

# Hao F. Zhang

*Curriculum Vitae*

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## EMPLOYMENT

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2017–present Professor, Department of Biomedical Engineering and Department of Ophthalmology (by courtesy), Northwestern University, IL  
2013–2016 Associate Professor, Department of Biomedical Engineering and Department of Ophthalmology (by courtesy), Northwestern University, IL  
2011–2012 Assistant Professor, Department of Biomedical Engineering and Department of Ophthalmology (by courtesy), Northwestern University, IL  
2007–2010 Assistant Professor, Department of Electrical Engineering and Computer Science  
University of Wisconsin-Milwaukee, Milwaukee, WI  
2006–2007 Postdoctoral Fellow, Department of Biomedical Engineering  
Washington University in St. Louis, St. Louis, MO

## EDUCATION

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2006 Ph.D. Biomedical Engineering, Texas A&M University, College Station, Texas  
2000 M.S. Biomedical Engineering, Shanghai Jiao Tong University, Shanghai, China  
1997 B. E. Computer Science, Shanghai Jiao Tong University, Shanghai, China  
1997 B. E. Instrumentation Engineering, Shanghai Jiao Tong University, Shanghai, China

## PEER-REVIEWED JOURNAL ARTICLES (§Corresponding author; \*Equal contribution)

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1. (Invited) Xiao Shu, Lisa Beckmann, and Hao F. Zhang<sup>§</sup>, “Visible-light optical coherence tomography: a review,” *Journal of Biomedical Optics*, in press (2017)
2. Ben E. Urban, Lei Xiao, Siyu Chen, Huili Yang, Biqin Dong, Yevgenia Kozorovitskiy, and Hao F. Zhang, “In vivo super-resolution imaging of neuronal structure in the mouse brain,” *IEEE Transactions on Biomedical Engineering*, in press (2017) (*Cover story*)
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4. Ben E. Urban, Lei Xiao, Siyu Chen, Biqin Dong, Yevgenia Kozorovitskiy, and Hao F. Zhang<sup>§</sup>, “Imaging neuronal structure dynamics using two-photon super-resolution patterned excitation reconstruction (SuPER) microscopy,” *Journal of Biophotonics*, in press (2017)
5. Hao Li, Wenzhong Liu, Christine M. Sorenson, Nader Sheibani, Daniel M. Albert, Thulani Senanayake, Serguei Vinogradov, Jack Henkin, and Hao F. Zhang<sup>§</sup>, “Sustaining intravitreal residence with L-Arginine peptide-conjugated nanocarriers,” *Investigative Ophthalmology & Vision Science* 58, 5142-5150 (2017)
6. Xiao Shu, Wenzhong Liu, Lian Duan, Hao F. Zhang<sup>§</sup>, “Spectroscopic Doppler analysis for visible-light optical coherence tomography,” *Journal of Biomedical Optics* 22, 121702 (2017)
7. Dou Yu, Omar F. Khan, Mario L. Suvà, Biqin Dong, Wojciech K. Panek, Ting Xiao, Meijing Wu, Yu Han, Atique U. Ahmed, Irina V. Balyasnikova, Hao F. Zhang, Sun Cheng, Robert Langer, Daniel G. Anderson, Maciej S. Lesniak, “Multiplexed RNAi therapy against glioblastoma stem cells via sustained lipopolymeric nanoparticle delivery delays tumor progression,” *Proceedings of the National Academy of Sciences of the USA* 114, E6147-E6156 (2017)
8. Qi Liu, Siyu Chen, Brian Soetikno, Wenzhong Liu, Shanbao Tong, and Hao F. Zhang<sup>§</sup>, “Monitoring acute stroke in mouse model using laser speckle imaging-guided visible-light optical coherence tomography,” *IEEE Transactions on Biomedical Engineering*, in press (2017)

9. Biqin Dong, Brian T. Soetikno, Xiangfan Chen, Vadim Backman, Cheng Sun, and Hao F. Zhang<sup>§</sup>, “Parallel three-dimensional tracking of quantum rods using polarization-sensitive spectroscopic photon localization microscopy,” *ACS Photonics* 4, 1747-1752 (2017)
10. Peter L Nesper, Brian T Soetikno, Hao F Zhang, and Amani A. Fawzi, “OCT angiography and visible-light OCT in diabetic retinopathy,” *Vision Research*, in press (2017)
11. Brian T. Soetikno, Xiao Shu, Qi Liu, Wenzhong Liu, Siyu Chen, Lisa Beckmann, Amani A. Fawzi, and Hao F. Zhang<sup>§</sup>, “Optical coherence tomography angiography of retinal vascular occlusions produced by imaging-guided laser photocoagulation,” *Biomedical Optics Express* 8, 3571-3582 (2017)
12. Xiao Shu, Hao Li, Biqin Dong, Cheng Sun, and Hao F. Zhang<sup>§</sup>, “Quantifying melanin concentration in retinal pigment epithelium using broadband photoacoustic microscopy,” *Biomedical Optics Express* 6, 2851-2865 (2017)
13. Lian Duan, Michael D McRaven, Wenzhong Liu, Xiao Shu, Jianmin Hu, Cheng Sun, Ronald S Veazey, Thomas J. Hope, and Hao F. Zhang<sup>§</sup>, “Colposcopic imaging using visible-light optical coherence tomography,” *Journal of Biomedical Optics* 22, 056003 (2017)
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96. Li Li, [Hao F. Zhang](#), Roger J. Zemp, Konstantin Maslov, and Lihong V. Wang, “Simultaneous imaging of a lacZ-marked tumor and microvasculature morphology *in vivo* by dual-wavelength photoacoustic microscopy,” *Journal of Innovative Optical Health Sciences* 1, 207–215 (2008), PMID: PMC2782593
97. Konstantin Maslov\*, [Hao F. Zhang\\*](#), Song Hu\*, and Lihong V. Wang, “Optical-resolution photoacoustic microscopy for *in vivo* imaging of single capillaries,” *Optics Letters* 33, 929–931 (2008) (**Top 5 download between 2008-2013**)
98. Konstantin Maslov\*, [Hao F. Zhang\\*](#), and Lihong V. Wang, “Effects of wavelength-dependent fluence attenuation on the noninvasive photoacoustic imaging of hemoglobin oxygen saturation in subcutaneous vasculature *in vivo*,” *Inverse Problems* 23, S113–S122 (2007)
99. [Hao F. Zhang\\*](#), Konstantin Maslov\*, and Lihong V. Wang, “*In vivo* imaging of subcutaneous structures using functional photoacoustic microscopy,” *Nature Protocols* 4, 797–804 (2007)

100. Hao F. Zhang, Konstantin Maslov, Mathangi Sivaramakrishnan, Gheorghe Stoica, and Lihong V. Wang, “Imaging of hemoglobin oxygen saturation variations in single vessels *in vivo* using photoacoustic microscopy,” *Applied Physics Letters* 90, 053901 (2007)
101. Mathangi Sivaramakrishnan, Konstantin Maslov, Hao F. Zhang, George Stoica, and Lihong V. Wang, “Limitations of quantitative photoacoustic measurement of blood oxygenation in small vessels,” *Physics in Medicine and Biology* 52, 1349–1361 (2007)
102. Hao F. Zhang, Konstantin Maslov, Meng-Lin Li, George Stoica, and Lihong V. Wang, “*In vivo* volumetric imaging of subcutaneous microvasculature using photoacoustic microscopy,” *Optics Express* 14, 9317–9323 (2006)
103. Hao F. Zhang, Konstantin Maslov, George Stoica, and Lihong V. Wang, “Imaging acute thermal burns by photoacoustic microscopy,” *Journal of Biomedical Optics* 11, 054033 (2006)
104. Hao F. Zhang\*, Konstantin Maslov\*, George Stoica, and Lihong V. Wang, “Functional photoacoustic microscopy for high-resolution and noninvasive *in vivo* imaging,” *Nature Biotechnology* 24, 848–851 (2006)
105. Jung-Taek Oh, Meng-Lin Li, Hao F. Zhang, Konstantin Maslov, Grogre Stoica, and Lihong V. Wang, “Three-dimensional imaging of skin melanoma *in vivo* by dual-wavelength photoacoustic microscopy,” *Journal of Biomedical Optics* 11, 034032 (2006)
106. Meng-Lin Li, Hao F. Zhang, Konstantin Maslov, and Lihong V. Wang, “Improved *in-vivo* photoacoustic microscopy based on a virtual-detector concept,” *Optics Letters* 31, 474–476 (2006)

## BOOKS AND BOOK CHAPTERS

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1. Vadim Backman, Adam Wax, and Hao F. Zhang, *Biophotonics Laboratory* (CRC Press, 2016)
2. Hao F. Zhang and Shuliang Jiao, “*Photoacoustic microscopy and its ophthalmic applications*” in *Emerging Imaging Technologies in Medicine*, edited by Mark A. Anastasio and Patrick J. La Riviere (Taylor & Francis, 2013)
3. Shuliang Jiao and Hao F. Zhang, “*Multimodal microscopy for comprehensive tissue characterization*” in *Advanced Biophotonics: Slicing Tissue with Photons*, edited by Valery Tuchin and Ricky Wang (Taylor & Francis 2012)
4. Hao F. Zhang, Konstantin Maslov, and Lihong V. Wang, “*Dark-field confocal photoacoustic microscopy*” in *Photoacoustic Imaging and Spectroscopy*, edited by Lihong V. Wang (Taylor & Francis, New York, NY, 2008)

## INVITED PRESENTATIONS

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1. Invited speaker, 5<sup>th</sup> *International Congress on OCT Angiography and Advances in OCT*, Rome, Italy (2017)
2. Seminar, Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, IL (2017)
3. Seminar, Fitzpatrick Institute for Photonics, Duke University, NC (2017)
4. Invited speaker, *OCT Angiography Summit*, Portland OR (2017)
5. Invited speaker, *Frontiers in Imaging Science*, HHMI Janelia Research Campus, Ashburn, VA (2017)
6. Invited speaker, *AAAS Annual Meeting*, Boston, MA (2017)
7. Seminar, Department of Biomedical Engineering, University at Buffalo, Buffalo NY (2016)
8. Seminar, College of Applied Physics, University of Kent, Canterbury, UK (2016)
9. Seminar, Department of Vision Neuroscience, University College London, London, UK (2016)
10. Seminar, Department of Biomedical Engineering, Nan Jing University, Nan Jing, China (2016)
11. Seminar, Department of Electronic Engineering, SooChow University, Su Zhou, China (2016)
12. Invited speaker, *Optics Society of America Biomedical Optics Workshop*, Fort Lauderdale, FL (2016)
13. Seminar, Genentech, South San Francisco, CA (2016)
14. Invited speaker, *Hyperspectral Imaging Workshop, IMEC Technology Forum*, Brussels, Belgium (2015)
15. Seminar, NKT Photonics, Copenhagen, Denmark (2015)
16. Invited speaker, *Association for Ocular Circulation Meeting*, Beijing, China (2015)
17. Seminar, Department of Ophthalmology, University of Pittsburg School of Medicine, Pittsburg, PA (2015)
18. Invited speaker, *Biennial Meeting of International Society for Eye Research*, San Francisco, CA (2014)
19. Seminar, Department of Biomedical Engineering, University of Wisconsin, Madison, WI (2014)
20. Invited speaker, *Twenty Years of Super-Resolution – The Next 20 Years Symposium*, Turku, Finland (2013)

21. Invited speaker, *The International Forum of Advancing Novel Digital and Minimal-Invasive Biomedical Engineering*, Shanghai, China (2013)
22. Seminar, Department of Physics, Harbin Institute of Technology, Harbin, Hei Long Jiang, China (2013)
23. Invited speaker, *MOI Cross-sectional Group Session: Functional Optical Imaging, Association for Research in Vision and Ophthalmology Annual Conference*, Seattle WA (2013)
24. Lecturer, *NSF Short Course on Novel Super-resolution Methods for Bioimaging*, San Diego, CA (2013)
25. Seminar, College of Information Technology, Wuhan University of Technology, Wuhan, Hu Bei, China (2013)
26. Seminar, Department of Ophthalmology, Tong Ji Hospital, Hua Zhong University of Science and Technology, Wuhan, Hu Bei, China (2013)
27. Seminar, Department of Chemistry, University of Texas at Dallas, Dallas, TX (2013)
28. Seminar, Department of Biomedical Engineering, Texas A&M University, College Station, TX (2013)
29. Invited speaker, *Design and Quality of Biomedical Technologies Conference, SPIE Photonics West*, San Francisco, CA (2013)
30. Seminar, Department of Ophthalmology and Vision Science, The University of Illinois Chicago, Chicago, IL (2013)
31. Seminar, Fitzpatrick Institute for Photonics, Duke University, Durham, NC (2012)
32. Invited speaker, *Association for Ocular Circulation Meeting*, Portland, Oregon (2012)
33. Invited speaker, *Northwestern University-Shanghai Jiao Tong University Mini-symposium on Vision Research*, Shanghai, China (2012)
34. Seminar, Department of Biomedical Engineering, University of Iowa, Iowa City, IA (2012)
35. Applied Physics Colloquium, National University of Ireland, Galway, Ireland (2012)
36. Seminar, Promega Corp., Madison, WI (2012)
37. Invited speaker, *MEMS Adaptive Optics VI Conference, SPIE Photonics West*, San Francisco, CA (2012)
38. Invited speaker, *Frontiers in Science*, Shanghai Jiao Tong University, Shanghai, China (2011)
39. Keynote speaker, *Observing the Invisible – Novel Imaging Horizons*, Center for Biotechnology, Turku, Finland (2011)
40. Invited speaker, *Microscopic Image Analysis with Applications to Biology, ACM Conference on Bioinformatics, Computational Biology and Biomedicine*, Chicago, IL (2011)
41. Invited speaker, *Chicago Innovation Spotlight*, Chicago, IL (2011)
42. Invited speaker, 1<sup>st</sup> Workshop on Data Analysis and Modeling Retina in Health and Disease, Madison, WI (2011)
43. Grand Round, Department of Ophthalmology, Northwestern University (2011)
44. Invited speaker, *Cancer Center Program in Cancer Bioengineering, Nanotechnology and Chemistry Mini-Symposium*, Northwestern University (2011)
45. Seminar, Cell Imaging Facility, Feinberg School of Medicine, Northwestern University (2011)
46. Seminar, Advanced Topics in Vision, Northwestern University (2011)
47. Invited speaker, *The 41<sup>th</sup> Winter Colloquium on the Physics of Quantum Electronics*, Snowbird, UT (2011)
48. Inaugural speaker, The Medical College of Wisconsin *The Spotlight on Translational Science Seminar*, Milwaukee, WI (2010)
49. Invited speaker, The Medical College of Wisconsin *Ophthalmology Annual Fall Alumni Symposium*, Milwaukee, WI (2010)
50. Invited speaker, *Optics Society of America Frontiers in Optics*, Rochester, NY (2010)
51. Seminar, Athinoula A. Martinos Center for Biomedical Imaging, Harvard University (2010)
52. Seminar, Department of Ophthalmology, University of Wisconsin-Madison (2010)
53. Seminar, Department of Ophthalmology, Northwestern University (2010)
54. Seminar, Department of Bioengineering, University of Washington (2010)
55. Seminar, Department of Biomedical Engineering, Northwestern University (2010)
56. Seminar, Department of Biomedical Engineering, University of Wisconsin-Madison (2010)
57. Seminar, Department of Biomedical Engineering, University of Minnesota (2009)
58. Colloquium, Department of Physics, University of Wisconsin-Milwaukee (2008)
59. Seminar, Department of Radiology, University of Chicago (2008)
60. Seminar, Center for Quality Engineering & Failure Prevention, Northwestern University (2008)
61. Seminar, Department of Biophysics, Medical College of Wisconsin (2008)
62. Seminar, Laboratory of Optical and Computational Instrumentation, University of Wisconsin-Madison (2007)
63. Seminar, Department of Biological Engineering, University of Missouri-Columbia (2007)
64. Seminar, Department of Mechanical, Aerospace, and Biomedical Engineering, University of Tennessee (2007)



65. Seminar, Department of Biomedical Engineering, Stony Brook University (2007)

## INTELLECTUAL PROPERTY

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1. Ji Yi, Wenzhong Liu, Vadim Backman, and Hao F. Zhang, “Devices, methods, and systems of functional optical coherence tomography,” US patent No. 9,619,903,B2; Application No. 14/698,641; Issue date: April 11, 2017
2. Cheng Sun and Hao F. Zhang, “Method, system, and apparatus of all-optics ultrasound sensor,” US patent No. 9,513,260, B2; Application No. 14/299,807; Issue date: Dec. 6, 2016
3. Shuliang Jiao and Hao F. Zhang, “Optical coherence photoacoustic microscopy,” US patent No. 9,442,095; Application No. 13/524,813; Issue date: Sep. 13, 2016
4. Ji Yi, Qing Wei, Vadim Backman, and Hao F. Zhang, “Methods and apparatus for laser scanning structured illumination microscopy and tomography,” US patent No. 9,360,660; Application No. 13/902,288; Issue date: June 7, 2016
5. Hao F. Zhang and Shuliang Jiao, “System and methods for photoacoustic ophthalmoscopy,” US patent No. 8,025,406 B2; Application No. 12/726,176; Issue date: Sep. 27, 2011
6. Hao F. Zhang and Shuliang Jiao, “System and methods for photoacoustic ophthalmoscopy,” US patent No. 8,016,419; Application No. 12/726,172; Issue date: Sep. 13, 2011

## NEWS COVERAGE

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1. John Edwards, “Peering inside cells,” *IEEE Signal Processing Magazine*, December 2017.
2. “Metabolism, Melanin, and multiple modalities,” *The Ophthalmologist*, October 2017.
3. Ivy Lebanan, “DNA blinking showed in a new imaging technique,” *The Science Times*, February, 22, 2017
4. Anaveesh Pandey, “New DNA imaging technology breaches 10-nanometer resolution threshold, becomes first to see DNA ‘blink’,” *International Business Times*, February 20, 2017
5. Rachel Ehrenberg, “New imaging technique catches DNA ‘blinking’ on,” *Science News*, February 19, 2017
6. Tim Dandle, “Research group are the first to see DNA ‘blink’,” *Digital Journal*, February 17, 2017
7. “Feature of Week 10/16/2016,” [www.OCTNews.org](http://www.OCTNews.org)
8. Editor’s highlight and cover image, *Journal of Applied Physics*, October 2014
9. “Combining sound and light for retinal imaging,” SPIE Newsroom, February 2013
10. “Watching while listening to the interaction of photons with bio-tissues,” SPIE Newsroom, January 2013
11. Featured article, *Journal of Biomedical Optics* 2012
12. Lynn Savage, “Sound and light, signifying improved imaging,” *Biophotonics International Magazine* 9, 21–25 (2010)
13. Cover story, *Milwaukee Engineer*, Spring 2010
14. Research highlight, University of Wisconsin Research 2010
15. “Feature Image,” Optical Society of America, Virtual Journal of Biomedical Optics Vol. 5, Issue 6, 03/15/2010
16. “Feature of the Week 03/14/2010,” [www.OCTNews.org](http://www.OCTNews.org)
17. Radio interview, Milwaukee Public Radio (National Public Radio), June 25<sup>th</sup>, 2009
18. Laura L. Hunt, news coverage in *UWM Today* and *The Business Journal of Milwaukee*, May 15<sup>th</sup>, 2009
19. Kathleen Gallagher, news coverage in *Milwaukee Journal Sentinel*, Jan. 5<sup>th</sup>, 2009
20. K. Robinson, “Scientists harness photoacoustic effect for imaging,” *Biophotonics International Magazine* 13, 55–56 (2006)
21. Research highlights, *Nature Reviews Drug Discovery* 5, 634 (2006)
22. Research highlights, *Nature Reviews Molecular Cell Biology* 7, 554 (2006)
23. K. P. Herlihy, “Virtual-detector-based photoacoustic microscopy improves *in vivo* imaging,” *Material Research Society Bulletin* 31, 366–367 (2006)

## HONORS AND AWARDS

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2017	Cozzarelli Prize, PNAS Office, National Academy of Sciences of the USA
2016	2016 SPIE Translational Research Award
2013	Young Investigator Award, Georgia Tech Frontiers in Bioengineering Workshop
2012–2013	Fellow, Searle Center for Teaching Excellence, Northwestern University
2011	National Science Foundation CAREER award
2011	Best Abstract Award Runner-up, <i>Physics of Quantum Electronics</i> , Snowbird, UT

2009–2011 NIH K-30 Clinical Research Scholar  
2009–2014 Shaw Scientist Award, The Greater Milwaukee Foundation (two awards per year to junior faculty members in Wisconsin to advance research in biochemistry, biological science, and cancer research; the first engineer awardee since the program was created in 1982)

## TEACHING

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### Quarter-long courses at Northwestern University

1. Fall 2011-2017, *BME 305 Introduction to Biomedical Signals and Electrical Circuits*
2. Fall 2011-2017, *BME 333 Modern Optical Microscopy and Imaging*
3. Spring 2011, *EDCI Engineering Design and Communication*

### Semester-long course at University of Wisconsin-Milwaukee

4. Fall 2009 and Spring 2010, *EE301 Electronic Circuits I*
5. Spring 2009, *EE539 Introduction to Nuclear Magnetic Resonance Imaging*
6. Fall 2008, *EE490/890 Introduction to Bio-optical Imaging*
7. Spring 2008 and Fall 2010, *EE490/890 Introduction to Biomedical Optics*
8. Fall 2007, *EE537 Fundamental of Neuroimaging Techniques*

## EDITORIAL SERVICE

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2016-present Associate Editor, *Biomedical Optics Express*  
2014–2017 Editorial board member, *Scientific Reports*  
2012–2017 Editorial board member, *Current Eye Research*

## CURRENT GROUP MEMBERS

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Postdoctoral fellow: Hao Li, Biqin Dong, Yang Zhang, and Xian Zhang (M.D.)  
Ph.D. student: Xiao Shu, Janel Davis, Lisa Beckmann, Ki-Hee Song, and Ian Rubinoff  
M.D./Ph.D. student: Brain Soetikno  
Undergraduate student: Jennifer Ryu

## GROUP MEMBER AWARDS

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2017 Biqin Dong, PicoQuant Young Investigator Award, SPIE Photonic West 2017  
2016–2021 Brain Soetikno, NIH F30 pre-doctoral fellowship  
2016 Wenzhong Liu, Northwestern University Biomedical Engineering Dissertation award  
2015 Brain Soetikno, SPIE Optics and Photonics Education Scholarship  
2015 Brain Soetikno, Siyu Chen, ARVO Annual Conference Travel Grant  
2014 Eric Yang, Northwestern University McCormick Undergraduate Student Summer Research Opportunities Award  
2014 Christina Chan, Northwestern University Biomedical Engineering Undergraduate Student Summer Research Award  
2014–2016 Ji Yi, Juvenile Diabetes Research Foundation (JDRF) postdoctoral fellow award.  
2013–2016 Wenzhong Liu, Howard Hughes Medical Institute (HHMI) International Fellowship, one of 42 in the U.S.A.  
2013–2014 Ji Yi, “Non-invasively quantifying retinal oxygen saturation by visible-light optical coherence tomography,” Research Seed Grant, Illinois Society for Prevention of Blindness  
2013 Chintan Pathak, Northwestern University Biomedical Engineering Undergraduate Student Summer Research Award  
2013 Kevin Zhang, Overall Oral Presentation Award, 2013 Chicago Area Undergraduate Research Symposium  
2012 Kevin Zhang, Northwestern University Undergraduate Research Grant  
2012 David Qiu and Kevin Zhang, *Fifty for the Future* award, Illinois Technology Foundation  
2012–2013 Qing Wei, “High-definition choroidal vascular imaging,” Research Seed Grant, Illinois Society for Prevention of Blindness  
2010 Karanvir S. Kaleka, Outstanding Undergraduate Student Award, College of Engineering & Applied Science, University of Wisconsin-Milwaukee

2010

Tan Liu, 1<sup>st</sup> Place Grand Award, graduate student poster competition, College of Engineering & Applied Science, University of Wisconsin-Milwaukee