b01000) [10.1021/acsanm.8b01000](https://pubs.acs.org/doi/abs/10.1021/acsanm.8b01000)
     6. Zheng Zheng, Julia Saar, Bo Zhi, Miranda J. Gallagher; D. Howard Fairbrother, Christy L. Haynes, Karen Lienkamp, and Zeev Rosenzweig. Structure-Property Relationships of Amine-Rich and Membrane- Disruptive Poly(oxonorbornene)-Coated Gold Nanoparticles. Langmuir. 2018, 34(15) 4614-4625.
     7. Taeyjuana Y. Lyons, Denise N. Williams, and Zeev Rosenzweig. Addition of Fluorescence Lifetime Spectroscopy to the Tool Kit Used to Study the Formation and Degradation of Luminescent Quantum Dots in Solution. *Langmuir*, 2017, 33 (12), 3018-3027.
     8. Bo Zhi, Yi Cui, Shenyang Wang, Benjamin Frank, Denise N. Williams, Richard Patrick Brown, Eric S. Melby, Robert J. Hamers, Zeev Rosenzweig, D. Howard Fairbrother, Galya Orr and Christy L.

Haynes, Malic acid carbon dots: From super-resolution live-cell imaging to highly efficient separation *ACS Nano*, **2018**, <http://dx.doi.org/10.1021/acsnano.8b01619>

* + 1. Miranda J. Gallagher, Joseph T. Buchman, Tian Autumn Qiu, Bo Zhi, Taeyjuana Lyons, Kaitlin M. Landy, Zeev Rosenzweig, Christy Haynes and Howard Fairbrother, Release, detection and toxicity of fragments generated during artificial accelerated weathering of CdSe/ZnS and CdSe quantum dot polymer composites. *Environmental Science: Nano*, **2018**, 5,1694-1710.

<http://dx.doi.org/10.1039/C8EN00249E>

* + 1. Richard P. Brown, Miranda J. Gallagher, D. Howard Fairbrother, and Zeev Rosenzweig, Synthesis and Degradation of Cadmium-Free InP and InPZn/ZnS Quantum Dots in Solution, *Langmuir* **2018**, 34, 46, 13924– 13934. [DOI: 10.1021/acs.langmuir.8b02402](https://pubs.acs.org/doi/10.1021/acs.langmuir.8b02402)
    2. Denise N. Williams, Julia S. Saar, Vera Bleicher, Sibylle Rau, Karen Lienkamp, and Zeev Rosenzweig, Poly(oxanorbornene)-coated CdTe Quantum Dots as Antibacterial Agents

*ACS Appl. Bio Mater.* **2020**, 3, 2, 1097–1104. [DOI: 10.1021/acsabm.9b01045](https://doi.org/10.1021/acsabm.9b01045)

* 1. *We developed and used computational chemistry, specifically density functional theory calculations to investigate the interactions between molecular pollutants and mineral surfaces to predict the impact of these pollutants on ceramic art works.*

1. Jessica E. Heimann, Jasper D. Tucker, Layla S. Huff, Ye Rin Kim, Jood Ali, Kaylor Stroot, Xavier J. Welch, Harley E. White, Marcus L. Wilson, Cecelia E. Wood, Glenn A. Gates, Zeev Rosenweig, and Joseph W. Bennett. “Density Functional Theory (DFT) as a Nondestructive Probe in the Field of Art Conservation: Small-Molecule Adsorption on Aragonite Surfaces.” ACS Appl. Mater. Interfaces 2022, 14, 11, 13858-13871. <https://doi.org/10.1021/acsami.1c23695>
2. Jessica Heimann, Tory Williams, Joseph Bennett, and Zeev Rosenzweig, Baltimore SCIART: A Fully Virtual Undergraduate Research Experience at the Interface of Computational Chemistry and Art, *J. Chem. Educ.* 2021, 98, 10, 3172-3179. [DOI: 10.1021/acs.jchemed.1c00425](https://doi.org/10.1021/acs.jchemed.1c00425)
3. Jessica Heimann, Ryan Grimes, Zeev Rosenzweig, and Joseph Bennett, A Density Functional Theory (DFT) Investigation of How Small Molecules and Atmospheric Pollutants Relevant to Art Conservation Adsorb on Kaolinite, *Appl. Clay Sci.* 2021, 206, 106075. DOI: 10.1016/j.clay.2021.106075
   1. *We demonstrated the fabrication of luminescence quantum dot-based fluorescence resonance energy transfer (FRET) probes for measurement of enzyme activity, proteases and phospholipases in cellular assays, most notably we found significant difference in protease activity in the extracellular matrix of normal breast and metastatic breast cancer cells.*
4. Venkata R Kethineedi, Georgeta Crivat, Matthew A Tarr, Zeev Rosenzweig, Quantum dot-NBD-liposome luminescent probes for monitoring phospholipase A2 activity, *Anal. and Bioanal. Chem.*, 2013*,405*, 9729- 9737.
5. Georgeta Crivat, Sandra Maria Da Silva, Darwin R. Reyes, Laurie E. Locascio, Michael Gaitan, Nitsa Rosenzweig and Zeev Rosenzweig, Quantum Dot FRET-Based Probes in Thin Films Grown in Microfluidic Channels, *J. Am. Chem. Soc.*, 2010, *132* (5), 1460–1461.
6. Lifang Shi, Nitsa Rosenzweig and Zeev Rosenzweig, Quantum Dot Based Probes for Screening Proteases and Protease Inhibitors, Anal. Chem. 2006 78(16) 5799-5804.
7. Lifang Shi, Vania de Paoli, Nitsa Rosenzweig and Zeev Rosenzweig, Synthesis and Application of Quantum Dots FRET–Based Protease Sensors, J. Am. Chem. Soc. 2006, 128(32) 10378-10379.
   1. *We demonstrated the synthesis and application of quantum dot-containing polymer and silica nanospheres as luminescent probes in bioassays and cellular assays, most notably for the detection of metal ions, proteins, and carbohydrates in cellular constructs.*
8. Ashley D. Quach, Georgeta Crivat, Matthew A. Tarr†, and Zeev Rosenzweig, Gold Nanoparticle−Quantum Dot−Polystyrene Microspheres as Fluorescence Resonance Energy Transfer Probes for Bioassays, *J. Am. Chem. Soc.*, 2011, *133* (7), 2028–2030
9. Liane M. Rossi, Lifang Shi, Nitsa Rosenzweig, and Zeev Rosenzweig, Fluorescent Silica Nanospheresfor Digital Counting Bioassay of the Breast cancer Marker HER2/neu, Biosensors and Bioelectronics, 2006, 21(10), 1900-1906.
10. Aihui Ma and Zeev Rosenzweig, "Synthesis, Characterization, and Application of a Lipobead-Based Fluorescence Nanosensor for Chloride Ions in Aqueous Samples," Anal. Chem., 2004 76, 569-575.
11. Gabriela Blagoi, Nitsa Rosenzweig, and Zeev Rosenzweig, Design, Synthesis, and Application of Particle- based Fluorescence Resonance Energy Transfer Sensors for Carbohydrates and Glycoproteins, Anal. Chem. 2004, 77(2), 393-399.
    1. *We developed a one-pot synthesis technique based on the Stober synthesis with modification for the preparation of magnetic, luminescent, and luminescent and magnetic silica nanocomposite particles, and demonstrated their utility as combined magnetic and luminescent probes in biological assays.*
12. Liane M. Rossi, Lifang Shi, Frank. H. Quina and Zeev Rosenzweig, Stöber Synthesis of Monodispersed Luminescent Silica Nanoparticles for Bioanalytical Assays, Langmuir, 2005, 21(10) 4277-4280.
13. Yuri A. Barnakov, Minghui H. Yu, and Zeev Rosenzweig, Manipulation of the Magnetic Properties of magnetite-Silica Nanocomposite Materials by Controlled Stober Synthesis, Langmuir, 2005, 21(16), 7524- 7527.
14. Liane M. Rossi, Lifang Shi, Frank H. Quina, and Zeev Rosenzweig, Stober Synthesis of Mono- dispersed Luminescent Silica Nanoparticles for Bioanalytical Assays, Langmuir, 2005, 21(10), 4277-4280.
15. Deshang Wang, Jianho He, Nitsa Rosenzweig and Zeev Rosenzweig; Superparamagnetic Fe2O3 Beads−CdSe/ZnS Quantum Dots Core−Shell Nanocomposite Particles for Cell Separation, *Nano Letters*, 2004, *4* (3), pp 409–413.

# Additional Information: Research Support and/or Scholastic Performance

Source: NSF CHE-1904600

Project: InP/ZnS Luminescent Quantum Dots for Bioimaging with Improved Cellular Targeting Capabilities

Lead PI: Rosenzweig

Period: 09/01/2019-08/31/2023 Total Award: $490,000

Project Location: University of Maryland, Baltimore County Person-months per Year Committed to the Project: 0.5

The project focuses on detailed spectroscopic characterization of InP luminescent quantum dots, their surface modification to increase cellular permeability, and their use for intracellular measurements of enzymatic activity of key metabolic enzymes - kinases and phosphatases in mammalian cells using high resolution fluorescence imaging and spectroscopic methods. The project activities are orthogonal to the project activities that are pursued as part of the CSN project above, which focuses on molecular interactions between nanomaterials and non-mammalian organisms.

Source: NSF CHE-2001611

Project: NSF Center for Sustainable Nanotechnology Lead PI: Hamers & 12 co-PIs

Period: 09/01/2020 – 08/31/2025

Total Award: $20,000,000 (Rosenzweig budget - $800,000) Project Location: University of Maryland Baltimore County Person-months per Year Committed to the Project: 0.5

In this project we will synthesize a wide range of luminescent nanoparticles and participate in collaborative studies aiming to understand the molecular interactions between these nanoparticles and living organisms in the environment and environmental interfaces. We will also be involved in a collaborative project aiming to incorporate luminescent quantum dots into polymers in order to improve the performance of optoelectronic devices.

Source: DOE DE-SC0020346

Project: Expanding the utility and range of quantum and polymer dots for multiplexed super resolution fluorescence imaging in plants

Lead PI: Stacey & 2 Co-PIs Period: 1/1/2019- 08/31/2023

Total Award: $2,250,000 (Rosenzweig budget - $750,000) Project Location: University of Maryland, Baltimore County Person-months per Year Committed to the Project: 1

The project focuses on the development of near IR imaging capabilities with dye-doped polymer nanoparticles. Rosenzweig lab’s part is to synthesize and modify the surface of near IR emitting polymer dots with receptor binding peptides.

Source: Mellon Foundation #41500634

Project: Baltimore SCIART: An Undergraduate Research Experience at the Interface between Science and Art

Lead PI: Rosenzweig

Period: 1/1/2019-12/31/2022 Total Award: $777,000

Project Location: University of Maryland, Baltimore County Person-months per Year Committed to the Project: 1

The project provides summer research experience to undergraduate students in art conservation science. The program involves collaboration with the Walters Museum of Art in Baltimore.