

CURRICULUM VITAE

Joseph T. Walsh, Jr.
Vice President for Research
Northwestern University
633 Clark Street
Evanston, IL 60208

Education:

1977-1981 Massachusetts Institute of Technology, B.S. Electrical Engineering
 1981-1984 Massachusetts Institute of Technology, M.S. Electrical Engineering
 1984-1988 Harvard Medical School-Massachusetts Institute of Technology
 Division of Health Sciences and Technology, Ph.D. Medical Engineering

Positions:

1979-1984 Research Assistant, Biomedical Engineering Center, M.I.T.
 1981 Teaching Assistant, Department of Biology, M.I.T.
 1983-1988 Graduate Resident Advisor, M.I.T. undergraduate dormitory
 1984-1988 Research Assistant, Wellman Laboratories,
 Harvard Medical School, Massachusetts General Hospital
 1988-1994 Assistant Professor of Biomedical Engineering, Northwestern University
 1994-2000 Associate Professor of Biomedical Engineering, Northwestern University
 2000- Professor of Biomedical Engineering, Northwestern University
 2002-2005 Associate Dean for Graduate Studies and Research, McCormick School of Engineering,
 Northwestern University
 2005-2007 Senior Associate Dean, McCormick School of Engineering, Northwestern University
 2007- Vice President for Research, Northwestern University
 2007- Member, Board of Directors, Chicago Council on Science and Technology
 Board Chair starting in 2019
 2007- Member, Board of Governors, Argonne National Laboratory
 2007-2014 Member, Board of Directors, Fermi National Laboratory
 2010-2014 Member, Illinois Governor's Innovation Council
 2010- Chair, Big Ten Academic Alliance SRO Group
 2012-2019 Member, Secretary of Navy's Naval Research Advisory Committee (NRAC)
 2012-2013 Member, Fermi National Laboratory Director Search Committee
 2014 Member, Argonne National Laboratory Director Search Committee

- 2016-2019 Member, Secretary of the Navy Advisory Panel (SNAP)
- 2018- Member, UILabs Board of Directors
- 2018- Vice-chair, Digital Manufacturing and Design Innovation Institute Executive Committee
- 2018- Incoming Chair, University Industry Demonstration Partnership Board

Visiting Positions:

- 1996-97 Visiting Professor, Institute d'Optique Appliquée,
Ecole Polytechnique Fédérale de Lausanne, Switzerland

Awards and Honors:

- 1990 Northwestern University, Undergraduate Engineering Student Council Faculty Teaching Honor Roll
- 1992 National Science Foundation Young Investigator Award
- 1994,04,07,08 Northwestern University Associated Student Government Faculty Honor Roll
- 1997 Teacher of the Year Award, McCormick School of Engineering and Applied Sciences, Northwestern
- 1997 Vice-President, American Society for Lasers in Medicine and Surgery (elected to one-year term)
- 2002 Fellow, American Institute for Medical and Biological Engineering
- 2002 President, American Society for Lasers in Medicine and Surgery (elected 2002, term 2003-04)
- 2005 The Keynote Speaker, 25th Anniversary Meeting of
the American Society for Lasers in Medicine and Surgery
- 2005 Advisor of the Year Award, McCormick School of Engineering and Applied Sciences, Northwestern
- 2006 William B. Mark Award, American Society for Lasers in Surgery and Medicine
- 2007 Vice-President, American Society for Lasers in Medicine and Surgery (elected to one-year term)

Conferences Chaired:

- 1991-93 Conference Co-Chairman, 1993 Engineering Foundation Conference on
Future Applications of Lasers in Medicine and Surgery
- 1992-93 Program Chairman, 1993 Annual Meeting of the American Society for
Lasers in Medicine and Surgery
- 1994-96 Conference Co-Chairman, 1996 Gordon Conference on Lasers in Medicine and
Biology
- 2001-02 Program Chairman, 2002 Annual Meeting of the American Society for
Lasers in Medicine and Surgery
- 2002-03 Scientific Chair, Joint International Meeting of the American Society for Lasers in
Medicine and Surgery/British Medical Laser Society, and Europe Laser Association,
Edinburgh, Scotland, September 2003
- 2003-06 Chairman Scientific Program, 2006 Biomedical Engineering Society Annual Meeting
- 2009-10 Co-Chair Scientific Program, National Academy of Engineering Grand Challenges
Chicago Summit

Publications in Refereed Journals (Selected):

- Valvano JW, Allan JT, Walsh JT, Hnatowich DJ, Tomera JF, Brunengraber H, Bowman HF: An Isolated Rat Liver Model for the Evaluation of Thermal Techniques to Quantify Perfusion. *J Biomechanical Engineering* 106:187-191, 1984.
- Walsh JT, Flotte TJ, Anderson RR, Deutsch TF: Pulsed CO₂ Laser Tissue Ablation: Effect of Tissue Type and Pulse Duration on Thermal Damage. *Lasers in Surgery and Medicine* 8:108-118, 1988.
- Walsh JT, Deutsch TF: Pulsed CO₂ Laser Tissue Ablation: Measurement of the Ablation Rate. *Lasers in Surgery and Medicine* 8:264-275, 1988.
- LaMuraglia GM, Walsh JT, Prince MR, Gregory KW: Differential Ablation of Arterial Wall Components with a Pulsed CO₂ Laser. *Surgical Forum* 39:311-313, 1988.
- Walsh JT, Flotte TJ, Deutsch TF: Er:YAG Laser Ablation of Tissue: Effect of Pulse Duration and Tissue Type on Thermal Damage. *Lasers in Surgery and Medicine* 9:314-326, 1989.
- Walsh JT, Deutsch TF: Er:YAG Laser Ablation of Tissue: Measurement of Ablation Rates. *Lasers in Surgery and Medicine* 9:327-337, 1989.
- Walsh JT, Deutsch TF: Pulsed CO₂ Laser Ablation of Tissue: Effect of Mechanical Properties. *IEEE Transactions on Biomedical Engineering* 36:1195-1201, 1989.
- Schomaker KT, Walsh JT, Flotte TJ, Deutsch TF: Thermal Damage Produced by High-Irradiance Continuous Wave CO₂ Laser Cutting of Tissue. *Lasers in Surgery and Medicine* 10:74-84, 1990.
- Walsh JT, Deutsch TF: Measurement of Er:YAG Laser Ablation Plume Dynamics. *Applied Physics B* 52:217-224, 1991.
- Maitland DJ, Walsh JT, Prystowsky JB: Optical Properties of Human Gallbladder Tissue and Bile. *Applied Optics* 32:586-591, 1993.
- Cummings JP, Walsh JT: Tissue Tearing Caused by Pulsed Laser-Induced Ablation Pressure. *Appl Optics* 32:494-503, 1993.
- Cummings JP, Walsh JT: Erbium Laser Ablation: The Effect of Dynamic Optical Properties. *Appl Physics Letters* 62:1988-1990, 1993.
- Wigdor H, Abt E, Ashrafi S, Walsh JT: The Effect of Lasers on Dental Hard Tissues. *J Am Dental Assoc.* 124:65-70, 1993.
- Walsh JT, Cummings JP: Effect of the Dynamic Optical Properties of Water on Midinfrared Laser Ablation. *Lasers in Surgery and Medicine* 15:295-305, 1994.

- Visuri SR, Prystowsky JP, Walsh JT: Er:YAG Laser Ablation of Prairie Dog Gallbladder Epithelium for the Prevention of Gallstones. *Lasers in Surgery and Medicine* 15:358-363, 1994.
- Jaffe BJ, Walsh JT: Water Flux From Partial-Thickness Skin Wounds: Comparative Study of the Effects of Er:YAG and Ho:YAG Lasers. *Lasers in Surgery and Medicine*. 18:1-9, 1996.
- Visuri SR, Walsh JT, Wigdor HA: Erbium Laser Ablation of Dental Hard Tissue: Effect of Water Cooling. *Lasers in Surgery and Medicine*. 18:294-300, 1996.
- Visuri SR, Gilbert JL, Wright DD, Walsh JT, Wigdor HA: Shear Strength of Composite Bonded to Er:YAG Laser-Prepared Dentin. *Journal of Dental Research*. 75:599-605, 1996.
- Staveteig PT, Walsh JT: Dynamic 193-nm optical properties of water. *Applied Optics*. 35:3392-3402, 1996.
- Fried D, Visuri SR, Featherstone JDB, Walsh JT, Seka W, Glana RE, McCormack SM, Wigdor HA: Infrared Radiometry of Dental Enamel During Er:YAG and Er:YSGG Laser Irradiation. *J Biomedical Optics* 1:455-465, 1996.
- Maitland DJ, Walsh JT: Quantitative Measurements of Linear Birefringence during the Heating of Native Collagen. *Lasers in Surgery and Medicine* 20:310-318, 1997.
- Delacrétaz G, Walsh JT, Asshauer T: Dynamic Polaroscopic Imaging of Laser-Induced Strain in a Tissue Phantom: *Applied Physics Letters* 70:3510-3512, 1997.
- Fried NM, Walsh JT: Dye-Assisted Laser Skin Closure with Pulsed Radiation: An *in vitro* Study of Weld Strength and Thermal Damage. *J Biomed Optics* 3:401-414, 1998.
- Sankaran V, Walsh JT: Birefringence Measurement of Rapid Structural Changes During Collagen Denaturation. *Photochem Photobio* 68:846-851, 1998.
- Bull JL, Nelson LK, Walsh JT, Glucksberg MR, Shürch S, Grotberg JB: Surfactant-spreading and surface-compression disturbance on a thin viscous film. *J Biomech Eng* 121:89-98, 1999.
- Sankaran V, Schönenberger K, Walsh T, Maitland DJ: Polarization Discrimination Of Coherently Propagating Light In Turbid Media. *Applied Optics* 38:4252-4261, 1999.
- Sankaran V, Everett MJ, Maitland DJ, Walsh JT: Comparison Of Polarized Light Propagation In Biologic Tissue And Phantoms. *Optics Letters* 24:1044-46 1999.
- Fried NM, Choi B, Welch AJ, Walsh JT: Radiometric Surface Temperature Measurements during Dye-Assisted Laser Skin Closure: In Vitro and In Vivo Results. *Lasers Surg Med* 25:291-303, 1999.
- Fried NM, Hung VC, Walsh JT: Laser Tissue Welding: Laser Spot Size and Beam Profile Studies. *J. Special Topics in Quantum Electronics* 5:1004-1012, 1999.

- Sankaran V, Walsh JT, Maitland DJ: Polarized light propagation through tissue phantoms containing densely packed scatterers. *Optics Letters* 25: 239-241, 2000.
- Fried NM, Walsh JT: Cryogen spray cooling during laser tissue welding. *Phys. Med. Biol* 45:753-63, 2000.
- Fried NM, Choi B, Welch AJ, Walsh JT: Laser Skin Welding: In Vivo Tensile Strength and Wound Healing Results. *Lasers Surg Med* 27:55-65, 2000.
- Drummond JL, Wigdor HA, Walsh JT, Fadavi S, Punwani I: Sealant Bond Strengths of CO₂ Laser-Etched Versus Acid-Etched Bovine Enamel. *Lasers Surg Med* 27:111-118, 2000.
- Edney PA, Walsh JT: Acoustic Modulation and Photon-Phonon Scattering in Optical Coherence Tomography. *Applied Optics* 40:6381-8, 2001.
- Shori RK, Walston AA, Stafsudd OM, Fried D, Walsh JT: Quantification and Modeling of the Dynamic Changes in the Absorption Coefficient of Water at $\lambda = 2.94 \mu\text{m}$. *J. Special Topics in Quantum Electronics* 7:959-970, 2001.
- Sankaran V, Walsh JT, Maitland DJ: A Comparative Study Of Polarized Light Propagation In Biologic Tissues. *J. Biomedical Optics* 7: 300-306, 2002.
- Wigdor HA, Walsh JT: A Histological Analysis of the Effect on Dental Pulp of a 9.6- μm CO₂ Laser. *Lasers Surg Med* 30:261-266, 2002.
- Yonzon CR, Haynes CL, Zhang X, Walsh JT, Van Duyne RP: A Glucose Biosensor Based on Surface-Enhanced Raman Scattering: Improved Partition Layer, Temporal Stability, Reversibility, and Resistance to Serum Protein Interference. *Analytical Chemistry* 76:78-85, 2004.
- Kim YL, Walsh JT, Glucksberg MR: Phase-slope and group-dispersion calculations in the frequency domain by simple Optical low-coherence reflectometry. *Applied Optics* 42:6959-6966, 2003.
- Tseng SH, Greene JH, Taflove A, Maitland D, Backman V, Walsh JT: Exact Solution of Maxwell's Equations for Optical Interactions with a Macroscopic Random Medium. *Optics Letters* 29:1393-1395, 2004.
- Kim YL, Walsh JT, Goldstick TG, Glucksberg MR: Variation of corneal refractive index with hydration. *Physics Medicine Biology* 49:859 – 868, 2004.
- Izzo A, Walsh JT: Light-induced modulation of Porphyromonas gingivalis growth. *Journal of Photochemistry and Photobiology B: Biology* 77:63-69, 2004.
- Tseng SH, Kim YL, Taflove A, Maitland D, Backman V, Walsh JT: Simulation of Enhanced Backscattering of Light by Numerically Solving Maxwell's Equations without Heuristic Approximations. *Optics Express* 13:3666-3672, 2005.
- Tseng SH, Greene JH, Taflove A, Maitland D, Backman V, Walsh JT: Exact Solution of Maxwell's Equations for Optical Interactions with a Macroscopic Random Medium: Addendum, *Optics Letters* 30:56-7, 2005.

- Tseng SH, Taflove A, Maitland D, Backman V, Walsh JT: Investigation of the Noise-Like Structures of the Total Scattering Cross-Section for Random Media, *Optics Express* 13:6127-6132, 2005.
- Wu FI, Walsh JT, Glucksberg MR: Measurements of Choroidal Blood by Optical Coherence Tomography, *Appl Optics* 44:1426-33, 2005.
- Stuart DA, Ranjit-Yonzon C, Zhang X, Lyandres O, Shah NC, Glucksberg MR, Walsh JT, Van Duyne RP: Glucose Sensing Using Near Infrared Surface-Enhanced Raman Spectroscopy: Gold Surfaces, 10-Day Stability, and Improved Accuracy, *Analytical Chemistry* 77:4013-4019, 2005.
- Lyandres O, Shah NC, Ranjit-Yonzon C, Walsh JT, Glucksberg MR, Van Duyne RP: Real-Time Glucose Sensing by Surface-Enhanced Raman Spectroscopy in Bovine Plasma Facilitated by a Mixed Decanethiol/Mercaptohexanol Partition Layer. *Anal. Chem* 77:6134-6139, 2005.
- Wu PJ, Walsh JT: Stokes polarimetry imaging of rat-tail tissue in a turbid medium using incident circularly polarized light. *Lasers Surg Med* 37:395-406, 2005.
- Marraccini TM, Bachmann L, Wigdor HA, Walsh JT, Turbino ML, Stabholtz A, Zezell DM: Enamel and dentin irradiation with 9.6 μm CO₂ and 2.94 μm Er:YAG lasers: bond strength evaluation. *Laser Physics Letters* 3:96-101, 2006.
- Tseng S, Taflove S, Maitland D, Backman V, Walsh JT: Extracting Geometrical Information of Closely Packed Random Media from Multiply Scattered Light via a Cross-correlation Analysis, *IEEE Antenna and Wireless Propagation Letters* 5:91-94, 2006.
- Izzo AD, Richter C-P, Jansen ED, Walsh JT: Laser stimulation of the auditory nerve, *Lasers Surg Med* 38:745-753, 2006.
- Wu PJ, Walsh JT: Stokes polarimetry imaging of rat tail tissue in a turbid medium: degree of linear polarization image maps using incident linearly polarized light. *J. Biomed. Opt.* 11:014031-10, 2006.
- Stuart DA, Yuen JM, Shah NC, Lyandres O, Yonzon CR, Glucksberg MR, Walsh JT, Van Duyne RP: *In Vivo* Glucose Measurement by Surface-Enhanced Raman Spectroscopy, *Analytical Chemistry* 78:7211-7215, 2006.
- Izzo AD, Suh E, Pathria J, Whitlon DS, Walsh JT, Richter CP: Selectivity of neural stimulation in the auditory system: a comparison of optic and electric stimuli. *J Biomed Opt* 12:021008, 2007.
- Izzo AD, Walsh JT, Jansen ED, Webb J, Ralph H, Richter CP: Optical parameter variability in laser nerve stimulation: a study of pulse duration, repetition rate, and wavelength. *IEEE Trans Biomed Eng* 54:1108-14, 2007.
- Teudt IU, Nevel A, Izzo AD, Walsh JT, Richter CP: Optical stimulation of the facial nerve – a new monitoring technique? *The Laryngoscope* 117:1641-7, 2007.

- Shah NC, Lyandres O, Walsh JT, Glucksberg MR, Van Duyne RP: Lactate and Sequential Lactate-Glucose Sensing Using Surface-Enhanced Raman Spectroscopy. *Analytical Chemistry* 79:6927-32, 2007.
- Lyandres O, Yuen JM, Shah NC, Van Duyne RP, Walsh JT, Glucksberg MR: Progress toward an in vivo surface-enhanced Raman spectroscopy glucose sensor. *Diabetes Technol Ther* 10:257-65, 2008.
- Richter CP, Bayon R, Izzo AD, Otting M, Suh E, Goyal S, Hotaling J, Walsh JT: Optical stimulation of auditory neurons: effects of acute and chronic deafening. *Hearing Research* 242:42-51, 2008.
- Izzo AD, Walsh JT, Ralph H, Webb J, Bendett M, Wells J, Richter CP: Laser stimulation of auditory neurons: effect of shorter pulse duration and penetration depth. *Biophys J.* 94:3159-66, 2008.
- Lyandres O, Glucksberg MR, Walsh JT, Shah NC, Yonzon CR, Zhang X, Van Duyne RP: Surface-Enhanced Raman Sensors for Metabolic Analytes. In *Modern Concepts of Biomedical Vibrational Spectroscopy*, Kneipp, J., Lasch, P., Eds., John Wiley & Sons, Inc.; pp. 221-241, 2008.
- Kim J, John R, Wu PJ, Martini MC, Walsh JT: In vivo characterization of human pigmented lesions by degree of linear polarization image maps using incident linearly polarized light. *Lasers Surg Med.* 42:76-85, 2010.
- Shah, NC, Yuen, JM, Glucksberg, MR, Walsh, JT, Van Duyne, RP: Surface-Enhanced Raman Spectroscopy for Glucose Analysis. In *In Vivo Analytical Chemistry of Glucose*, Stenken J, Cunningham D, Eds, John Wiley & Sons, Inc 421-443, 2010.
- Lyandres O, Van Duyne RP, Walsh JT, Glucksberg MR, Mehrotra S: Robust Optimization for Prediction Range Estimation from Noisy Raman Spectra, *The Analyst* 135:2111-2118, 2010.
- Yuen JM, Shah NC, Walsh JT, Glucksberg MR, Van Duyne RP: Transcutaneous Glucose Sensing by Spatially Offset Surface-Enhanced Raman Spectroscopy in a Rat Model, *Analytical Chemistry* 82:8382-8385, 2010.
- Izzo Matic A, Walsh JT, Richter CP: Spatial extent of cochlear infrared neural stimulation determined by tone-on-light masking. *J Biomedical Optics* 16:118002-1 - 118002-8, 2011.
- Richter CP, Rajguru SM, Matic AI, Moreno LE, Fishman A, Robinson AJ, Suh E, Walsh JT: Spread of cochlear excitation during stimulation with optical radiation: Inferior colliculus measurements. *J. Neural Eng.* 8:056006-1 – 056006-11, 2011.
- Ma K, Yuen JM, Shah NC, Walsh JT, Glucksberg MR, Van Duyne RP: In Vivo, Transcutaneous Glucose Sensing Using Surface-Enhanced Spatially Offset Raman Spectroscopy: Multiple Rats, Improved Hypoglycemic Accuracy, Low Incident Power, and Continuous Monitoring for Greater Than 17 Days, *Analytical Chemistry* 83:9146-52, 2011.
- Richter CP, Matic AI, Wells JD, Jansen ED, Walsh JT: Neural stimulation with optical radiation. *Laser and Photonics Reviews* 5:68-80, 2011.

Patents

- Sires BS, Zukowski ML, Walsh JT: Bone Allograft Material and Method. US Patent # 5,112,354; May 12, 1992.
- Fried NM, Walsh JT: Method for welding tissue. US Patent # 6,221,068; April 24, 2001.
- Healy KE, Walsh JT, Dorfman GS: Thermo-mechanically Expandable Stent. US patent # 6,736,842; May 18, 2004.
- Healy KE, Walsh JT, Dorfman GS: Method for Deploying a Thermo-mechanically Expandable Stent. US patent # 6,607,553; August 19, 2003.
- Edney PA, Walsh JT: Signal processing using non-linear regression with a sinusoidal model. US patent # 7,574,253; August 11, 2009.
- Walsh JT, Wu PJ: System and method for imaging sub-surface polarization-sensitive material structures. US Patent # 7,289,211; October 30, 2007.
- Walsh, JT, Jansen ED, Izzo A, Richter CP: Apparatus and methods for optical stimulation of the auditory nerve. US patent # 7,833,257. November 16, 2010.
- Van Duyne RP, Glucksberg M, Peltier KE, Hayes CL, Walsh JT, Yonzon CR, Shah N, Lyandres O, Stuart DA, Yuen JM: Surface Enhanced Raman Nanobiosensor. US patent # 8,592,226; November 26, 2013.

Invited Scientific Talks (selected):

- “Time-resolved Measurements of Thermally-induced Changes in Collagen Birefringence”, *Institute d’Optique Appliquée, Ecole Polytechnique Fédérale de Lausanne, Switzerland*, March, 1996.
- “Lasers for the Dental Practitioner”, Keynote Address for *Northwestern University Dental School Research Symposium*, Chicago, IL, March, 1996.
- “Optical and Thermal Issues for the *In Vivo* Welding of Skin”, Special Seminar, Wellman Laboratories, *Massachusetts General Hospital, Harvard University*, February, 1999.
- "Polarized light imaging of tissue: stress propagation in phantoms and tissue", *Gordon Conference on Lasers in Medicine and Biology*. New London, CT, June 2000.
- “Basic Laser-Tissue Interactions and the Patient” Dermatology Grand Rounds, Cook County Hospital, Chicago, IL, May 2002.
- “Lasers and Living Tissue”, The Chicago SPIE/OSA Optical Group, Elmhurst, IL, November 2002.
- “Collagen – The Basics: Chemistry and Response to Light and Heat”, The Annual Meeting of the American Society for Lasers in Medicine and Surgery, Collagen Workshop, Anaheim April 2003.

- “Core Competencies in BME Lab Curricula”, PEBEL II, Biomedical Engineering Society Annual Meeting, Philadelphia, PA, October, 2004.
- “Cosmetics, Heart Disease, Cancer, Diabetes: ASLMS's History -- an Optic for the Future of Medicine”, Keynote Speaker, American Society for Lasers in Surgery 25th Annual Meeting, Orlando, FL, 1 April 2005.
- “Optical Imaging in Medicine and Biology: A Paradigm for the Interrogation of Art?” Art Institute of Chicago. 17 March 2005.
- “Polarization: The (Nearly) Forgotten Parameter”, Plenary Session, Mark Award Presentation. American Society for Lasers in Medicine and Surgery Annual Meeting, Boston, 7 April 2006
- “Optical Stimulation of Neural Tissue: Results from the Auditory System” Massachusetts General Hospital. 18 May 2007.
- “Climate Change R&D at Research Universities”, National Council on Energy Policy, May 2008.
- “Linking the Resources of Major Research Universities”, American Association for the Advancement of Science Annual Meeting, February, 2009.