

# Curriculum Vitae - Alexander Michael Spokoyny

## Current Address

University of California, Los Angeles, Department of Chemistry and Biochemistry and California NanoSystems Institute (CNSI).

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## Education

Northwestern University

Inorganic Chemistry

Ph.D. (12/2011)

UCLA

Chemistry

B.S. (06/2006)

## Professional Experience

- 8/2014 – present Assistant Professor,  
Department of Chemistry and Biochemistry, UCLA.
- 1/2012 – 07/2014 Post-Doctoral Fellow, Chemistry Department, MIT.  
Stephen L. Buchwald and Bradley L. Pentelute Laboratories.  
Research Specialization: New Methods for Protein Labeling,  
Development of Peptide Therapeutics.
- 12/2006 – 12/2011 Graduate Researcher, Chemistry Department, Northwestern  
University. Advisor: Chad A. Mirkin.  
Research Specialization: Organometallic, Coordination and  
Materials Chemistry of Multidentate Ligands.
- 12/2004 – 08/2006 Undergraduate Researcher, Department of Chemistry and  
Biochemistry, UCLA. Advisor: M. Frederick Hawthorne.  
Research Specialization: Chemistry of *closo*-C<sub>2</sub>B<sub>9</sub>H<sub>11</sub>.
- 12/2003 – 12/2004 Research Assistant, Physical Optics Corporation (POC),  
Torrance, CA. Project: Micro Reticular Assemblies  
for LEXID™ (X-ray Detection System).

## Selected Awards and Honors

- Cottrell Scholar, Research Corporation for Science Advancement (2018)  
NIH/NIGMS Maximizing Investigators Research Award (MIRA) (2017)  
Alfred P. Sloan Foundation Research Fellowship (2017)  
Glenn T. Seaborg Award, UCLA (2017)  
Krug Lectureship, University of Illinois, Urbana Champaign (2017)  
Chemical and Engineering News (C&EN), Talented 12 (2016)  
ACS Petroleum Research Fund, Doctoral New Investigator Grant (2016)  
3M Non-Tenured Faculty Award (2016)  
Inorganic Chemistry Frontiers, Emerging Investigator (2015)  
UCLA Faculty Career Development Award (2015, 2016)  
Best Poster Prize, 23<sup>rd</sup> American Peptide Symposium, Hawaii, USA (2013)  
IUPAC Prize for Young Chemists (2012)  
NIH Ruth Kirschstein NRSA Post-Doctoral Fellowship (2012 – 2014)  
Award for Excellence in Graduate Research, Northwestern Univ., Chemistry Department (2011)  
Finalist, Young Boron Chemist Award, XIV International Conference on Boron Chemistry (2011)  
Young Investigator Award, American Chemical Society, Division of Inorganic Chemistry (2011)  
JSPS Global Center of Excellence Visiting Fellowship, University of Tokyo (2011)  
E. W. Gelewitz Award (PLU, Alpha Gamma Chapter), Northwestern University (2010)  
Presidential Fellowship, Northwestern University (2010 – 2011)  
Society of Fellows, Northwestern University (2010 – present)  
GAANN Fellowship, U. S. Department of Education, Northwestern University (2006 – 2007)

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### Synergistic Activities

- 2018 UCLA Search Committee for a General Chemistry Academic Administrator.
- 2018 UCLA Chemistry and Biochemistry Committee on Teaching Mentorship, Faculty Mentor.
- 2018 Harry Gray Award for Inorganic Chemistry Symposium, Organizer.
- 2018 Photochemistry and Polymers Symposium, ACS Meeting, Session Chair.
- 2018 – present American Association for the Advancement of Science, Member (AAAS).
- 2018 – present Royal Society of Chemistry, Member (MRSC).
- 2018 – present Society of Biological Inorganic Chemistry (SBIC), Member.
- 2018 – present Air Force Office of Scientific Research (AFOSR), Proposal Reviewer.
- 2018 – present Cottrell Scholar (RCSA), Proposal Reviewer.
- 2017 – present National Science Foundation, Proposal Reviewer.
- 2017 – present ACS Petroleum Research Fund, Proposal Reviewer.
- 2017 National Academy of Sciences Panel on Preprint Servers, Panelist.
- 2017 C&EN Talented 12 Selection Committee, Advisor.
- 2017 NSF Early Career Investigator Workshop, Faculty Participant.
- 2017 SoCal Organometallics Meeting, Organizer.
- 2017 SoCal Main Group Symposium, Organizer.
- 2017 UCLA Bruin Day Ambassador (together w. Azin Saebi).
- 2017 ACS SoCal Undergraduate Research Conference, Discussion Leader.
- 2016 – present UCLA Justice Work Group, Member.
- 2016 – present UCLA Chemistry-Biology Interface Program, Faculty Mentor.
- 2016 – present Boron in the Americas (BORAM) Advisory Committee, Member.
- 2016 4<sup>th</sup> International Conference on Chemical Bonding, Session Chair.
- 2016 NIH/NIGMS, New Faculty Workshop, Participant.
- 2016 UCLA Faculty Extramural Fellowships Advisor.
- 2016 ACS National Meeting, Inorganic Division, Session Chair.
- 2016 Organometallic Chemistry Gordon Research Seminar, Discussion Leader and Invited Panelist.
- 2016 EMN Hawaii Meeting, Organocatalysis Session Chair.
- 2016 UC LEADS Meeting (UC Davis), Poster Judge.
- 2015 – present Legislative Assembly Representative, UCLA Faculty Senate.
- 2015 – present UCLA Chemistry and Biochemistry Graduate Recruitment Committee.
- 2015 – present UCLA Undergraduate Scholars Program, Proposal Reviewer.
- 2015 UCLA Undergraduate Student Orientation, Faculty Speaker.
- 2015 NSF Center for Enabling Technologies through Catalysis Summer School, Session Chair.
- 2014 – present National Science Foundation, Graduate Research Fellowship Program (GRFP), Reviewer.
- 2015 – present Beta Gamma Chapter of AXE, Chapter Faculty Advisor.
- 2015 – present UCLA Diversity Outreach Day, Faculty Mentor.
- 2014 – present External Proposal Reviewer for Czech Academy of Sciences, Netherlands Foundation for Fundamental Research.
- 2014 “New Faculty Workshop on Best Practices in Teaching”, Participant.
- 2013 American Chemical Society Meeting, Inorganic Division, Session Chair.
- 2013 – present American Peptide Society, Member.
- 2011 Gordon Research Seminar, Organometallic Chemistry, co-Chair.
- 2011 – present Referee for *ACS*, *Wiley*, *RSC* and *Nature* journals (~ 40 per year).
- 2009 – 2010 Basolo-Ibers-Pearson Inorganic Seminars (“BIP”), Organizer.
- 2009 – 2010 Northwestern Graduate Student Association, Operations Officer.

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2008 – 2009	Alpha Gamma Chapter of PLU, Awards Chair (2008-2009).
2008 – present	Materials Research Society, Member.
2006 – 2011	Northwestern University, Department of Chemistry, Graduate Liaison Committee, Student Member.
2005 – present	American Chemical Society, Member.

### Teaching and Mentoring

2018	Instructor (8.7/9), Chemistry – Material World (Chemistry 3), UCLA.
2018	Instructor (8.5/9), Chemistry – Material World (Chemistry 3), UCLA.
2018	Instructor (8.3/9), Careers in Chemistry Seminar (Chemistry 147), UCLA.
2018	Instructor (8.7/9), Inorganic and Metallorganic Chemistry (Chemistry 174), UCLA.
2017	Instructor (8.2/9), Advanced Inorganic Chemistry (Chemistry 172), UCLA.
2017	Instructor (9/9), Inorganic and Metallorganic Chemistry (Chemistry 174), UCLA.
2017	Instructor, Chemistry of Biology Seminar (Chemistry 206), UCLA.
2016	Instructor (8.6/9), Careers in Chemistry Seminar (Chemistry 147), UCLA.
2016	Instructor (4.8/5), Chemistry Fiat Lux Seminar (Chemistry 19), UCLA.
2015	Instructor (8.2/9), Intermediate Inorganic Chemistry (Chemistry 171), UCLA.
2015	Instructor (8.4/9), Bioinorganic Chemistry (Chemistry 179/279), UCLA.
2015	Instructor (7.9/9), Intermediate Inorganic Chemistry (Chemistry 171), UCLA.

2014 – now **Graduate student mentees:** Mr. Alex Wixtrom (Ph.D. 2018, Current Position: Materials Scientist at BNNT), Mr. Rafal Dziedzic, Mr. Kent Kirlikovali, Ms. Elaine Qian, Ms. Dahee Jung, Mr. Marco Messina, Ms. Mary Waddington, Ms. Jessica Logan, Mr. Harrison Mills, Mr. Nicholas Bernier, Ms. Kierstin Anderson, Mr. Zeeshan Parvez, Ms. Rebecca Kubena, Ms. Hayden Montgomery.

**Past undergraduate student mentees:** Ms. Elamar Hakim Mouilly (Chemistry, Departmental Scholar), Ms. Seong-Jin Kim (Chemistry), Ms. Jamie Lam (Biochemistry), Mr. Vinh Nguyen (Biochemistry), Mr. Brian Munekiyo (Chemistry), Mr. Shaunt Kevork (Materials Science), Ms. Simone Stevens (Biochemistry), Mr. Parker Beatty (Biochemistry), Mr. Yanwu Shao (Chemistry), Mr. Yanbo Ren (Chemistry), Ms. Talia Saravi (Materials Science), Mr. Daniel Mosallaei (Biochemistry), Ms. Sarah Kim (Chemistry), Ms. Alice Phung (Biochemistry), Ms. Azin Saebi (Biochemistry, Departmental Scholar), Ms. Monica Kirolos (Biochemistry), Mr. Joshua Martin (Biochemistry), Ms. Michelle Ko (Chemistry), Ms. Ekaterina Titarenko (Chemistry), Ms. Sylvia Chow (Materials Science), Mr. Timur Katsnelson (Neuroscience), Mr. Graham Nethercot (Chemistry), Ms. Katelyn Spilman (Biochemistry), Mr. Paul Chong (Chemistry), Ms. Alejandra Gonzalez (Chemistry), Ms. Olivia Brand (Biology), Mr. Kevin Qian (Chemistry – Amgen Scholar), Ms. Chantel Mao (Chemistry).

**Current undergraduate student mentees:** Mr. Miles Savage (Chemistry), Ms. Morgan Hopp (Biochemistry), Ms. Maya Pathuri (Chemistry), Mr. Alex Umanzor (Chemistry), Mr. Isaac Diaz (Materials Chemistry), Ms. Ila Castro De La Torre (Chemistry), Mr. Benjamin Pisa (Materials Chemistry).

**Post-Doctoral mentees:** Dr. Liban Saleh (2015 - 2017); Dr. Jonathan Axtell (2015 - present); Dr. Mu Xin (2017 - present); Dr. Roshini Ramachandran (2017 - present); Dr. Julia Stauber (2017 - present).

2014 – now Chemistry and Biochemistry Doctoral Committee: Ziyang Feng, Patrick Yee, Brett Cory, Jason Fell, Eric Raftery, Nathan Gallup, Ha Seoung Kim, Raymond Gamache, Logan Stewart, Natcha Wattanatorn, Mufan Li, Boris Voloskiy, Shenkai Wang, Christopher Karaba, Andrew Serino, Brian Shao, Wai Han Mak, Katharine Winchell, Chengzhang Wan, Emily Cosco, Chuanzhen Zhao, Sophia King, Katherine Bay, Erin Avery, Dan Zhu, Anna Kataki, Neil Forsythe, Carl Ferber, Guangyan Zhong, Sydnee Green, James McDaniel.

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- 2014 – now Chemistry and Biochemistry Master's Committee: Amylynn Chen; Jun Gao; Michael Liao, Azin Saebi, Yi Shen, Daniel Hatfield.
- 2013 – 2014 Mentored graduate student colleagues: Dr. Katia Vinogradova and Chi Zhang.
- 2012 Mentored summer student: Calvin D. Lewis.
- 2011 Mentored NSF/REU undergraduate student: Noel Leon.
- 2009 – 2011 Mentored graduate student colleagues: Dr. Charles Machan, Dr. Daniel Clingerman and Dr. Mari Rosen (Mirkin Group).
- 2006 – 2007 Teaching Assistant (Organic Chemistry Lab/Lecture), NU.
- 2006 Teaching Assistant (Chemistry 14CL and Chemistry 174), UCLA.

### Outreach Activities

- 2016 – now UCLA Prison Education Program.
- 2016 Careers in Chemistry, Outreach Presentation at Santa Monica College.
- 2015 – now Educational Outreach for UCLA Advancing Women in Science and Engineering (AWiSE).
- 2015 AVID Guest Speaker, Careers in Science, Los Angeles Unified School District.
- 2015 Guest Lecturer, Careers in Chemistry, UCLA.
- 2014 – now Polling Place Inspector, Los Angeles, CA.
- 2014 Faculty Host, Outreach and Diversity Day, UCLA.
- 2008 – 2011 Volunteer Cook at the Inspiration Café, Chicago, IL.
- 2008 – 2009 Teaching Outreach, Hayt Elementary, Chicago, IL.

### Peer-Reviewed Publications at UCLA (\* - denotes corresponding authorship)

1. Barton, J. L.; Wixtrom, A. I.; Kowalski, J. A.; Brushett, F. R.\*; Spokoyny, A. M.\* "Perfunctionalized Dodecaborate Clusters as Stable Metal-Free Active Materials for Charge Storage", **2019**, *in revision*. Preprint: <https://doi.org/10.26434/chemrxiv.7472921.v1>.
2. Aubry, T. J.; Axtell, J. C.; Basile, V. M.; Winchell, K. J.; Lindemuth, J. R.; Porter, T. M.; Liu, J.-Y.; Alexandrova, A. N.; Kubiak, C. P.; Tolbert, S. H.\*; Spokoyny, A. M.\*; Schwartz, B. J.\* "Dodecaborane-Based Dopants Designed to Shield Anion Electrostatics to Increased Carrier Mobility in Doped Conjugated Polymers", *Adv. Mater.* **2019**, *online*.
3. Dziedzic, R. M.\*; Spokoyny, A. M.\* "Metal-Catalyzed Cross-Coupling Chemistry with Polyhedral Boranes", *Chem. Commun.* **2019**, *55*, 430-442. Feature Article.
4. Anderson, K. P.; Mills, H. A.; Mao, C.; Kirlikovali, K. O.; Axtell, J. C.; Rheingold, A. L.; Spokoyny, A. M.\* "Improved Synthesis of Icosahedral Carboranes Containing Exohedral B-C and C-C Bonds", *Tetrahedron* **2019**, *75*, 187-191. (Special Issue on Frustrated Lewis Acids and Organoboranes).
5. Kirlikovali, K. O.; Axtell, J. C.; Anderson, K.; Djurovic, P. I.; Rheingold, A. L.; Spokoyny, A. M.\* "Fine-Tuning Electronic Properties of Luminescent Pt(II) Complexes via Vertex-Differentiated Coordination of Sterically Invariant Carborane-Based Ligands", *Organometallics* **2018**, *37*, 3122-3131.
6. Zhang, C.; Vinogradova, E. V.; Spokoyny, A. M.; Buchwald, S. L.; Pentelute, B. L. "Arylation Chemistry for Bioconjugation", *Angew. Chem., Int. Ed.* **2018**, *online*. DOI: 10.1002/anie.201806009.
7. Messina, M. S.; Stauber, J. M.; Waddington, M. A.; Rheingold, A. L.; Maynard, H. D.\*; Spokoyny, A. M.\* "Organometallic Gold(III) Reagents for Cysteine Arylation", *J. Am. Chem. Soc.* **2018**, *140*, 7065-7069.
8. Ramachandran, R.; Jung, D.; Bernier, N. A.; Logan, J. K.; Waddington, M. A.; Spokoyny, A. M.\* "Synthesis of Small Boron Oxide Nanoparticles", *Inorg. Chem.* **2018**, *57*, 8037-8041.
9. Wixtrom, A. I.; Parvez, Z. A.; Savage, M. D.; Qian, E. A.; Jung, D.; Khan, S. I.; Rheingold, A. L.; Spokoyny, A. M.\* "Tuning the Electrochemical Potential of Perfunctionalized Dodecaborate Clusters through Vertex Differentiation", *Chem. Commun.* **2018**, *54*, 5867-5870.
10. Jung, D.; Saleh, L. M. A.; Berkson, Z.; El-Kady, M. F.; Hwang, J. Y.; Mohamed, N.; Wixtrom, A. I.; Titarenko, E.; Shao, Y.; McCarthy, K.; Guo, J.; Martini, I. B.; Kraemer, S.; Wegener, E. C.; Saint-Crieq, P.; Ruehle, B.; Langeslay, R. R.; Delferro, M.; Brosmer, J. L.;

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- Hendon, C. H.; Gallagher-Jones, M.; Rodriguez, J.; Chapman, K. W.; Miller, J. T.; Duan, X.; Kaner, R. B.; Zink, J. I.; Chmelka, B. F.; Spokoyny, A. M.\* "A Molecular Cross-Linking Approach for Hybrid Metal Oxides", *Nature Materials* **2018**, *17*, 341-348. Highlighted by *Chemistry World* (Mar. 6, 2018), *C&EN*, *UCLA Newsroom*, *EurekaAlert*, *Materials Today*, *Argonne National Laboratory*, *PhysOrg*.
11. Kung, C.-W.; Otake, K.; Buru, C. T.; Goswami, S.; Cui, Y.; Hupp, J. T.; Spokoyny, A. M.; Farha, O. K. "Increased Electrical Conductivity in Mesoporous Metal-Organic Framework Featuring Metallocarborane Guests", *J. Am. Chem. Soc.* **2018**, *140*, 3871-3875.
  12. Kirlikovali, K. O.; Cho, E.; Downard, T. J.; Grigoryan, L.; Han, Z.; Hong, S.; Jung, D.; Quintana, J. C.; Reynoso, V.; Ro, S.; Shen, Y.; Swartz, K.; Ter Sahakyan, E.; Wixtrom, A. I.; Yoshida, B.; Rheingold, A. L.; Spokoyny, A. M.\* "Buchwald-Hartwig Amination Using Pd(I) Dimer Precatalysts Supported by Biaryl Phosphine Ligands", *Dalton Trans.* **2018**, *47*, 3684-3688. Highlighted by *Org. Process Res. Dev.* **2018**, *22*, 257-266 and *Daily Bruin* (Feb. 20, 2018).
  13. Dziedzic, R. M. Waddington, M. A.; Lee, S. E.; Kleinsasser, J.; Plumley, J. B.; Ewing, W. C.; Bosley, B. D.\*; Lavallo, V.\*; Peng, T. L.\*; Spokoyny, A. M.\* "Reversible Silver Electrodeposition from Boron Cluster Ionic Liquid (BCIL) Electrolytes", *ACS Appl. Mater. Interfaces* **2018**, *10*, 6825-6830.
  14. Axtell, J. C.; Saleh, L. M. A.; Qian, E. A.; Wixtrom, A. I.; Spokoyny, A. M.\* "Synthesis and Applications of Perfunctionalized Boron Clusters", *Inorg. Chem.* **2018**, *57*, 2333-2350.
  15. Kirlikovali, K. O.; Spokoyny, A. M.\* "The Long Lasting Blues: A New Record for Phosphorescent Organic Light-Emitting Diodes", *Chem (Preview)* **2017**, *3*, 385-387.
  16. Serino, A. C.; Anderson, M. E.; Saleh, L. M. A.; Dziedzic, R. M.; Mills, H.; Heidenreich, L.; Dunn, B. S.; Spokoyny, A. M.\*; Weiss, P. S.\* "Work Function Control of Germanium through Carborane-Based Carboxylic Acid Ligand Surface Passivation", *ACS Appl. Mater. Interfaces* **2017**, *9*, 34592-34596.
  17. Axtell, J. C.; Kirlikovali, K. O.; Dziedzic, R. M.; Gembicky, M.; Rheingold, A. L.; Spokoyny, A. M.\* "Magnesium Reagents Featuring a 1,1'-Bis(*o*-Carborane) Ligand Platform", *Eur. J. Inorg. Chem. (Special Issue on Boron Chemistry)* **2017**, *38-39*, 4411-4416. Cover Article. Selected as a Very Important Paper (VIP).
  18. Dziedzic, R. M.; Martin, J. L.; Axtell, J. C.; Saleh, L. M. A.; Yang, Y.; Messina, M.; Houk, K. N.; Spokoyny, A. M.\* "Cage-Walking: Vertex Differentiation by Palladium-Catalyzed Isomerization of B(9)-Bromo-*meta*-Carborane", *J. Am. Chem. Soc.* **2017**, *139*, 7729-7732.
  19. Axtell, J. C.; Kirlikovali, K. O.; Jung, D.; Rheingold, A. L.; Spokoyny, A. M.\* "Metal-Free Peralkylation of the *closo*-Hexaborate Dianion, B<sub>6</sub>H<sub>6</sub><sup>2-</sup>", *Organometallics* **2017**, *36*, 1204-1210. Highlighted by *Chemistry Views* (Mar. 14, 2017).
  20. Qian, E. Q.; Wixtrom, A. I.; Axtell, J. C.; Saebi, A.; Rehak, P.; Han, Y.; Moully, E. H.; Mosallaei, D.; Chow, S.; Messina, M.; Wang, J.-Y.; Royappa, A. T.; Rheingold, A. L.; Maynard, H. D.; Kral, P.; Spokoyny, A. M.\* "Atomically Precise Organomimetic Cluster Nanomolecules (OCNs) Assembled via Perfluoroaryl-Thiol S<sub>N</sub>Ar Chemistry", *Nature Chem.* **2017**, *9*, 333-340. Highlighted by "The Sceptical Chymist Blog" and *Nature News and Views Article by Majewski, et al (ibid)*.
  21. Axtell, J. C.; Kirlikovali, K. O.; Djurovich, P. I.; Jung, D.; Nguyen, V. T.; Munekiyo, B.; Royappa, A. T.; Rheingold, A. L.; Spokoyny, A. M.\* "Blue Phosphorescent Zwitterionic Iridium(III) Complexes Featuring Weakly Coordinating Carborane-based Ligands", *J. Am. Chem. Soc.* **2016**, *138*, 15758-15765.
  22. Saleh, L.; Dziedzic, R.; Spokoyny, A. M.\* "An Inorganic Twist in Nanomaterials: Making an Atomically Precise Double Helix." (*First Reactions*) *ACS Central Sci.* **2016**, *2*, 685-686.
  23. Dziedzic, R. M.; Saleh, L. M. A.; Stevens, S. L.; Martin, J. L.; Royappa, A. T.; Rheingold, A. L.; Spokoyny, A. M.\* "B-N, B-O and B-C Bond Formation via Palladium Catalyzed Cross-Coupling of B-Bromo-Carboranes" *J. Am. Chem. Soc.* **2016**, *138*, 9081-9084.
  24. Messina, M. S.; Axtell, J. C.; Wang, Y.; Chong, P.; Wixtrom, A. I.; Kirlikovali, K. O.; Upton, B. M.; Hunter, B. M.; Shafaat, O. S.; Khan, S. I.; Winkler, J. R.; Gray, H. B.; Alexandrova, A. N.; Maynard, H. D.; Spokoyny, A. M.\* "Visible-Light Induced Olefin Activation using 3D

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- Aromatic Boron-Rich Cluster Photooxidants" *J. Am. Chem. Soc.* **2016**, *138*, 6952-6955. Highlighted by P. Szuromi - *Science* **2016**, *352*, 1422-1423.
25. Kirlikovali, K. O.; Axtell, J. C.; Gonzalez, A.; Phung, A. C.; Khan, S. I.; Spokoyny, A. M.\* "Luminescent Metal Complexes Featuring Photophysically Innocent Boron Cluster Ligands" *Chem. Sci.* **2016**, *7*, 5132-5138.
  26. Saleh, L. M. A.; Dzedzic, R. M.; Khan, S. I.; Spokoyny, A. M.\* "Forging Unsupported Metal-Boryl Bonds with Icosahedral Carboranes" *Chem. Eur. J.* **2016**, *22*, 8466-8470. Highlighted by T. M. Swager and S. Lin - *Synfacts* **2016**, *12*, 0808.
  27. Schwartz, J. J.; Mendoza, M. A.; Wattanatorn, N.; Zhao, Y.; Nguyen, V. T.; Spokoyny, A. M.; Mirkin, C. A.; Baše, T.; Weiss, P. S. "Surface Dipole Control of Liquid Crystal Alignment" *J. Am. Chem. Soc.* **2016**, *138*, 5957-5967.
  28. Wixtrom, A. I.; Shao, Y.; Jung, D.; Machan, C. W.; Kevork, S. N.; Qian, E. A.; Khan, S. I.; Kubiak, C. P.; Spokoyny, A. M.\* "Rapid Synthesis of Redox-Active Dodecaborane B<sub>12</sub>(OR)<sub>12</sub> Clusters Under Ambient Conditions" *Inorg. Chem. Front.* (Emerging Investigator Issue) **2016**, *3*, 711-717.
  29. Vinogradova, E. V.; Zhang, C.; Spokoyny, A. M.; Buchwald, S. L.; Pentelute, B. L. "Organometallic Palladium Reagents for Cysteine Bioconjugation", *Nature* **2015**, *526*, 687-691. Highlighted by *C&EN* and *Nature News and Views (ibid)*.
  30. Thomas, J. C.; Schwartz, J. J.; Hohman, J. N.; Claridge, S. A.; Auluck, H. S.; Serino, A. C.; Spokoyny, A. M.; Tran, G.; Kelly, K. F.; Mirkin, C. A.; Gilles, J.; Osher, S. J.; Weiss, P. S. "Defect-Tolerant Aligned Dipoles within Two-Dimensional Plastic Lattices", *ACS Nano*, **2015**, *9*, 4734-4742.

### Peer-Reviewed Publications prior to UCLA Appointment

31. Zhang, C.; Dai, P.; Spokoyny, A. M.; Pentelute, B. L. "Enzyme-Catalyzed Macrocyclization of Long Unprotected Peptides" *Org. Lett.* **2014**, *16*, 3652-3655.
32. Simon, M.; Heider, P.; Adamo, A.; Li, X.; Berger, T.; Policarpo, R.; Zhang, C.; Zou, Y.; Spokoyny, A. M.; Jensen, K. F.; Pentelute, B. L. "Rapid Flow-Based Peptide Synthesis" *ChemBioChem* **2014**, *15*, 713-720. Highlighted by *Nature Chem. Bio.*, *C&EN* (Mar 17, 2014) and MIT News.
33. Zou, Y.; Spokoyny, A. M.; Zhang, C.; Simon, M. D.; Yu, H.; Lin, Y.-S.; Pentelute, B. L. "Convergent Diversity-Oriented Side-Chain Macrocyclization Scan for Unprotected Polypeptides Enabled by Perfluoroaryl-Cysteine S<sub>N</sub>Ar Chemistry." *Org. Biomol. Chem.* **2013**, *12*, 566-573. Cover Article.
34. Zhang, C.; Spokoyny, A. M.; Zou, Y.; Simon, M. D.; Pentelute, B. L. "Enzymatic "Click" Ligation: Selective Cysteine Modification in Polypeptides Enabled by Promiscuous Glutathione S-Transferase." *Angew. Chem., Int. Ed.* **2013**, *52*, 14001-14005.
35. Spokoyny, A. M.; Zou, Y.; Ling, J. J.; Yu, H.; Lin, Y.-S.; Pentelute, B. L. "A Perfluoroaryl-Cysteine S<sub>N</sub>Ar Chemistry Approach to Unprotected Stapled Peptides", *J. Am. Chem. Soc.* **2013**, *135*, 5946-5949. Highlighted by *C&EN* (Apr. 29, 2013); Reviewed at Faculty of 1000.
36. Lifschitz, A. M.; Shade, C. M.; Spokoyny, A. M.; Mendez, J. E.; Stern, C. L.; Sarjeant, A. A.; Mirkin, C. A. "Boron-Dipyrrromethene-Functionalized Hemilabile Ligands as "Turn-On" Fluorescent Probes for Coordination Changes in Weak-Link Approach Complexes", *Inorg. Chem.* **2013**, *52*, 5484-5492.
37. Spokoyny, A. M.\* "New Ligand Platforms Featuring Boron-Rich Clusters as Organomimetic Substituents" *Pure & Appl. Chem.* (invited review), **2013**, *85*, 903-919.
38. Spokoyny, A. M.\*; Lewis, C. D.; Teverovskiy, G.; Buchwald, S. L. "Extremely Electron-Rich, Icosahedral Carborane-Based Phosphinoboranes", *Organometallics* **2012**, *31*, 8478-8481.
39. Spokoyny, A. M.; Machan, C. W.; Clingerman, D. C.; Rosen, M. S.; Wiester, M. J.; Kennedy, R. D.; Sarjeant, A. A.; Stern, C. L.; Mirkin, C. A. "A Coordination Chemistry Dichotomy for Icosahedral Carborane-Based Ligands" *Nature Chem.* **2011**, *3*, 590-596. Cover Article. Highlighted by *Nature Chemistry* (Weller, A. *Nature Chem.* **2011**, *3*, 577-578).

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40. Li, T. C.; Fabregat-Santiago, F.; Farha, O. K.; Spokoyny, A. M.; Raga, S. R.; Bisquert, J.; Mirkin, C. A.; Marks, T. J.; Hupp, J. T. "Aerogel-Templated, Porous Photoanodes for Enhanced Performance in Ni(III)/(IV) Bis(dicarbollide)-Based Dye-Sensitized Solar Cells" *J. Phys. Chem. C* **2011**, *115*, 11257-11264.
41. Machan, C. W.; Spokoyny, A. M.; Jones, M.; Sarjeant, A. A.; Stern, C.; Mirkin, C. A. "The Plasticity of the Nickel(II) Coordination Environment in Complexes with Hemilabile Phosphino-Thioether Ligands" *J. Am. Chem. Soc.* **2011**, *133*, 3023-3033.
42. Rosen, M. S.; Spokoyny, A. M.; Machan, C. W.; Stern, C.; Sarjeant, A. A.; Mirkin, C. A. "The Chelating Effect as a Driving Force Leading to Selective Formation of Heteroligated Pt(II) Complexes with Bidentate Phosphine-Chalcoether Ligands" *Inorg. Chem.* **2011**, *50*, 1411-1419.
43. Pandey, P.; Farha, O. K.; Spokoyny, A. M.; Thomes, M.; Mirkin, C. A.; Kanatzidis, M. G.; Hupp, J. T.; Nguyen, S. T. "Click-Based" Porous Organic Polymers From Tetrahedral Building Blocks" *J. Mater. Chem.* **2011**, *21*, 1700-1703. Highlighted by *Angew. Chem., Int. Ed.* (Muller, T. and Bräse, S. *Angew. Chem., Int. Ed.* **2011**, *50*, 11844-11845).
44. Spokoyny, A. M.; Farha, O. K.; Mulfort, K. L.; Hupp, J. T.; Mirkin, C. A. "Porosity Tuning in Carborane-Based Metal Organic Frameworks (MOFs) via Coordination Chemistry and Ligand Design" *Inorg. Chim. Acta* (Arnold Rheingold Festschrift) **2010**, *364*, 266-271.
45. Spokoyny, A. M.; Li, T. C.; Farha, O. K.; Machan, C. W.; She, C.; Marks, T. J.; Hupp, J. T.; Mirkin, C. A. "Electronic Tuning of Nickel-Based Bis(dicarbollide) Redox Shuttles in Dye-Sensitized Solar Cells" *Angew. Chem., Int. Ed.* **2010**, *49*, 5339-5343.
46. Bae, Y.-S.; Spokoyny, A. M.; Farha, O. K.; Snurr, R. Q.; Hupp, J. T.; Mirkin, C. A. "Separation of Gas Mixtures Using Co(II)-Carborane-Based Porous Coordination Polymers" *Chem. Commun.* **2010**, *46*, 3478-3480.
47. Li, T. C.; Spokoyny, A. M.; She, C.; Farha, O. K.; Mirkin, C. A.; Marks, T. J.; Hupp, J. T. "Ni(III)/(IV) Bis(dicarbollide) as a Fast, Noncorrosive Redox Shuttle for Dye-Sensitized Solar Cells" *J. Am. Chem. Soc.* **2010**, *132*, 4580-4582. Highlighted by *C&EN* (Apr. 12, 2010).
48. Farha, O. K.; Bae, Y.-S.; Hauser, B. G.; Spokoyny, A. M.; Snurr, R. Q.; Mirkin, C. A.; Hupp, J. T. "Chemical Reduction of a Diimide Based Porous Polymer for Selective Uptake of Carbon Dioxide Versus Methane" *Chem. Commun.* **2010**, *46*, 1056-1058.
49. Spokoyny, A. M.; Rosen, M. S.; Ulmann, P. A.; Stern, C. L.; Mirkin, C. A. "Selective Formation of Heteroligated Pt(II) Complexes with Bidentate Phosphine-Thioether and Phosphine-Selenoether Ligands via Halide Induced Ligand Rearrangement." *Inorg. Chem.* **2010**, *49*, 1577-1586.
50. Farha, O. K.; Spokoyny, A. M.; Hauser, B.G.; Bae, Y.-S.; Brown, S. E.; Snurr, R. Q.; Mirkin, C. A.; T. J.; Hupp, J. T. "Synthesis, Properties and Gas Separation Studies of a Robust Diimide-based Microporous Organic Polymer" *Chem. Mater.* **2009**, *21*, 3033-3035.
51. Spokoyny, A. M.; Reuter, M. G.; Stern, C. L.; Ratner, M. A.; Seideman, T.; Mirkin, C. A. "Carborane-Based Pincers: Synthesis and Structure of SBS and SeBSe Complexes" *J. Am. Chem. Soc.* **2009**, *131*, 9482-9483. Highlighted by *Angew. Chem., Int. Ed.* (van der Vlugt, J. I. *Angew. Chem., Int. Ed.* **2010**, *49*, 252-255).
52. Farha, O.K; Spokoyny, A. M.; Mulfort, K. L.; Galli, S.; Hupp, J. T.; Mirkin, C.A. "Morphology Dependence in Hydrogen Uptake of a Cobalt-Carborane based Metal-Organic Framework (MOF) Materials" *Small* **2009**, *5*, 1727-1731.
53. Spokoyny, A. M.; Kim, D.; Sumrein, A.; Mirkin, C. A. "Infinite Coordination Polymer Nano- and Micro Particles" *Chem. Soc. Rev.* **2009**, *38*, 1218-1227 (invited review).
54. Bae, Y.-S.; Farha, O. K.; Spokoyny, A. M.; Mirkin, C.A.; Hupp, J. T.; Snurr, R. Q., "Carborane-Based MOFs as Highly Selective Sorbents for CO<sub>2</sub> over Methane." *Chem. Commun.* **2008**, 4135-4137. Highlighted by *Nature Chemistry* (Armstrong, G. 25 July, **2008**, doi: 10.1038/nchem41).
55. Farha, O.K.; Spokoyny, A. M.; Mulfort, K. L.; Hawthorne, M. F.; Mirkin, C. A.; Hupp, J. T. "Synthesis and Hydrogen Sorption Properties of Carborane-Based Metal-Organic Framework Materials" *J. Am. Chem. Soc.* **2007**, *129*, 12680-12681.



## Curriculum Vitae - Alexander Michael Spokoyny

### Public Presentations (total given: > 80)

Upcoming Invited Presentations: Michigan State University, Cornell University, Queens University, Rutgers University, University of Toronto, Massachusetts Institute of Technology, Columbia University, Stanford University, UC Irvine, UC San Diego, Organometallic Chemistry GRC, 2<sup>nd</sup> International Conference on Boron Chemistry, The Scripps Research Institute, Northwestern University.

1. "Boron Cluster Building Blocks and Reagents" UC Davis, Department of Chemistry, January 2019 (invited seminar).
2. "Atomically Precise Hybrid Nanoparticles with Multivalent Capabilities" 9<sup>th</sup> Asian Biological Inorganic Chemistry Conference (talk).
3. "Boron Cluster Building Blocks for the Development of Hybrid Materials" Carnegie Mellon University, Department of Chemistry, October 2018 (invited seminar).
4. "Boron Cluster Building Blocks for the Development of Hybrid Materials" Ohio State University, Department of Chemistry, October 2018 (invited seminar).
5. "Atomically Precise Hybrid Nanoparticles with Multivalent Capabilities" ChemTrends-2018, Moscow, Russia, September 2018 (plenary invited lecture).
6. "Atomically Precise Hybrid Nanoparticles with Multivalent Capabilities" University of Texas at El Paso, PREM Seminar Series, September 2018 (invited seminar).
7. "A Boron Cluster-Based Approach to Nucleophilic Borylation" Gordon Research Conference on Green Chemistry, Spain, July 2018 (poster).
8. "A Boron Cluster-Based Approach to Nucleophilic Borylation" Gordon Research Conference on Organic Reactions and Processes, MA, July 2018 (poster).
9. "Improving Chemistry Appreciation" Cottrell Scholar's Meeting, Tucson, AZ, July 2018 (invited talk).
10. "A Boron Cluster-Based Approach to Nucleophilic Borylation" Gordon Research Conference on Organic Reactions and Processes, MA, July 2018 (poster).
11. "A Boron Cluster-Based Approach to Nucleophilic Borylation" XVI Boron in the Americas (BORAM), June 2018 (invited talk).
12. "A Boron Cluster-Based Approach to Nucleophilic Borylation" Gordon Research Conference on Inorganic Chemistry, ME, June 2018 (poster).
13. "3D Aromatic Building Blocks and Reagents" 3M Corporation, MN, June 2018 (invited seminar).
14. "3D Aromatic Building Blocks and Reagents" University of Minnesota, MN, June 2018 (invited seminar).
15. "3D Aromatic Building Blocks and Reagents" University of California, Riverside, CA, May 2018 (invited seminar).
16. "3D Aromatic Building Blocks and Reagents" University of Washington, WA, April 2018 (invited seminar).
17. "Boron Cluster Photosensitizers and Dopants", ACS National Meeting, New Orleans, LA, March 2018 (invited talk).
18. "Boron Clusters as Dopants for Solid-State and Polymer Materials" ACS National Meeting, New Orleans, LA, March 2018 (invited talk).
19. "Boron Cluster Chromophores and Photosensitizers" University of Rengensburg, Germany, November 2017 (invited seminar).
20. "Boron Cluster Chromophores and Photosensitizers" Friedrich-Alexander University of Erlangen – Nurnberg (FAU), Germany, November 2017 (invited seminar).
21. "Atomically-Precise Multivalent Nanoparticles" Physical Sciences Faculty Lunch Talk Series, UCLA, October 2017.
22. "Organomimetic Boron Cluster Chromophores and Photosensitizers" University of Kansas, KS, September 2017 (invited seminar).
23. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Baylor University, TX, September 2017 (invited seminar).



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24. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Texas A&M University, TX, September 2017 (invited seminar).
25. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Gordon Research Conference on Photochemistry, ME, July 2017 (invited talk).
26. "Plan B with Boron Clusters" International Conference on Boron Chemistry (IMEBORON), Hong Kong, July 2017 (invited talk).
27. "Building Atomically Precise Hybrid Nanoparticles" Bioconjugates: From Targets to Therapeutics, San Diego, CA, June 2017 (invited talk).
28. "Organomimetic Boron Cluster Chromophores and Photosensitizers" ACS National Meeting, San Francisco, CA, April 2017 (invited talk).
29. "Plan B with Boron Clusters" University of Illinois, Urbana Champaign, IL, April 2017 (invited Krug Lectureship).
30. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Washington University at St. Louis (WUSTL), MO, March 2017 (invited talk).
31. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Wichita State University, KS, March 2017 (invited talk).
32. "Organomimetic Chemistry" PEERs Research Talk, UCLA, February 2017 (invited talk).
33. "Organomimetic Boron Cluster Chromophores and Photosensitizers" University of Missouri, Columbia, MO, December 2016 (invited talk).
34. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Virginia Tech Highlands in Chemistry Seminar Series, Blacksburg, VA, October 2016 (invited talk).
35. "Organomimetic Boron Cluster Chromophores and Photosensitizers" Argonne National Laboratory, Argonne, IL, October 2016 (invited talk).
36. "Organomimetic Boron Cluster Chromophores and Photosensitizers" KEMP Symposium, CSU Long Beach, Long Beach, CA, September 2016 (invited talk).
37. "Organomimetic Boron Cluster Chromophores and Photosensitizers" 4<sup>th</sup> International Conference on Molecular Bonding, Kauai, HI, July 2016 (invited talk).
38. "Forging Metal-Boron Bonds in Icosahedral Boron-Rich Clusters" Organometallic Chemistry Gordon Research Seminar and Conference, Salve Regina, RI, July 2016 (poster).
39. "Boron Cluster Chromophores and Photosensitizers" XV Boron in the Americas (BORAM) Meeting, Queen's University, Ontario, Canada, June 2016 (invited talk).
40. "Hybrid Metal Oxide Materials Featuring Icosahedral Boron Clusters" Inorganic Gordon Research Conference, Biddeford, ME, June 2016 (poster).
41. "Organomimetic Cluster Chemistry" The 3M Company, May 2016 (invited talk).
42. "Cluster-Based Organomimetic Pharmacophores" NIGMS New Faculty Workshop, Dallas, TX, April 2016 (invited talk).
43. "Organomimetic Boron Cluster Polymerization Photocatalysts", EMN Hawaii Meeting, Kona, HI, March 2016 (invited talk).
44. "Visible Light-Induced Olefin Activation using 3D Aromatic Organomimetic Boron-Rich Cluster Photooxidants", ACS National Meeting, San Diego, CA, March 2016 (talk).
45. "Organomimetic Cluster Chemistry", California State University, Chico, Chemistry and Biochemistry Department Seminar, October 2015 (invited talk).
46. "Organometallic Palladium Reagents for Cysteine Bioconjugation", California Institute of Technology, 2015 SoCal Organometallics Meeting, February 2015 (invited talk).
47. "Organomimetic Chemistry of Fluorine-Rich Molecules", California State University, Los Angeles, CA, October 2014 (invited seminar).
48. "Organomimetic Chemistry of Fluorine- and Boron-Rich Molecules" MIT Chemistry Student Seminar Series, Cambridge, MA, May 2014 (invited seminar).
49. "Organomimetic Chemistry of Fluorine-Rich Molecules", St. Jude Children's Research Hospital, Memphis, TN, March 2014 (invited seminar).
50. "Organomimetic Chemistry" Northwestern University, Evanston, IL, March 2014 INN Frontiers in Nanotechnology Seminars (invited seminar).
51. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of California, Santa Barbara, Santa Barbara, CA, January 2014 (junior faculty candidate seminar).

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52. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of California, Los Angeles, Los Angeles, CA, January 2014 (junior faculty candidate seminar).
53. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of Rochester, Rochester, NY, January 2014 (junior faculty candidate seminar).
54. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" Texas A&M University, College Station, TX, January 2014 (junior faculty candidate seminar).
55. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" New York University, Manhattan, NY, January 2014 (junior faculty candidate seminar).
56. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" California Institute of Technology, Pasadena, CA, December 2013 (junior faculty candidate seminar).
57. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of Pennsylvania, Philadelphia, PA, December 2013 (junior faculty candidate seminar).
58. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" Yale University, New Haven, CT, December 2013 (junior faculty candidate seminar).
59. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" Brown University, Providence, RI, December 2013 (junior faculty candidate seminar).
60. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" Pittsburgh University, Pittsburgh, PA, December 2013 (junior faculty candidate seminar).
61. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of Chicago, Chicago, IL, November 2013 (junior faculty candidate seminar).
62. "Organomimetic Chemistry of Aromatic Fluorine- and Boron-Rich Molecules" University of Buffalo, Buffalo, NY, November 2013 (junior faculty candidate seminar).
63. "Peptide Stapling Enabled by Cysteine Perfluoroarylation." 2013 Fall ACS National Meeting, Indianapolis, IN, September 2013 (talk).
64. "Development and Applications of Cysteine on Unprotected Peptides." 2013 American Peptide Society Symposium, Big Island, HI, June 2013 (poster).
65. "Organomimetic Chemistry of Fluorine- and Boron-Rich Molecules." Northwestern University, Chemistry Department Colloquium, May 2013 (invited seminar).
66. "Icosahedral Carborane-Based Phosphinoboranes." ACS National Meeting, New Orleans, LA, April 2013 (talk).
67. "Extremely Electron-Rich, Icosahedral Carborane-Based Phosphinoboranes." Organometallic Chemistry Gordon Research Seminar and Conference, Salve Regina, RI, July 2012 (poster).
68. "The Fifth Element: Multipass for Unique Ligands, Materials, and Molecular Devices." Harvey Mudd, Chemistry Department Seminar, February 2012 (invited seminar).
69. "A Coordination Chemistry Dichotomy for Icosahedral Carborane-Based Ligands." Young Boron Chemist Award Symposium, IME Boron, Niagara Falls, Canada, September 2011 (invited talk).
70. "Unique and Unmatched Coordination Chemistry of Boron-Rich Ligands." Young Investigator Symposium (Inorganic Division), 2011 Fall ACS National Meeting, Denver, CO, August 2011 (invited talk).
71. "A Coordination Chemistry Dichotomy for Icosahedral Carborane-Based Ligands." Organometallic Chemistry Gordon Research Conference, Salve Regina, RI, July 2011 (poster and invited talk).
72. "Bonding with Boron." Northwestern University, Society of Fellows, Evanston, IL, April 2011 (invited seminar).
73. "Plan B: Unique and Unmatched Coordination Chemistry of Boron Rich Ligands." Wesleyan University, Chemistry Department Seminar, Middletown, CT, March 2011 (invited seminar).
74. "Unique and Unmatched Coordination Chemistry of Boron Rich Ligands." University of Tokyo, GCOE Symposium, Tokyo, Japan, January 2011 (poster).
75. "Strategies for Making Tridentate XB<sub>3</sub> Pincer Complexes from *m*-Carborane." Organometallic Chemistry Gordon Research Seminar and Conference, Salve Regina, RI, July 2010 (poster).
76. "Abiotic Supramolecular Structures (Molecular Machines)." 2010 Nanotechnology for Defense Conference, Atlanta, GA, May 2010 (invited talk).

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77. "Strategies for Designing XB<sub>X</sub>-type Pincer Complexes" 2010 Spring ACS National Meeting, San Francisco, CA, March 2010 (Main Group Chemistry section, talk).
78. "Understanding the Formation of Pt(II) Heteroligated Tweezer Structures via the Halide Induced Ligand Rearrangement (HILR)" Spring ACS National Meeting, San Francisco, CA, March 2010 (Coordination Chemistry section, talk).
79. "Generation of Weak-Link Approach (WLA) Structures via Pt(II) Chemistry." Organometallic Chemistry Gordon Research Seminar and Conference, Salve Regina, RI, July 2009 (invited talk and poster).
80. "Infinite Coordination Polymer Nano- and Micro Particles." MRS National Meeting, San Francisco, CA, April 2009 (invited talk).
81. Metal-Organic Frameworks Materials Based on Carboranes" Applied Research Day, Northwestern University, Evanston, IL, November 2007 (poster).

### Patents and Patent Applications

1. Spokoyny, Kennedy, Logan, Saebi, Dziedzic, "Carborane-Based Histone Deacetylase (HDAC) Inhibitors" UCLA Provisional Patent Application (December 5, 2018).
2. Perez, Spokoyny, Black, Teh, Bernier, "Nanoparticles for Boron Neutron Capture Therapy", UCLA/Cedar Sinai Medical Center Provisional Patent Application (April 18, 2018).
3. Spokoyny, Ramachandran, Logan, "System and Method for Making Boron Oxide Nanoparticles", UCLA Invention Disclosure (April 20, 2018).
4. Spokoyny, Maynard, Qian, Messina, Wixtrom, Axtell, Kirlikovali, Gonzalez, "Novel Three-Dimensional Boron-Rich Clusters", UCLA Provisional Patent Application (April 2, 2016), Full U.S. Patent Application (February 21, 2017), International Application (February 21, 2017).
5. Buchwald, Pentelute, Spokoyny, Vinogradova, Zhang, "Transition Metal-Based Selective Functionalization of Chalcogens in Biomolecules" U.S. Patent Applications 62/024,769 and 62/091,720 and International Application PCT/US15/040495 (July 14, 2014).
6. Pentelute, Spokoyny, Zou, Zhang "Click-Type" Modifications of Peptides via S<sub>N</sub>Ar Reaction of Thiols with Fluorinated Aromatic Molecules" United States Patent: 9,018,172; International: WO/2014/052650.
7. Hupp, Mirkin, Farha, Spokoyny, "Gas Adsorption and Gas Mixture Separations Using Porous Organic Polymer" U. S. Patent Application 20110160511.
8. Hupp, Mirkin, Farha, Spokoyny, Mulfort "Metal-organic Framework Materials Based on Icosahedral Boranes and Carboranes" U. S. Patent: 7,824,473.
9. Hupp, Snurr, Mirkin, Farha, Bae, Spokoyny "Separation of CO<sub>2</sub> from CH<sub>4</sub> Employing Carborane-Based MOFs" U. S. Patent: 7,744,842.

### Paid Technical Consulting Activities

L.E.K Consulting (2014 - 2015), The Dow Chemical Company (2017 - present), Rubin-Anders Scientific, Inc. (2018 - present).