BIOGRAPHICAL SKETCH

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NAME: **Guoqiang Yu**

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

POSITION TITLE: Professor, F. Joseph Halcomb III, M.D. Department of Biomedical Engineering, University of Kentucky

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
Tianjin University, Tianjin, P.R. China	B.S.	09/1986	Biomedical Engineering
Tianjin University, Tianjin, P.R. China	M.Sc.	03/1989	Biomedical Engineering
Tianjin University, Tianjin, P.R. China	Ph.D.	10/1999	Biomedical Engineering
University of Pennsylvania, Philadelphia, USA	Postdoc	06/2006	Physics & Astronomy

A. Personal Statement

I have a broad background in biomedical engineering with specific training and expertise in near-infrared spectroscopy and imaging. I am leading a team of graduate students and postdoctoral scholars to work continually on technology development and clinical translation of optical imaging technologies for tissue hemodynamic measurements in animals and humans. I have played a leading role in multiple collaborative projects supported by federal sponsors (e.g., NIH, DOD) and national foundations (e.g., AHA). Through these interdisciplinary studies, my group has established a rich portfolio of collaborations across bioengineering and medicine. Results from our collaborative studies have been published in many prestigious journals and led to a several patent applications.

1. T Li, Y Lin, Y Shang, L He, C Huang, M Szabunio, **G Yu**. Simultaneous measurement of deep tissue blood flow and oxygenation using noncontact diffuse correlation spectroscopy flow-oximeter. *Sci Rep* 3:1358, 2013. PMCID: PMC3584314
2. Y Lin, C Huang, D Irwin, L He, Y Shang, **G Yu**. Three-dimensional flow contrast imaging of deep tissue using noncontact diffuse correlation tomography (ncDCT). *Appl Phys Lett* 104(12):121103, 2014. PMCID: PMC3971827
3. C Huang, JP Radabaugh, RK Aouad, Y Lin, TJ Gal, AB Patel, J Valentino, Y Shang, **G Yu**. Noncontact diffuse optical assessment of blood flow changes in head and neck free tissue transfer flaps. *J Biomed Opt* 20(7):075008, 2015. PMCID: PMC4696658
4. L. Dong, M. Kudrimoti, D. Irwin, L. Chen, Y. Shang, X. Li, Scott D. Stevens, B. J. Shelton, **G. Yu**, "Diffuse optical measurements of head and neck tumor hemodynamics for early prediction of radiation therapy", *Journal of Biomedical Optics*, 21(8), 085004 (2016)

B. Positions and Honors

Positions

1999-2001 Research Scientist, Physikalisch-Technische Bundesanstalt (PTB), Germany
2001-2002 Postdoctoral Fellow, Physics & Astronomy, University of Pennsylvania
2002-2004 Research Associate, Physics & Astronomy, University of Pennsylvania
2004-2006 Senior Research Investigator, Physics & Astronomy, University of Pennsylvania
2006-2007 Research Assistant Professor, Physics & Astronomy, University of Pennsylvania
2007-2012 Assistant Professor, Department of Biomedical Engineering, University of Kentucky
2012-2016 Associate Professor, Department of Biomedical Engineering, University of Kentucky

2016-present Professor, F. Joseph Halcomb III, M.D. Department of Biomedical Engineering, University of Kentucky

Other Professional Experience

Editorial Boards

2010- Editorial Board Member for Journal of Cancer Therapy
2011- Editorial Board Member for Anatomy & Physiology
2012- Senior Editor Board Member for American Journal of Cancer Science
2012- Editorial Board Member for Journal of Spectroscopy
2015- International Advisory Board member for Physiological Measurements

Reviewer for Grants and Study Sections

2009 NIH study section review for RC3 and R43 ARRA grant applications (Washington DC)
2010 Hong Kong RGC Collaborative Research Fund
2011 University of Wisconsin-Milwaukee (UWM) Research Foundation
2012 American Association for the Advancement of Science Research Competitiveness Program through the King Abdulaziz City for Science and Technology
2013 COST-Switzerland office at the State Secretariat for Education, Research and Innovation SERI
2014 New Zealand Fast Start Application of Marsden Fund
2014 NIH study section review for MEDI (Washington DC)
2015 Israeli Ministry of Science, Technology and Space
2016 NIH study section review for MEDI (San Diego, CA)
2016 NIH study section review for SBIB-G 83 R15 (San Diego, CA)

Patents

2012 United States Letters Patent #8082015, "Optical Measurement of Tissue Blood Flow Hemodynamics and Oxygenation" (2012-2032)
2016 United States Letters Patent Application #15/07840, "Noncontact Three-dimensional Diffuse Optical Imaging of Deep Tissue Blood Flow Distribution" (Mar. 2016)
2016 United States Provisional Patent Application #62365119, "A Low-cost Compact Diffuse Speckle Contrast Flow-Oximeter using Small Laser Diodes and a Bare Charge-Coupled-Device" (July 2016)

Honors

2004 DOD New Investigator Award for Prostate Cancer Program (W81XWH-04-1-0006)
2004 Best Poster Award at the Institute for Medicine and Engineering (IME) Interdisciplinary Research Symposium 2004 (University of Pennsylvania)
2004, 2006 Second Place Winner of Young Investigators Awards Competition at 15th and 17th Annual Meeting of the Society of Vascular Medicine and Biology (SVMB)
2012 Notable Research Professor honored by University of Kentucky Chapter of the National Society of Black Engineers (University of Kentucky)
2015 Mentor Recognition Award, Center for Clinical and Translational Science 10th Annual Spring Conference (University of Kentucky)
2015 College of Engineering Dean's Award for Excellence in Research (University of Kentucky)
2016 A Teacher Who Made a Difference, College of Education (University of Kentucky)

C. Contribution to Science (>75 peer-reviewed articles)

1. State-of-the-art diffuse correlation spectroscopy (DCS) for the quantification of deep tissue blood flow. I worked in Dr. Arjun Yodh's laboratory at the University of Pennsylvania (UPenn) from 2001 to 2007, where I spent 5 years in various research positions and one year as a research assistant professor. My major role was to develop and validate a state-of-the-art diffuse correlation spectroscopy (DCS) for the quantification of deep tissue blood flow (up to ~15 mm depth). A hybrid instrumentation combining the DCS and conventional near-infrared spectroscopy (NIRS) was also invented and has been recently granted a US patent [US#8082015 (2012-2032)]. My research activities at UPenn were fairly independent, and well-funded via

three nationally competitive grants on which I was the principal investigator (NIH R21, AHA BGIA, and DOD New Investigator Award).

a. **G Yu**, T Durduran, C Zhou, HW Wang, ME Putt, HM Saunders, CM Sehgal, E Glatstein, AG Yodh, TM Busch. Noninvasive monitoring of murine tumor blood flow during and after photodynamic therapy provides early assessment of therapeutic efficacy. Clini Cancer Res 11(9), 3543-3552 (2005).
b. **G Yu**, T Durduran, C Zhou, TC Zhu, JC Finlay, TM Busch, SB Malkowicz, SM Hahn, AG Yodh. Real-time in situ monitoring of human prostate photodynamic therapy with diffuse light. Photochem Photobiol 82(5):1279-1284, 2006.
c. **G Yu**, TF Floyd, T Durduran, C Zhou, JA Detre, AG Yodh. Diffuse correlation spectroscopy for muscle blood flow: Validation with Arterial-spin-labeling perfusion MRI. Opt Express 15(3):1064-1075, 2007.
d. AG Yodh, JH Greenberg, **G Yu**, JA Detre, T Durduran, MG Burnett, ER Mohler III, H Quon, SM Hahn. Optical measurement of tissue blood flow, hemodynamics and oxygenation. Patent, US #8082015 (2012-2032)

2. Novel portable dual-wavelength DCS flow-oximeter for simultaneous measurement of deep tissue blood flow and oxygenation. Since joining the Department of Biomedical Engineering at the University of Kentucky as a faculty member in 2007, I have been continually working on technology development and clinical translation of diffuse optical technologies. My group has developed several novel instruments along with new theories/algorithms, including a truly portable dual-wavelength DCS flow-oximeter for simultaneous measurements of deep tissue blood flow and oxygenation. The new device has been successfully applied to the diagnosis and therapeutic monitoring of various diseases in brains, cancers, and skeletal muscles.

a. Y Shang, Y Zhao, R Cheng, L Dong, D Irwin, **G Yu**. Portable optical tissue flow oximeter based on diffuse correlation spectroscopy. *Opt Lett* 34(22):3556-3558, 2009. (Highlighted by Virtual Journal of Biological Physics Research)
b. **G Yu**, Y Shang, Y Zhao, R Cheng, L Dong, SP Saha. Intraoperative evaluation of revascularization effect on ischemic muscle hemodynamics using near-infrared diffuse optical spectroscopies. *J Biomed Opt* 16(2): 027004, 2011. PMCID: PMC3061333
c. R Cheng, Y Shang, S Wang, JM Evans, A Rayapati, DC Randall, **G Yu**. Near-infrared diffuse optical monitoring of cerebral blood flow and oxygenation for the prediction of vasovagal syncope. *J Biomed Opt* 19(1): 017001, 2014. PMCID: PMC3884846
d. B Henry, M Zhao, Y Shang, T Uhl, DT Thomas, ES Xenos, SP Saha, **G Yu**. Hybrid diffuse optical techniques for continuous hemodynamic measurement in gastrocnemius during plantar flexion exercise. *J Biomed Opt* 20(12): 125006, 2015. PMCID: PMC4688865

3. Novel noncontact diffuse correlation spectroscopy and tomography (ncDCS/ncDCT). Most DCS/DCT measurements use optical fibers in contact with tissues for photon collection and require tissues to conform to simple boundaries such as a slab, often requiring compression that can introduce a hemodynamic distortion of soft tissues or an infection of injured tissues. My group recently developed a novel noncontact DCS/DCT system for 3-D imaging of tissue blood flow contrasts. This system uses our unique lens-focusing technique to project the sources and detectors onto the tissue surface for hemodynamic measurements. We have tested this system on tissue phantoms and breasts with tumors.

a. Y Lin, L He, Y Shang, **G Yu**. Noncontact diffuse correlation spectroscopy for noninvasive deep tissue blood flow measurement. *J Biomed Opt Lett* 17(2): 010502, 2012. PMCID: PMC4019367
b. T Li, Y Lin, Y Shang, L He, C Huang, M Szabunio, **G Yu**. Simultaneous measurement of deep tissue blood flow and oxygenation using noncontact diffuse correlation spectroscopy flow-oximeter. *Sci Rep* 3:1358, 2013. PMCID: PMC3584314
c. Y Lin, C Huang, D Irwin, L He, Y Shang, **G Yu**. Three-dimensional flow contrast imaging of deep tissue using noncontact diffuse correlation tomography. *Appl Phys Lett* 104:121103, 2014. PMCID: PMC3971827
d. C Huang, Y Lin, L He, D Irwin, MM Szabunio, **G Yu**. Alignment of sources and detectors on breast surface for noncontact diffuse correlation tomography of breast tumors. *Appl Opt* 54(29): 8808-8816, 2015. PMCID: PMC4801123

4. Intraoperative monitoring of blood flow variations in reconstructive tissue flaps using ncDCS/ncDCT. We recently applied our ncDCS/ncDCT device to the clinic for intraoperative monitoring of dynamic blood flow changes in reconstructive flaps without getting in contact with the targeted tissue. Intraoperative measurements of blood flow variations in head and neck transfer flaps and in mastectomy skin flaps have demonstrated the great potential to predict ischemic flaps.

    a. C Huang, JP Radabaugh, RK Aouad, Y Lin, TJ Gal, AB Patel, J Valentino, Y Shang, **G Yu**. Noncontact diffuse optical assessment of blood flow changes in head and neck free tissue transfer flaps. *J Biomed Opt* 20(7): 075008, 2015. PMCID: PMC4696658
    b. NB Agochukwu, C Huang, M Zhao, **G Yu**, L Wong. A novel noncontact optical method for assessing blood flow in mastectomy skin flaps: a prospective study in patients undergoing prosthetic based reconstructions. Accepted for publication by the Society of Plastic Surgeons, 2016.

5. Novel prototype CCD-based speckle contrast diffuse correlation tomography (scDCT). One challenge left to address with ncDCS/ncDCT system is that limited source-detector pairs currently restrict its spatial and temporal resolution. Very recently, we developed a novel prototype CCD-based speckle contrast diffuse correlation tomography (scDCT) system with new algorithms for imaging reconstruction, which significantly reduced costs and increased the spatial-temporal resolution. Results from our pilot experiments with this novel imaging tool have been published in journals and have led to a pending patent application (US Letters Patent Application 15/07840).

    a. C Huang, D Irwin, Y Lin, Y Shang, W Kong, J Luo, **G Yu**. Speckle contrast diffuse correlation tomography (scDCT) of complex turbid media. *Med Phys Lett* 42: 4000-4006, 2015. PMCID: PMC4464064
    b. **G Yu**, Y Lin, C Huang. Noncontact Three-dimensional Diffuse Optical Imaging of Deep Tissue Blood Flow Distribution. US Letters Patent Application 15/07840 (Mar. 2016)
    c. C Huang, M Seong, JP Morgan, S Mazdeyasna, GG Kim, JT Hastings, **G Yu**. A low-cost compact diffuse speckle contrast flowmeter using small laser diode and bare charge-coupled-device chip. *J Biomed Opt Lett* 21(8): 80501, 2016. PMCID: PMC4975738

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/18UM8ca_uwA7/bibliography/47566616/public/?sort=date&direction=ascending"

D. Research Support

Ongoing Research Support

16GRNT30820006 (PI: Yu, G) 07/01/16-06/30/18
America Heart Association (AHA) Grant-In-Aid
"Spatially Resolved Diffuse Correlation Spectroscopy for Cerebral Blood Flow Monitoring in Mouse Stroke Model"
Goal: To develop a portable diffuse optical device for intraoperative monitoring of cerebral blood flow in stroke mice.
Role: PI

3048112770 (PI: Lesley Wong) 07/01/15-06/30/17
National Endowment for Plastic Surgery, Plastic Surgery Foundation
"Noncontact Diffuse Optical Assessment of Mastectomy Skin Flaps"
Goal: To measure tissue blood flow during mastectomy for prediction of treatment outcomes.
Role: Co-I

R21 AG046762 (PI: Thomas, DT) 08/15/14-05/31/17
NIH/NIA
"Vitamin D Contribution to Muscle Metabolic Function in the Elderly"
Goal: To study muscle hemodynamics and metabolism in response to the integration of Vitamin D and exercise training in the elderly with noninvasive diffuse optical technique and functional MRI.
Role: Co-I

No ID (PI: Sunderam, S) 08/01/15-07/31/19
NSF EPSCoR 1539068
“RII Track 2 FEC: Innovative, Broadly Accessible Tools for Brain Imaging, Decoding, and Modulation”
Goal: To develop innovative and broadly accessible brain imaging technologies to provide insight into how the nervous system functions in health and disease.
Role: Co-I

Completed Research Support (During the Last Three Years)

R01 CA149274 (PI: Yu, G) 07/01/10-04/30/16
NIH/NCI
“Diffuse Optical Monitoring of Head and Neck Tumor Therapy”
Goal: To develop and test a low-cost clinical-level optical instrument that can quickly assess head/neck tumor hemodynamic/metabolic status and responses to radiation therapy in early stages of cancer therapy.
Role: PI

R21 AR062356 (PI: Yu, G) 02/15/12-01/31/15
NIH/NIAMS
“Noncontact Diffuse Optical Assessment of Pressure Ulcer and Therapy”
Goal: To develop a noncontact diffuse optical system for early diagnosis and therapy monitoring of pressure ulcer.
Role: PI

No ID (PI: Yu, G) 07/01/13-06/30/14
UK Pilot Grant for Studies on Alzheimer's Disease
NIH P30 (#AG028383)
“Noninvasive Optical Diagnosis of Cerebrovascular Disease in Older Population”
Goal: To investigate the sensitivity of diffuse optical techniques in detecting cerebral vascular disease in the elderly.
Role: PI

No ID (PI: Yu, G) 03/01/12-02/28/14
UK CCTS Pilot Grant Program Supported by NIH UL-1RR033173
“Noncontact Diffuse Optical Quantification of Hemodynamic Contrast in Breast Tumor”
Goal: To develop a noncontact diffuse optical tomography system for 3-D imaging of tumor hemodynamic contrast.
Role: PI