

## Sheel C. Dodani

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### Research Interests

My research program is focused on developing a toolkit to identify the cellular sources, molecular targets, and signaling roles of biologically relevant anions from the chemical biology/bioinorganic perspective. We aim to not only define the molecular criteria required for aqueous anion detection, a long-standing challenge in molecular recognition, but will also make fundamental contributions to understanding the roles of anions in biological systems with applications in the development of diagnostics and treatment of associated diseases, with a particular interest in the brain. To achieve these goals, we employ techniques in synthetic and materials chemistry, protein engineering, spectroscopy, molecular and cellular biology, and bioimaging.

### Appointments

2016-present Assistant Professor of Chemistry and Biochemistry, University of Texas at Dallas  
Courses: Inorganic Chemistry, Biochemistry I

2013-2016 NIH NRSA Postdoctoral Fellow, California Institute of Technology  
Advisor: Professor Frances H. Arnold  
Research area: Discovery and development of aromatic nitration biocatalysts

2007-2013 Graduate Student Researcher, University of California, Berkeley  
Advisor: Professor Christopher J. Chang  
Research area: Development and application of new chemical tools for studying the cell biology of metals

2007-2009 Graduate Student Teaching Assistant, University of California, Berkeley  
Courses: General I Chemistry Laboratory; Metals in Biology

2007 Summer Student Research Assistant, University of California, Berkeley  
Advisor: Professor Kenneth N. Raymond  
Research area: Design and synthesis of luminescent lanthanide complexes

2004-2007 Undergraduate Student Researcher, University of Texas at Dallas  
Advisor: Professor John W. Sibert  
Research area: Design and synthesis of redox active macrocycles for cation sensing

2003-2004 Anson L. Clark Scholar Program Fellow, University of Texas at Dallas  
Advisor: Professor Dennis Miller  
Research area: Analysis of RNA polymorphisms in myxomycetes

### Education

2013	University of California, Berkeley	Ph.D. in Chemistry
2007	University of Texas at Dallas	B.S. in Chemistry

### Training Workshops

2018 NSF-CHE Early Career Investigator Workshop  
2017 Cottrell Scholars Collaborative New Faculty Workshop  
2017 NIH Annual Mentoring Workshop for New Faculty in Organic and Biological Chemistry

### Honors and Awards

2015 Rising Stars in Chemistry Symposium, University of Chicago  
2014 Rising Stars in Chemical Biology Symposium, University of Utah  
2014 Poster awarded top honors, Biocatalysis Gordon Research Conference and Seminar  
2013-2016 National Institutes of Health NRSA F32 Individual Postdoctoral Fellowship  
2011 Taihi Hong Memorial Graduate Student Education Award  
2011 Novartis Fellowship in Organic Chemistry for Minorities and Women  
2010 Poster selected for oral presentation, Metals in Biology Gordon Research Conference  
2007 University of Texas at Dallas *summa cum laude*

2007	Merck Index Women in Chemistry Scholarship
2007	Dallas-Fort Worth American Chemical Society Scholarship
2007	Julia Williams Van Ness Merit Scholarship
2006	Frank and Sara McKnight Prize in Undergraduate Chemistry
2006	Poster awarded top honors, Annual UTD Chemistry and Biology Symposium
2005-2006	University of Texas at Dallas Presidential Achievement Scholar
2004	Poster awarded top honors, SWRM ACS
2003, 2004	Anson L. Clark Scholarship
2003-2007	Academic Honors Scholarship

## Publications

1. Tutol, J. N., Peng, W.; Dodani, S. C. “Discovery and Characterization of a Naturally Occurring, Turn-on Fluorescent Sensor for Chloride.” *Biochemistry* **2019**, *58*, 31-35.
2. Boulet, A.; Vest, K. E.; Maynard, M. K.; Gammon, M. G.; Russell, A. C.; Mathews, A. T.; Cole, S. E.; Zhu, X.; Phillips, C. B.; Kwong, J. Q.; Dodani, S. C.; Leary, S. C.; Cobine, P. A. “The mammalian phosphate carrier SLC25A3 is a mitochondrial copper transporter required for cytochrome c oxidase biogenesis.” *J. Biol. Chem.* **2018**, *293*, 1887-1896.
3. Herwig, L.; Rice, A. J.; Bedbrook, C. N.; Zhang, R. K.; Lignell, A.; Cahn, J. K. B.; Renata, H.; Dodani, S. C.; Cho, I.; Cai, L.; Gradinaru, V.; Arnold, F. H. “Directed evolution of a bright near-infrared fluorescent rhodopsin using a synthetic chromophore.” *Cell Chem. Biol.* **2017**, *24*, 1-11.
4. Dodani, S. C.; Kiss, G.; Cahn, J. K. B.; Su, Y.; Pande, V. S.; Arnold, F. H. “Discovery of a regioselectivity switch in the nitrating cytochrome P450 TxtE guided by MD simulations and Markov models.” *Nat. Chem.* **2016**, *8*, 419-425. (Featured cover article)
5. Hong-Hermesdorf, A.; Miethke, M.; Gallaher, S. D.; Kropat, J.; Dodani, S. C.; Chan, J.; Barupala, D.; Domaille, D. W.; Shirasaki, D. I.; Loo, J. A.; Weber, P. K.; Pett-Ridge, J.; Stemmler T. L.; Chang, C. J.; Merchant, S. S. “Subcellular metal imaging identifies dynamic sites of Cu accumulation in Chlamydomonas.” *Nat. Chem. Biol.* **2014**, *10*, 1034-1042.
6. Dodani, S. C.; Firl, A.; Chan, J.; Nam, C. I.; Onak, C.; Feller, M. F.; Chang, C. J. “Copper is an endogenous modulator of neural circuit spontaneous activity.” *Proc. Natl. Acad. Sci. USA* **2014**, *111*, 16280-16285. (Highlighted by LBNL News, Chem. Eng. News, and R&D Magazine)
7. Heel, T.; McIntosh, J. A.; Dodani, S. C.; Meyerowitz, J. T.; Arnold, F. H. “Non-natural olefin cycloproponation catalyzed by diverse cytochrome P450s and other hemoproteins.” *ChemBioChem* **2014**, *15*, 2556-62.
8. Dodani, S. C.; Cahn, J. K. B.; Heinisch, T.; Brinkmann-Chen, S.; McIntosh, J. A.; Arnold, F. H. “Structural, functional, and spectroscopic characterization of the substrate scope of the novel nitrating cytochrome P450 TxtE.” *ChemBioChem* **2014**, *15*, 2259-2267.
9. Garcia-Molina, A.; Andrés-Colás, N.; Perea-García, A.; Neumann, U.; Dodani, S. C.; Huijser, P.; Peñarrubia, L.; Puig, S. “The Arabidopsis COPT6 transport protein functions in copper distribution under copper-deficient conditions.” *Plant Cell Physiol.* **2013**, *54*, 1378-1390.
10. Cusick, K. D.; Wetzel, R. K.; Minkin, S. C. Jr.; Dodani, S. C.; Wilhelm, S. W.; Sayler, G. S. “Paralytic shellfish toxins inhibit copper uptake in Chlamydomonas reinhardtii.” *Environ. Sci. Technol.* **2013**, *32*, 1388-1395.
11. Chan, J.; Dodani, S. C.; Chang, C. J. “Reaction-based small-molecule fluorescent probes for chemoselective bioimaging.” *Nat. Chem.* **2012**, *4*, 973-984.
12. Bernal M.; Casero D.; Singh V.; Wilson G. T.; Grande, A.; Yang H.; Dodani, S.C.; Pellegrini, M.; Huijser, P.; Connolly, E. L.; Merchant S. S.; Krämer, U. “Transcriptome sequencing identifies SPL7-regulated copper acquisition genes FRO4/FRO5 and the copper dependence of iron homeostasis in arabidopsis.” *Plant Cell.* **2012**, *24*, 2738-2761.
13. Cusick, K. D.; Minkin, S.; Dodani, S. C.; Chang, C. J.; Wilhelm, S. W.; Sayler, G. S. “Inhibition of copper uptake in yeast reveals that the copper transporter Ctr1p as a potential molecular target of saxitoxin.” *Environ. Sci. Technol.* **2012**, *45*, 2959-2966.
14. Beadoin, J.; Ioannoni, R.; Lopez-Maury, L.; Bahler, J.; Ait-Mohand, S.; Guerin, B.; Dodani, S.C.; Chang, C.J., Labbe, S. “Mfc1 is a novel forespore membrane copper transporter in meiotic and sporulating cells.” *J. Biol. Chem.* **2011**, *286*, 34356-34372.

15. Dodani, S. C.; Leary, S. C.; Cobine, P. A.; Winge, D. R.; Chang, C. J. "A targetable fluorescent sensor reveals that copper-deficient *SCO1* and *SCO2* patient cells prioritize mitochondrial copper homeostasis." *J. Am. Chem. Soc.* **2011**, *133*, 8606-8616.
16. Dodani, S. C.; Domaille, D. W.; Nam, C. I.; Miller, E. W.; Finney, L. A.; Vogt, S.; Chang, C. J. "Calcium-dependent copper redistributions in neuronal cells revealed by a fluorescent copper sensor and X-ray fluorescence microscopy." *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 5980-5985.
17. Moore, E. G.; Xu, J.; Dodani, S. C.; Jocher, C. J.; D'Alo, A.; Seitz, M.; Raymond, K. N. "1-Methyl-3-hydroxy-pyridin-2-one complexes of near infra-red emitting lanthanides: efficient sensitization of Yb(III) and Nd(III) in aqueous solution." *Inorg. Chem.* **2010**, *49*, 4156-4166.
18. Dodani, S. C.; He, Q.; Chang, C. J. "A turn-on fluorescent sensor for detecting nickel in living cells." *J. Am. Chem. Soc.* **2009**, *131*, 18020-18021.

## Presentations

1. "Repurposing and Evolving Pigment-Containing Proteins for Aqueous Anion Sensing," Telluride Science Research Center Workshop on Aqueous Supramolecular Chemistry, Telluride, CO, August 2019 (Invited seminar).
2. "Exploring the Negative Side (X<sup>-</sup>) of Biology: Genetically Encoded Fluorescent Sensors to Illuminate Cellular Chloride Signaling," University of Texas at Arlington, Arlington, TX, March 2019 (Invited seminar).
3. "Genetically Encoded Fluorescent Sensors to Illuminate Cellular Chloride Signaling," 16<sup>th</sup> Annual Advanced Imaging Methods Workshop, Berkeley, CA, January 2019 (Invited seminar).
4. "Repurposing and Evolving Pigment-Containing Proteins for Aqueous Anion Sensing," Metals in Biology Gordon Research Conference, Ventura, CA, January 2019 (Poster).
5. "Molecular Cameras for Exploring the Negative (X<sup>-</sup>) Side of Biology," Scholar's Day, The University of Texas at Dallas Richardson, TX, November 2018 (Invited seminar).
6. "Genetically Encoded Fluorescent Sensors to Illuminate Cellular Chloride Signaling," Janelia Conference: Fluorescent Proteins and Biological Sensors VI, Ashburn, VA, October 2018 (Invited seminar).
7. "Exploring the Negative (X<sup>-</sup>) Side of Biology: Genetically Encoded Fluorescent Sensors to Illuminate Cellular Chloride Signaling," Southern Methodist University, Dallas, TX, September 2018, (Invited seminar)
8. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," International Symposium on Macrocyclic and Supramolecular Chemistry, Quebec City, Canada, July 2018 (Invited seminar).
9. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," International Symposium on Macrocyclic and Supramolecular Chemistry, Quebec City, Canada, July 2018 (Poster).
10. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," American Society for Biochemistry and Molecular Biology Meeting, San Diego, CA, April 2018 (Seminar).
11. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," American Society for Biochemistry and Molecular Biology Meeting, San Diego, CA, April 2018 (Invited poster).
12. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," Texas Protein Folders and Function Meeting, Cleveland, TX, April 2018 (Invited seminar).
13. "Optical Imaging Tools for Elucidating the Roles of Anions in Cellular Signaling," 255<sup>th</sup> National Meeting of the American Chemical Society, New Orleans, LA, March 2018 (Seminar).
14. "Exploring the Negative (X<sup>-</sup>) Side of Biology: Molecular Technologies for Elucidating the Roles of Cellular Anions," Advanced Imaging Research Center at the UT Southwestern Medical Center, Dallas, TX, September 2016 (Invited seminar)
15. "From Neurons to Microbes: Discovering New Bioinorganic Chemistry," Rising Stars in Chemistry Symposium, University of Chicago, Chicago, IL, June 2015 (Invited seminar).
16. "Simulation Guided Discovery of a Regioselectivity Switch in the Nitrating Cytochrome P450 TxtE," Young Investigator Workshop on Biocatalysis, Schwarzenberg, Austria, March 2015 (Seminar).
17. "Cytochrome P450 TxtE: A Biological Nitration Platform for the Development of Aromatic Nitration Biocatalysts," Metals in Biology Gordon Research Conference and Seminar, Ventura, CA, January 2015 (Poster).
18. "A Chemical Biology Approach for Elucidating New Roles of Copper in Cell Signaling," Rising Stars in Chemical Biology Mini-Symposium, University of Utah, Salt Lake City, UT, October 2014 (Invited seminar).
19. "A Chemical Biology Approach for Elucidating New Roles of Copper in Cell Signaling," The University of Texas at Dallas, Richardson, TX, September 2014 (Invited seminar).

20. "Cytochrome P450 TxtE: A Novel Platform for the Development of Aromatic Nitration Biocatalysts," Biocatalysis Gordon Research Conference and Seminar, Smithfield, RI, July 2014 (Poster).
21. "A Chemical Biology Approach for Elucidating New Roles of Copper in Cell Signaling," Bioinorganic Chemistry Gordon Research Seminar, Ventura, CA, January 2013 (Seminar).
22. "A Chemical Biology Approach for Elucidating New Roles of Copper in Cell Signaling," University of California, Berkeley Biological and Biomedical Sciences Retreat, Asilomar, CA, January 2013 (Seminar).
23. "Probing the Roles of Copper in Cell Signaling Using New Fluorescent Sensors," Howard Hughes Medical Institute Scientific Meeting, Ashburn, VA, June 2011 (Poster).
24. "Expanding the Palette of Fluorescent Sensors for Studying the Cell Biology of Metals," Metals in Medicine Gordon Research Conference, Andover, NH, July 2010 (Seminar selected from poster session).
25. "Expanding the Palette of Fluorescent Sensors for Studying the Cell Biology of Metals," Metals in Medicine Gordon Research Conference, Andover, NH, July 2010 (Poster).
26. "Targetable Fluorescent Sensors for Studying the Cell Biology of Copper," 239<sup>th</sup> National Meeting of the American Chemical Society, San Francisco, CA, March 2010 (Seminar).
27. "Tuning the Potential of Wurster's Crowns: Toward the Development of an Electrochemical Toolbox for Redox Sensing/Switching," 234<sup>th</sup> National Meeting of the American Chemical Society, Boston, MA, August 2007 (Seminar).
28. "Wurster's Thiocrown Ethers and Related Acyclic Ligands," 233<sup>rd</sup> National Meeting of the American Chemical Society, Chicago, IL, March 2007 (Poster).
29. "The Synthesis and Properties of Tunable Redox-Active *para* Wurster's Crowns," UT Southwestern Biochemistry Research Retreat, New Braunfels, TX, November 2006 (Poster).
30. "Cation- $\pi$  Bonding in a Redox-Responsive Wurster's Cryptophane," 232<sup>nd</sup> National Meeting of the American Chemical Society, San Francisco, CA, September 2006 (Poster).
31. "The Synthesis and Properties of Tunable Redox-Active *para* Wurster's Crowns," 232<sup>nd</sup> National Meeting of the American Chemical Society, San Francisco, CA, September 2006 (Poster).
32. "The Synthesis and Properties of Tunable Redox-Active *para* Wurster's Crowns," 11<sup>th</sup> Annual Chemistry and Biology Symposium of the University of Texas at Dallas, Richardson, TX, March 2006 (Poster).
33. "The Design and Synthesis of a Wurster's Crown-Based, Redox-Switchable MRI Contrast Agent," 60<sup>th</sup> Southwestern Regional Meeting of the American Chemical Society, Fort Worth, TX, September 2004 (Poster).

### Professional Activities

Manuscript reviewer: ACS Omega, ACS Chemical Biology, Biochemistry, Chemical Science, Journal of the American Chemical Society, JoVE, Nanoscale, Scientific Reports

Memberships: American Chemical Society (2018-present), American Society for Biochemistry and Molecular Biology (2018-present)

The University of Texas at Dallas Service: Core Facility Advisory Committee (2017), Graduate Student Recruitment Committee (2017-2018), Department Seminar Committee Co-Chair (2018-present), Department Coordinator for Anson L. Clark Summer Research Program (2019-present)

### Courses Taught

Inorganic Chemistry, undergraduate (Fall 2016, Fall 2017, Fall 2018)  
 Biochemistry I, undergraduate (Spring 2018)

### Outreach Activities

2017-2018 Women in Science and Engineering mentor, Team pHuture awarded second place  
 2017, 2018 Comet Chemistry Camp  
 2017 Judge for Greenwood Hills Elementary Science Fair  
 2014, 2015 Women in STEM, California Institute of Technology  
 2014-2015 Women Mentoring Women, California Institute of Technology  
 2014 Reddit AMA Ladies of Science with NPR's Kelly McIvers

### **Current Research Group**

Postdoctoral researcher (1)

Chemistry graduate students (6)

Molecular and cell biology graduate students (3)

Undergraduate students (6)

### **Mentorship**

Graduate students: Jyothi Kallu (Chemistry rotation student, 2016-2017); Jessica Lee (Molecular and Cell Biology M.S., 2016-2017, Currently at DAVA Oncology); Hsichuan Chi (Biotechnology M.S., 2016-2018).

Undergraduate students: Farah Faizuddin (Biochemistry, 2016-2018); Kaivalya Gudooru (Biochemistry, 2017-2018)

High school students: Christopher Chen (Welch Summer Scholar, 2018)

### **Current Research Support**

Welch Foundation 8/1/17-7/30/20

Title: *Exploring the Negative (X) Side of Biology: Molecular and Protein-Based Technologies for Imaging Cellular Chloride*

Role: PI

National Institutes of Health 8/1/18-7/31/23

Title: *Optical imaging tools for elucidating the roles of anions and anionic modifications in cellular signaling*

Role: PI