

## CURRICULUM VITAE

**Joseph T. Walsh, Jr.**  
**Biomedical Engineering Department**  
**Northwestern University**  
**2145 Sheridan Road**  
**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- Senior Associate Dean, McCormick School of Engineering, Northwestern University

### 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, 2004, 2007 Northwestern University Associated Student Government Faculty/Administrator 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, 25<sup>th</sup> 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

Publications in Refereed Journals

- 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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. *Applied Optics* 32:494-503, 1993.
- Cummings JP, Walsh JT: Erbium Laser Ablation: The Effect of Dynamic Optical Properties. *Applied Physics Letters* 62:1988-1990, 1993.
- Wigdor H, Abt E, Ashrafi S, Walsh JT: The Effect of Lasers on Dental Hard Tissues. *J American 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, Glenna 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(4):401-414, 1998.
- Sankaran V, Walsh JT: Birefringence Measurement of Rapid Structural Changes During Collagen Denaturation. *Photochem Photobiol* 68(6): 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(19):4252-4261, 1999.
- Sankaran V, Everett MJ, Maitland DJ, Walsh JT: Comparison Of Polarized Light Propagation In Biologic Tissue And Phantoms. *Optics Letters* 24(15): 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 and Joseph T. Walsh: Laser Tissue Welding: Laser Spot Size and Beam Profile Studies. *J. Special Topics in Quantum Electronics* 5(4):1004-1012, 1999.
- Sankaran V, Walsh JT, Maitland DJ: Polarized light propagation through tissue phantoms containing densely packed scatterers. *Optics Letters* 25(4): 239-241, 2000.
- Fried NM, Walsh JT: Cryogen spray cooling during laser tissue welding. *Phys. Med. Biol* 45(3):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(1):55-65, 2000.
- Drummond JL, Wigdor HA, Walsh JT, Fadavi S, Punwani I: Sealant Bond Strengths of CO<sub>2</sub> 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(34): 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(6):959-970, 2001.
- Sankaran V, Walsh JT, Maitland DJ: A Comparative Study Of Polarized Light Propagation In Biologic Tissues. *J. Biomedical Optics*. 7(3), 300-306, 2002.
- Wigdor, HA, Walsh JT: A Histological Analysis of the Effect on Dental Pulp of a 9.6- $\mu\text{m}$  CO<sub>2</sub> Laser. *Lasers Surg Med* 30(4): 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(34): 6959-6966, 2003.
- Tseng SH, Greene JH, Taflove A, Maitland D, Backman V, Walsh JT: Initial Exact Solution of Maxwell's Equations for Optical Interactions with a Macroscopic Random Medium. *Optics Letters* 29(12): 1393-1395, 2004.
- Kim YL, Walsh JT, Goldstick TG, Glucksberg MR: Variation of corneal refractive index with hydration. *Physics Medicine Biology*, 49 (5):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, S.H., Kim, Y.L., Taflove, A., Maitland, D., Backman, V., Walsh, J.T.: Simulation of Enhanced Backscattering of Light by Numerically Solving Maxwell's Equations without Heuristic Approximations. *Optics Express* 13: 3666-3672, 2005.
- Tseng, S.H., Greene, J.H., Taflove, A., Maitland, D., Backman, V., Walsh, J.T.: Exact Solution of Maxwell's Equations for Optical Interactions with a Macroscopic Random Medium: Addendum, *Optics Letters*, 2005.
- Tseng, S.H., Taflove, A., Maitland, D., Backman, V., Walsh, J.T.: 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, *Applied Optics*, 2005
- Stuart, D.A., Ranjit-Yonzon, C., Zhang, X., Lyandres, O., Shah, N.C., Glucksberg, M.R., Walsh, J.T., Van Duyne, R.P.: 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, N.C., Ranjit-Yonzon, C., Walsh, J.T., Glucksberg, M.R., Van Duyne, R.P.: 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(5):395-406, 2005.
- Marraccini TM, Bachmann L, Wigdor HA, Walsh JT, Turbino ML, Stabholtz A, Zzell DM: Enamel and dentin irradiation with 9.6  $\mu\text{m}$  CO<sub>2</sub> and 2.94  $\mu\text{m}$  Er : YAG lasers: bond strength evaluation. *Laser Physics Letters* 3: 96-101, 2006.
- 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 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, Walsh JT, Jansen ED, Webb J, Ralph H, and Richter C-P. Optical parameter variability in laser nerve stimulation: a study of pulse duration, repetition rate, and wavelength. *IEEE Trans Biomed Eng* 54:1108-14, 2007.
- Izzo AD, Richter C-P, Jansen ED, and Walsh JT. Laser stimulation of the auditory nerve, *Lasers Surg Med* 38(8): 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 D. A., Yuen J. M., Shah N. C., Lyandres O., Yonzon C. R., Glucksberg M. R., Walsh J. T., Van Duyne R. P. : *In Vivo* Glucose Measurement by Surface-Enhanced Raman Spectroscopy, *Anal. Chem.*, 78, 7211-7215, 2006.
- Izzo AD, Suh E, Pathria J, Whitlon DS, Walsh JT, and Richter C-P. Selectivity of neural stimulation in the auditory system: a comparison of optic and electric stimuli, *J Biomed Opt* 12(2), March/April 2007.
- Teudt IU, Nevel A, Izzo AD, Walsh JT, Richter CP: Optical stimulation of the facial nerve – a new monitoring technique? *The Laryngoscope* (in press).
- Shah NC, Lyandres O, Walsh JT, Glucksberg MR, Van Duyne RP: Lactate and Sequential Lactate-Glucose Sensing Using Surface-Enhanced Raman Spectroscopy. *Analytical Chemistry* (in press)

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 using pulsed radiation and a dye. US Patent # 6,221,068 B1; April 24, 2001.
- Healy KE, Walsh JT, Dorfman GS: Method for Deploying a Thermo-mechanically Expandable Stent. US patent 6,736,842 (issued 18 May 2004) and separately in the EU, 2001
- Walsh JT, Kitagawa R: Coupler for End-to-End Microvascular Anastomosis. Disclosure submitted, 2002.
- Edney PA, Walsh JT: Acoustically Enhanced Optical Coherence Tomography. Disclosure submitted, 2003, patent pending.
- Edney PA, Walsh JT: Processing of Optical Coherence Tomography Signals. Disclosure submitted, 2003; patent pending.
- van Duyne RP, Glucksberg MR, Shafer-Peltier KE, Haynes CL, Walsh JT: Surface-Enhanced Raman Nanobiosensor for Multianalyte Detection. Disclosure submitted, 2003, 2005, 2005.
- Walsh JT, Wu PJ: Stoke Polarimetry Based Method of Imaging. Accepted (expected issue date: fall 2007)

Review Articles

- Parrish JA, Walsh JT: Potentials for Progress in Laser Medicine. *Yale J Biology and Medicine*. 58:535-545, 1985. (invited)
- Walsh JT, Parrish JA: Lasers: the healing tool of the future. *IEEE Potentials*. 4:36-39, 1985. (invited)
- Walsh JT: Systems and Applications: Lasers in Surgery and Medicine. *IEEE Lasers and Electro-optics Society Newsletter* 6(5):1-17, 1993. (invited)
- Wigdor HA, Walsh JT, Featherstone JDB, Visuri SR, Fried D, Waldvogel JL: Lasers in Dentistry *Lasers in Surgery and Medicine* 16:103-133, 1995. (invited)
- Riesbeck CK, Qiu L, Weusijana BK, Walsh JT, Parsek M: Learning technologies to foster critical reasoning. *IEEE Engineering In Medicine And Biology Magazine* 22 (4): 55-58. 2003 (invited)

Invited Talks (selected):

- "Mid-Infrared Laser Cutting of Dental Hard Tissues", *Gordon Conference on Lasers in Medicine and Biology*. Meriden, NH, July 1994.
- "Linear Birefringence-Based Methods of Rapidly Quantifying Tissue Thermodynamic Properties", *University of Minnesota Biomedical Engineering Seminar Series*, May 1994.
- "Laser-Cutting of Tissue: Effect of Dynamic Optical Properties on Ablation Thermodynamics", *University of Minnesota Mechanical Engineering Seminar Series*, May 1994.
- "Tissue Birefringence: Toward an Understanding and Control of Structural Changes in Tissue", *Institute für Biomedizinische Technik und Medizinische Informatik*, Universität & ETH Zürich, September 1994.
- "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.
- "The Photophysics and Photobiology of Laser-Tissue Interactions", *Surgical Applications of Energy Sources*, Estes Park, CO, May, 1996.
- "Rapid Denaturation of Collagen", *Institute d'Optique Appliquée, Ecole Polytechnique Fédérale de Lausanne*, Switzerland, March, 1997.
- "Thermal Denaturation of Collagen: Heating Times from  $10^{-3}$  to  $10^{+3}$  Seconds", *Institute d'Optique Appliquée, Ecole Polytechnique Fédérale de Lausanne*, Switzerland, June, 1997.
- "Er:YAG and CO<sub>2</sub> Laser Ablation of Dental Hard Tissues", *ESC Medical Systems, Inc.* Cesarea, Israel, July 1998.
- "Optical and Thermal Issues for the *In Vivo* Welding of Skin", Special Seminar, Wellman Laboratories, *Massachusetts General Hospital, Harvard University*, February, 1999.
- "Thermal Welding of Tissue: Optical, Thermal, and Healing Studies in a Skin Model", *Marquette University Biomedical Engineering Department Seminar Series*, March 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 25<sup>th</sup> 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.