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Date of birth: June 19, 1974

Citizenship: U.S.A.

Education

1988 – 1992	Diploma, Mission San Jose High School Cumulative GPA : 4.000
1992 – 1996	B.S. with honors, Bioengineering University of California, Berkeley Emphasis: Electronic Instrumentation <i>Cumulative GPA</i> : 3.697
1996 – 2001	 Ph.D., Bioengineering University of California, Berkeley and San Francisco Major area: Medical Imaging, Minor Areas: Oncology, Computer Vision Thesis: "Applications of Proton Magnetic Resonance Spectroscopic Imaging in Radiation Therapy of Malignant Glioma" <i>Cumulative GPA</i> : 3.967

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<u>Employment</u>	
1996 – 2001	Graduate Research Assistant Magnetic Resonance Science Center, Department of Radiology University of California, San Francisco <i>Research summary</i> : My research at the MRSC involved the use of magnetic resonance spectroscopic imaging (MRSI) to improve diagnosis and followup of brain tumors, particularly after radiation therapy. My doctoral thesis focused on research performed at this institution on the use of these techniques to characterize response to radiation in both neoplastic and normal brain tissue. The execution of this research required both the engineering of magnetic resonance acquisition and analysis techniques as well as clinical research with brain tumor patients. Specifically, this involved designing software for displaying, registering, and analyzing magnetic resonance images and spectroscopy as well as radiation treatment data, implementing improvements to the spectroscopy acquisition sequence, and collecting and analyzing of clinical and research data from a large population of brain tumor patients undergoing treatment. This work bettered our understanding of the factors involved in successfully treating a brain tumor with radiation, and therefore significantly improved the clinical management of brain tumor patients.
2001 – 2003	Postdoctoral Fellow Center for Molecular Imaging Research, Department of Radiology Massachusetts General Hospital <i>Research summary</i> : At the CMIR I developed imaging techniques for use in conjunction with contrast agents targeted at specific molecular events, particularly events significant in the development of cancer. Specifically, I engineered fluorescence-mediated molecular tomography (FMT) hardware and software for application in three-dimensional fluorescence imaging of murine tumor models. I also developed software for multimodal image visualization and display to facilitate more thorough biomedical investigations using optical, magnetic resonance, nuclear medicine, and other imaging technologies.
2003 – present	Assistant Professor Director, Imaging Radiobiology Laboratory Division of Radiation Physics, Department of Radiation Oncology Stanford University, California <i>Research summary</i> : I am interested in applications of emerging functional and molecular imaging techniques in radiation therapy of cancer. In order to integrate these novel imaging procedures with state-of-the-art radiation therapy, a number of issues must be addressed. First, what are the molecular targets that hold the most promise for targeting and monitoring response to radiation therapy, and how can they best be visualized <i>in vivo</i> ? Second, what are the limitations of novel imaging techniques that may bear on their application in radiation oncology? Third, how can one display, analyze, and segment multiple three-dimensional datasets to generate target volumes for radiotherapy? And finally, how will the information contained in imaging results of different modalities be integrated into the selection of a treatment

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course for a patient and subsequently, where appropriate, the specification of an optimized radiation target? These questions comprise my research. Projects that address these topics include the development and validation of novel methods for preclinical and clinical imaging of tumor hypoxia and hypoxia-inducible physiology, study of tumor hypoxia and radioresistance in small animal models using a multimodality molecular imaging approach, implementation and evaluation of clinical PET/CT imaging for radiation treatment planning, and development of software for multimodal image analysis.

Publications

Peer-Reviewed Papers: Published and In Press

- 1. Zarándy A, Orzó L, **Grawes E**, Werblin F. CNN-Based Models for Color Vision and Visual Illusions. *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications* 1999; 46:229-238.
- Graves EE, Nelson SJ, Vigneron DB, Chin C, Verhey L, McDermott M, Larson D, Sneed PK, Chang S, Prados MD, Lamborn K, Dillon WP. A Preliminary Study of the Prognostic Value of Proton Magnetic Resonance Spectroscopic Imaging in Gamma Knife Radiosurgery of Recurrent Malignant Gliomas. *Neurosurgery* 2000; 46:319-328.
- 3. Graves EE, Nelson SJ, Vigneron DB, Verhey L, McDermott M, Larson D, Chang S, Prados MD, Dillon WP. Serial Proton MR Spectroscopic Imaging of Recurrent Malignant Gliomas after Gamma Knife Radiosurgery. *American Journal of Neuroradiology* 2001; 22:613-624.
- 4. Pirzkall A, McKnight TR, **Graves EE**, Carol MP, Sneed PK, Wara WW, Nelson SJ, Verhey LJ, Larson DA. MR-Spectroscopy Guided Target Delineation for High-Grade Gliomas. *International Journal of Radiation Oncology Biology Physics* 2001; 50:915-928.
- 5. **Graves EE**, Pirzkall A, Nelson SJ, Verhey L, Larson D. Registration of Magnetic Resonance Spectroscopic Imaging to Computed Tomography for Radiotherapy Treatment Planning. *Medical Physics* 2001; 28:2489-2496.
- 6. Ntziachristos V, Bremer C, Graves EE, Weissleder R. In-vivo tomographic imaging of nearinfrared fluorescent probes. *Journal of Molecular Imaging* 2002; 1:82-88.
- 7. **Graves EE**, Pirzkall A, McKnight TR, Vigneron DB, Larson DA, Verhey LJ, McDermott M, Chang S, Nelson SJ. Use of Proton Magnetic Resonance Spectroscopic Imaging Data for Planning Focal Radiation Therapies. *Image Analysis and Stereology* 2002; 21:69-76.
- 8. Pirzkall A, Nelson SJ, McKnight TR, Takahashi MM, Li X, **Graves EE**, Verhey LJ, Wara WW, Larson DA, Sneed PK. Metabolic imaging of low-grade gliomas with three-dimensional magnetic resonance spectroscopy. *International Journal of Radiation Oncology Biology Physics* 2002; 53:1254-1264.
- McKnight TR, von dem Bussche MH, Vigneron DB, Lu Y, Berger MS, McDermott MW, Dillon WP, Pirzkall A, Graves EE, Nelson SJ. Histopathological validation of a three-dimensional magnetic resonance spectroscopy index as a predictor of tumor presence. *Journal of Neurosurgery* 2002; 97:794-802.
- Nelson SJ, Graves E, Pirzkall A, Li X, Chan AA, Vigneron D, McKnight TR. In Vivo Molecular Imaging for Planning Radiation Therapy of Gliomas: An Application of 1H MRSI. *Journal of Magnetic Resonance Imaging* 2002; 16:464-476.
- 11. Graves EE, Ripoll J, Weissleder R, Ntziachristos V. A Sub-Millimeter Resolution Fluorescence Molecular Imaging System for Small Animal Imaging. *Medical Physics* 2003; 30:901-911.
- 12. Kircher MF, Allport JR, **Graves EE**, Love V, Josephson L, Lichtman AH, Weissleder R. In vivo high resolution three-dimensional imaging of antigen-specific cytotoxic T-lymphocyte trafficking to tumors. *Cancer Research* 2003; 63:6838-6846.
- 13. Graves EE, Culver JP, Ripoll J, Weissleder R, Ntziachristos V. Singular-value analysis and optimization of experimental parameters in fuorescence molecular tomography. *Journal of the Optical Society of America A* 2004; 21:231-241.

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- 14. Graves EE, Weissleder R, Ntziachristos V. Fluorescence Molecular Imaging of Small Animal Tumor Models (Review). *Current Molecular Medicine* 2004; 4:419-430.
- 15. Ntziachristos V, Schellenberger EA, Ripoll J, Yessayan D, **Graves E**, Bogdanov A, Josephson L, Weissleder R. Visualization of antitumor treatment by means of fluorescence molecular tomography with an annexin V-Cy 5.5 conjugate. *Proceedings of the National Academy of Sciences of the United States of America* 2004, 101:12294-12299.
- Li X, Vigneron DB, Cha S, Graves EE, Crawford F, Chang SM, Nelson SJ. Relationship of MR-Derived Lactate, Mobile Lipids, and Relative Blood Volume for Gliomas *in Vivo*. *American Journal of Neuroradiology* 2005, 26:760-769.
- 17. Graves ÉE, Yessayan D, Turner G, Weissleder R, Ntziachristos V. Validation of *In Vivo* Fluorochrome Concentrations Measured Using Fluorescence Molecular Tomography. *Journal of Biomedical Optics* 2005, 10:04419.
- Catalaa I, Henry R, Dillon WP, Graves EE, McKnight TR, Lu Y, Vigneron DB, Nelson SJ. Perfusion, Diffusion and Spectroscopy Values in Newly Diagnosed Cerebral Gliomas. NMR in Biomedicine 2006, 19:463-475.
- 19. Graves EE, Giaccia AJ. Imaging Tumoral Hypoxia: Oxygen Concentrations and Beyond. Oncology 2007, 21:368-378.
- 20. Graves EE, Quon A, Loo BW. RT_Image: An Open Source Tool for Investigating PET in Radiation Oncology. *Technology in Cancer Research and Therapy* 2007, 6:111-121.
- Cecic I, Chan D, Sutphin P, Ray P, Gambhir SS, Giaccia A, Graves EE. Oxygen sensitivity of reporter genes: implications for preclinical imaging of tumor hypoxia. *Molecular Imaging* 2007, 6: 219-228.
- 22. Cheng Z, Zhang L, **Graves E**, Xiong Z, Dandekar M, Chen X, Gambhir SS. Small-animal PET of melanocortin 1 receptor expression using a 18F-labeled alpha-melanocyte-stimulating hormone analog. *Journal of Nuclear Medicine* 2007, 48:987-994.
- 23. Graves EE, Cecic IK, Zhang L, Giaccia AJ. Imaging Hypoxia-Inducible Pathways as Prognostic Biomarkers for Cancer. *Frontiers in Bioscience* (in press).
- 24. Lee P, Weerasuriya D, Le Q, Lavori PW, Quon A, Hara W, Wakelee H, Graves E, Loo BW. Metabolic Tumor Burden Predicts for Disease Progression in Lung Cancer. *International Journal of Radiation Oncology Biology Physics* 2007, 69: 328-333.
- 25. **Graves EE**, Zhou H, Chatterjee R, Keall PJ, Gambhir SS, Contag CH, Boyer AL. Design and Evaluation of a Variable Aperture Collimator for Conformal Radiotherapy of Small Animals Using a MicroCT Scanner. *Medical Physics* 2007, 34: 4359-4367.
- 26. Le QT, Koong A, Lieskovsky YY, Narasimhan B, Graves E, Pinto H, Brown JM, Spielman D. In vivo(1)H Magnetic Resonance Spectroscopy of Lactate in Patients with Stage IV Head-and-Neck Squamous Cell Carcinoma. *International Journal of Radiation Oncology Biology Physics* 2008; 71:1151-1157.
- Bennewith KL, Huang X, Ham CM, Graves EE, Erler JT, Kambham N, Feazell J, Yang GP, Koong A, Giaccia AJ. The Role of Tumor Cell-Derived Connective Tissue Growth Factor (CTGF/CCN2) in Pancreatic Tumor Growth. *Cancer Research* 2009; 69:775-784.
- 28. Zhou H, Keall PJ, **Graves EE**. A Bone Composition Model for Monte Carlo X-Ray Transport Simulations. *Medical Physics* 2009; 36:1008-1018.
- 29. Rodriguez M, Zhou H, Keall P, **Graves E**. Commissioning of a Novel MicroCT/RT System for Small Animal Conformal Radiotherapy. *Physics in Medicine and Biology* 2009; 54:3727-3740.
- Minn AY, Schellenberg D, Maxim P, Cox B, Dieterich S, Xing L, Graves E, Goodman K, Chang D, Koong AC. Pancreatic tumor motion on a single planning 4D-CT does not correlate with intrafraction tumor motion during treatment. *American Journal of Clinical Oncology* 2009; 32:364-368.
- 31. La TH, Filion EJ, Turnbull BB, Chu JN, Lee P, Nguyen K, Maxim P, Loo BW, Quon A, Graves EE, Le QT. Metabolic Tumor Volume Predicts for Recurrence and Death in Head and Neck Cancer. *International Journal of Radiation Oncology Biology Physics* 2009; 74:1335-1341.
- 32. Cairns R, Bennewith K, **Graves E**, Giaccia A, Chang D, Denko N. Pharmacologically increased tumor hypoxia can be measured by ¹⁸F FAZA PET and enhances tumor response to hypoxic cytotoxin PR-104. *Clinical Cancer Research* 2009; Epub ahead of print.

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- 33. Schellenberg D, Quon A, Minn YA, **Graves EE**, Kunz P, Ford JM, Fisher GA, Goodman KA, Koong AC, Chang DT. ¹⁸Fluorodoxyglucose-PET is prognostic of progression free and overall survival in locally advanced pancreas cancer treated with stereotactic radiotherapy. *International Journal of Radiation Oncology Biology Physics* (in press).
- 34. Bazalova M, Zhou H, Keall PJ, Graves EÉ. Kilovoltage beam Monte Carlo dose calculations in sub-millimeter voxels for small animal radiotherapy. *Medical Physics* 2009; 36:4991-4999.
- 35. Graves EE, Maity A, Le QT. The tumor microenvironment in NSCLC. Seminars in Radiation Oncology (in press).
- 36. Zhou H, Xu J, Rodriguez M, van den Haak F, Zhu X, Xian Y, Nelson G, Jogani R, Keall PJ, **Graves EE**. Development of a MicroCT-Based Image-Guided 3D Conformal Radiotherapy System for Small Animals. *International Journal of Radiation Oncology Biology Physics* (in press).
- 37. Motomura AR, Bazalova M, Zhou H, Keall PJ, **Graves EE**. Investigation of the effects of treatment planning variables in small animal radiotherapy dose distributions. *Medical Physics* (in press).

Peer-Reviewed Papers: Submitted and In Preparation

- Behera D, Kamaya S, Rosenberg J, Lee SW, Graves E, Gold G, Yeomans D, Biswal S. Manganese-enhanced MRI (MEMRI) Functionally Highlights Injured Peripheral Nerves in Neuropathic Pain. *Journal of Neuroscience* (submitted).
- 39. Bennewith KL, Koehne AL, Ham CM, Jia JX, LePard NE, Yang GP, **Graves EE**, Giaccia AJ. PR-104 targets hypoxic tumor cells in orthotopic and metastatic human pancreatic tumor xenografts. *Clinical Cancer Research* (submitted).
- 40. Apte SD, Zhang L, Cecic I, Cheng Z, Gambhir SS, **Graves EE**. Radiosynthesis, In Vitro Cell Uptake, and MicroPET Imaging of [18F]-2,3,5,6-tetrafluoro-3'-sulfamoylbenzanilide, a Potential PET Probe for Carbonic Anhydrase IX. *Nuclear Medicine and Biology* (in preparation).
- 41. Bazalova M, Zhou H, Keall PJ, Graves EE. Monte Carlo treatment planning for small animal microCT-based radiotherapy: tissue segmentation. *Radiotherapy and Oncology* (in preparation).
- 42. Graves EE, Cecic IK, Erler JT, Ham Č, Le QT, Giaccia AJ. Patterns of Hypoxia in Subcutaneous and Orthotopic Models of Lung Cancer. *Nature Medicine* (in preparation).

Book Chapters

- 1. McDermott MW, Chang SM, Keles GE, Graves EE, Nelson SJ, Larson DA, Berger MS. Gamma Knife Radiosurgery for Primary Brain Tumors. In: Germano IM, ed. *LINAC and Gamma Knife Radiosurgery*. Park Ridge: American Association of Neurological Surgeons; 2000; 189-202.
- 2. Graves EE, Xing L, Loo BW, Quon A. Molecular Imaging and PET/CT. In: Leibel S, Hoppe R, Phillips T, eds. *Textbook of Radiation Oncology*. In press.
- 3. Graves EE, Bazalova M. X-ray Computed Tomography Principles and Contrast Agents. In: Chen X, ed. *Molecular Imaging Probes for Cancer Research*. In press.

Abstracts

- Zarándy A, Grawes E, Roska T, Werblin F, Chua LO. CNN Model for Identifying Colors under Different Illumination Conditions via Land's Experiments. Presented at the 4th IEEE International Workshop on Cellular Neural Networks and their Applications, Seville, Spain, June 24-26 1996.
- Graves EE, Nelson SJ, Vigneron DB, Day MR, Noworolski SM, Henry RG, Verhey L, Dillon WP. Changes in Contrast Enhancing Volume of Intracranial Neoplasms in Response to Gamma Knife Radiosurgery. Presented at the 6th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Sydney, Australia, April 18-24, 1998.
- 3. **Graves EE**, Nelson SJ, Vigneron DB, Chin C, Verhey L, Dillon WP. ¹H-Spectroscopic Imaging as a Prognostic Indicator for Gamma Knife Radiosurgery. Presented at the ISMRM Experimental and Clinical Cancer Research Workshop, St. Louis, MO, November 13-15, 1998.
- 4. **Graves EE**, Nelson SJ, Vigneron DB, McKnight TR, Chin C, Chang S, Verhey L, Dillon WP. Quantitative Evaluation of Brain Tumor Response to Gamma Knife Radiosurgery Using ¹H-

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Spectroscopic Imaging. Presented at the 7th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Philadelphia, PA, May 22-28, 1999.

- 5. Catalaa I, Henry R, Hanna M, **Graves T**, Nelson S, Vigneron D. Three-Dimensional Diffusion, Perfusion and H1-Spectroscopy Measures in Gliomas. Presented at the 8th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Denver, CO, April 1-7, 2000.
- Lee JI, Graves EE, Nelson SJ, Vigneron DB, Dillon WP. Serial Evaluation of Gliomas Using a Multimodal Magnetic Resonance Approach: A Case Study of Patients in the Marimastat Phase II Clinical Trial. Presented at the 8th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Denver, CO, April 1-7, 2000.
- Graves EE, Lee JI, Nelson SJ, Vigneron DB, Verhey L, Larson D, McDermott M, Fischbein NJ, Dillon WP. Improved Diagnosis of Brain Tumor Recurrence Using MR Spectroscopy: A Case Study of Patients in the Marimastat Clinical Trial. Presented at the 38th Annual Meeting of the American Society of Neuroradiology, Atlanta, GA, April 2-8, 2000.
- Lee JI, Graves EE, Nelson SJ, Vigneron DB, Chang SM, Prados M, Larson D, McDermott M, Verhey L, Dillon WP. Serial Evaluation of Gliomas Using a Multimodal Magnetic Resonance Approach: A Case Study of Patients in the Marimastat Phase II Clinical Trial. Presented at the 4th Biennial AANS/CNS Brain Tumor Satellite Symposium, San Francisco, CA, April 13-14, 2000.
- Pirzkall A, Graves E, McKnight TR, Larson DA, Sneed PK, Wara WM, Nelson SJ, Verhey LJ. Magnetic Resonance Spectroscopy Guided Integrated Boost Irradiation for High Grade Gliomas Using IMRT. Presented at the 13th Conference on the Use of Computers in Radiation Therapy, Heidelberg, Germany, May 22-25, 2000.
- Graves EE, Nelson SJ, Day MR, Verhey L, Dillon WP. Integration of Radiology and Radiation Oncology Data for Improved Clinical Management of Brain Tumor Patients. Presented at the World Congress on Medical Physics and Biomedical Engineering, Chicago, IL, July 23-28, 2000.
- 11. Graves EE, Nelson SJ, Lee JI, Vigneron DB, Verhey LJ, Larson D, Chang S, McDermott M, Dillon WP. Uses of Proton Magnetic Resonance Spectroscopic Imaging in Gamma Knife Radiosurgery of Recurrent Malignant Gliomas. Presented at the ISMRM Experimental and Clinical Cancer Research in the New Millenium Workshop, Geiranger, Norway, August 10-12, 2000.
- 12. Pirzkall A, Larson DA, McKnight TR, **Graves E**, Nelson SJ, Verhey LJ. MR Spectroscopy Results in Improved Target Delineation for High Grade Gliomas. Presented at the 42nd Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Boston, MA, October 22-26, 2000.
- 13. Catalaa I, Henry RG, **Graves E**, Lu Y, Vigneron D, Nelson SJ. Diffusion, Perfusion, and H1-Spectroscopy in Patients with Newly Diagnosed Gliomas. Presented at the 9th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Glasgow, Scotland, UK, April 21-27, 2001.
- 14. **Graves EE**, Pirzkall A, Nelson SJ, Larson D, Verhey LJ. Incorporation of ¹H Magnetic Resonance Spectroscopic Imaging Data in the Radiation Treatment Planning Process. Presented at the 9th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Glasgow, Scotland, UK, April 21-27, 2001.
- 15. Pirzkall A, **Graves EE**, Lau A, Sneed PK, Larson DA, Verhey LJ, Nelson SJ. Gamma Knife (GK) Radiosurgery for Recurrent High-Grade Gliomas: What does Magnetic Resonance Spectroscopy have to add? Presented at the 5th International Stereotactic Radiosurgery Society Congress, Las Vegas, NV, June 10-13, 2001.
- 16. Pirzkall A, Takahashi M, McKnight TR, Graves EE, Nelson SJ, Verhey LJ, Larson DA, Sneed PK. Metabolic Imaging by means of 3D MR-Spectroscopy for Low-Grade Gliomas. Presented at the 43rd Annual Meeting of the American Society for Therapeutic Radiology and Oncology, San Francisco, CA, November 4-8, 2001.
- 17. Ntziachristos V, **Graves E**, Weissleder R. Advantages of fluorescence-mediated tomography: a prelude to molecular interrogations in deep tissues. Presented at the Optical Society of America Biomedical Optical Spectroscopy and Diagnostics Meeting, Miami, FL, April 7-10, 2002.

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- 18. Graves EE, Petrovsky A, Weissleder R, Ntziachristos V. *In vivo* time-resolved optical spectroscopy of mice. Presented at the Optical Society of America Biomedical Optical Spectroscopy and Diagnostics Meeting, Miami, FL, April 7-10, 2002.
- 19. Graves EE, Takahashi M, Pirzkall A, Larson D, Verhey LJ, Chang S, Prados M, Vigneron DB, Nelson SJ. Serial ¹H Magnetic Resonance Spectroscopic Imaging of Gliomas After Fractionated Radiation Therapy. Presented at the 10th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Honolulu, HI, May 18-24, 2002.
- 20. **Graves EE**, Petrovsky A, Yessayan D, Weissleder R, Ntziachristos V. Simultaneous *in vivo* fluorescence imaging and tomography of murine tumor models. Presented at the 1st Annual Meeting of the Society for Molecular Imaging, Boston, MA, August 24-26, 2002.
- 21. **Graves EE**, Ripoll J, Weissleder R, Ntziachristos V. An integrated fluorescence imaging system for combined reflectance imaging and fluorescence-mediated tomography of mice. Presented at the 1st Annual Meeting of the Society for Molecular Imaging, Boston, MA, August 24-26, 2002.
- the 1st Annual Meeting of the Society for Molecular Imaging, Boston, MA, August 24-26, 2002.
 22. Ntziachristos V, Ripoll J, Graves E, Weissleder R. In-Vivo Molecular Investigations of Live Tissues Using Diffracting Sources. Presented at the 5th International Conference on Medical Image Computing and Computer Assisted Intervention, Tokyo, Japan, September 25-28, 2002.
- 23. Li X, Graves EE, Vigneron DB, Cha S, McKnight TR, Nelson SJ. Reliable estimate of lactate and lipid for newly-diagnosed glioma patients using lactate-edited 3D 1H-MRSI with ellipsoidal k-space sampling. Presented at the 11th Annual Meeting of the International Society of Magnetic Resonance in Medicine, Toronto, Canada, July 10-16, 2003.
- Resonance in Medicine, Toronto, Canada, July 10-16, 2003.
 24. Zacharakis G, Yulliano A, Graves EE, Ishii K, Saeki Y, Weissleder R, Ntziachristos V. In Vivo Imaging of GFP Expressing Tumor Cells in Mice Using Fluorescence Molecular Tomography. Presented at the 2nd Annual Meeting of the Society for Molecular Imaging, San Francisco, CA, August 16-18, 2003.
- 25. Graves EE, Zacharakis I, Schulz RB, da Silva A, Yessayan D, Yulliano A, Weissleder R, Ntziachristos V. Quantitative Molecular Imaging Using Fluorescence: Applications of Fluorescence-Mediated Tomography. Presented at the 2nd Annual Meeting of the Society for Molecular Imaging, San Francisco, CA, August 16-18, 2003.
- 26. Kircher MF, Allport JR, Graves EE, Love V, Josephson L, Lichtman AH, Weissleder R. High Resolution 3D Imaging of Cytotoxic T Cell Trafficking in Live Mice. Presented at the 2nd Annual Meeting of the Society for Molecular Imaging, San Francisco, CA, August 16-18, 2003.
- 27. Ntziachristos V, **Graves E**, Schultz R, Ripoll J. Fluorescence Molecular Tomography: New detection schemes for acquiring high information content measurements. Presented at the 2004 IEEE International Symposium on Biomedical Imaging, Arlington, VA, April 15-18, 2004.
- 28. Graves EE, Loo BW. Implementation of Molecular Imaging-Guided Radiation Therapy: Software Development and Validation. Presented at the American Association of Physicists in Medicine 46th Annual Meeting, Pittsburgh, PA, July 25-29, 2004.
- 29. **Graves EE**, Chan DA, Sutphin PD, Giaccia AJ. Evaluation of Reporter Gene Expression and Protein Activity in Hypoxic Conditions. Presented at the 3rd Annual Meeting of the Society for Molecular Imaging, St. Louis, MO, September 9-12, 2004.
- 30. Loo BW, Quon A, Le Q, Vasanawala MS, **Graves ÉE**. A Method of Target Definition in PETbased Radiotherapy Planning. Presented at the 46th Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, October 3-7, 2004.
- 31. Boyer A, Graves T, Xing L. A Precision Small Animal Image-Guided Irradiator. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 18-23, 2005.
- 32. Cecic I, Chan DA, Sutphin PD, Ray P, Gambhir SS, Giaccia AJ, **Graves EE**. Triple Fusion Reporter Protein Expression and Activity Under Hypoxic Conditions. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 18-23, 2005.
- 33. **Graves EE**, Loo BW, Gambhir SS. Development of Image Segmentation Methods for Positron Emission Tomography/Computed Tomography-Guided Radiation Therapy. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 18-23, 2005.
- 34. Grow A, Quon A, **Graves EE**, Loo BW. Metabolic Tumor Volume as an Independent Prognostic Factor in Lymphoma. Presented at the American Society of Clinical Oncology Annual Meeting, Orlando, FL, May 13-17, 2005.

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- 35. **Graves EE**, Chatterjee R, Gambhir SS, Contag CH, Boyer A. A Variable Aperture Collimator for Conformal Radiotherapy of Small Animals. Presented at the 4th Annual Meeting of the Society for Molecular Imaging, Cologne, Germany, September 7-10, 2005.
- 36. Cecic I, Chan DA, Sutphin PD, Ray P, Gambhir SS, Giaccia AJ, Graves EE. Triple Fusion Reporter Protein Expression and Activity Under Hypoxic Conditions. Presented at the 4th Annual Meeting of the Society for Molecular Imaging, Cologne, Germany, September 7-10, 2005.
- 37. Zhang L, Cecic I, Cheng Z, Gambhir SS, Graves EE. Radiosynthesis and uptake in cells of ¹⁸F-2,3,5,6-tetrafluoro-3'-sulfamoylbenzanilide, a potential PET probe for Carbonic Anhydrase 9. Presented at the 4th Annual Meeting of the Society for Molecular Imaging, Cologne, Germany, September 7-10, 2005.
- Thorndyke B, Loo BW, Graves E, Xing L. Effect of Respiratory Cycle Irregularities on Image Quality in Four-Dimensional Computed Tomography. Presented at the 47th Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Seattle, WA, October 16-20, 2005.
- 39. Lee P, Le Q, Quon A, Graves EE, Loo BW. Metabolic Tumor Volume Measured on Initial Staging FDG-PET Scans Predicts Disease Progression in Lung Cancer. Presented at the 47th Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Seattle, WA, October 16-20, 2005.
- 40. Boyer A, Korreman S, **Graves E**, Mostafavi H, Le Q. Radiographic Respiratory Gating for Lung Radiotherapy Without Internal Fiducials. Presented at the 3rd International Conference on Translational Research and Pre-Clinical Strategies in Radio-Oncology, Lugano, Switzerland, March 12-15, 2006.
- 41. Cecic I, Zinyk D, Giaccia AJ, **Graves EE**. Employing β-Galactosidase as a reporter for optical imaging of stabilized HIF levels in tumours. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 26-29, 2006.
- 42. Zhang L, Cecic I, Cheng Z, Gambhir SS, **Graves EE**. In vitro evaluation of ¹⁸F-2,3,5,6tetrafluoro-3'-sulfamoylbenzanilide as a potential PET probe for carbonic anhydrase IX. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 26-29, 2006.
- 43. Graves EE, Chatterjee R, Gambhir SS, Contag CH, Boyer AL. A MicroCT-Based Platform for Small Animal Conformal Radiotherapy. Presented at the Annual Conference of the Academy of Molecular Imaging, Orlando, FL, March 26-29, 2006.
- 44. **Graves EE**, Chatterjee R, Gambhir SS, Contag CH, Boyer AL. A Hybrid MicroCT Scanner for Image-Guided Conformal Radiotherapy of Small Animals. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Philadelphia, PA, November 5-9, 2006.
- 45. Zhou H, Sawant A, Keall P, **Graves E**. Monte Carlo Modeling of Variable-Aperture Collimator for Small Animal Radiation Therapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Minneapolis, MN, 2007.
- 46. Zhou H, Chatterjee R, Contag C, Gambhir S, Boyer A, Keall P, **Graves E**. Development of a Variable-Aperture Collimator for Small Animal Radiation Therapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Minneapolis, MN, 2007.
- 47. Eastham DV, Weerasuriya D, Wakelee H, Quon A, Maxim P, Le Q, Graves EE, Loo BW. Quantification of Progression of Non-Small Cell Lung Cancer in the Interval between Diagnostic and Radiotherapy Treatment Planning PET Scans. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Los Angeles, CA, 2007.
- 48. Olson MR, Weerasuriya DK, Wakelee HA, Quon A, Maxim P, Le Q, **Graves EE**, Loo BW. Mid-treatment FDG-PET Predicts Disease Progression In Patients With Non-small Cell Lung Cancer. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Los Angeles, CA, 2007.
- 49. Le Q, Lieskovsky Y, **Graves E**, Pinto H, Brown J, Spielman D. Lactate-Base ¹H Magnetic Spectroscopy Does Not Predict Response and Outcomes in Patients With Stage IV Head and

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Neck Squamous Cell Carcinoma. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Los Angeles, CA, 2007.

- 50. Schellenberg D, Chang ŠT, Quon A, Graves EE, Goodman KA, Koong AC. Using Pre-radiation PET Parameters to Predict Survival in Adenocarcinoma of the Pancreas Treated With Gemcitabine and Single Fraction Stereotactic Body Radiation Therapy. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Los Angeles, CA, 2007.
- 51. Graves E, Cecic I, Bennewith K, Erler E, Ham C, Chin F, Yang G, Giaccia A. Imaging Hypoxia in Murine Orthotopic Models of Cancer with ¹⁸F-FAZA PET. Presented at the Joint Molecular Imaging Conference, Providence RI, September 8-11, 2007.
- 52. Cheng Z, Zhang L, Graves E, Xiong Z, Dandekar M, Chen X, Gambhir SS. Evaluation of ¹⁸F-Labeled- Alpha-Melanocyte Stimulating Hormone Analog for Melanocortin 1 Receptor Imaging. Presented at the Joint Molecular Imaging Conference, Providence RI, September 8-11, 2007.
- 53. Kim B, Dhatt H, Mittra E, Do BH, **Graves E**, Biswal S. Increased ¹⁸F-FDG Uptake is Observed Within the Spinal Canal in Low Back Patients. Presented at the Joint Molecular Imaging Conference, Providence RI, September 8-11, 2007.
- 54. Cecic I, Padmanabhan P, Biswal S, Gambhir SS, **Graves EE**. Differentiation of Reporter Gene Expression and Oxygen-Mediated Activity. Presented at the Joint Molecular Imaging Conference, Providence RI, September 8-11, 2007.
- 55. Lee SW, Graves E, Jeon TJ, Lee SH, Gold GE, Biswal S. Validation of Manganese-Enhanced Magnetic Resonance Imaging (MEMRI) as a Method to Detect Changes in the Spinal Cord Following Painful Stimuli. Presented at the Joint Molecular Imaging Conference, Providence, RI, September 8-11, 2007.
- 56. Cecic IK, Razorenova O, Padmanabhan P, Biswal S, Gambhir SS, Giaccia AJ, **Graves EE**. Development of Reporter Constructs for Molecular Imaging of Hypoxia. Presented at the Tumor Microenvironment Workshop, May 15-17, 2008, Miami, FL.
- 57. Graves EE, Cecic IK, Bennewith K, Erler JT, Ham CM, Yang GP, Giaccia AJ. Imaging Hypoxia in Murine Orthotopic Models of Cancer With 18F-FAZA PET. Presented at the Tumor Microenvironment Workshop, May 15-17, 2008, Miami, FL.
- Zhou H, Keall P, Graves E. Bone Models for Kilo-Voltage X-Ray Monte Carlo Simulations. Presented at the Annual Conference of the American Association of Physicists in Medicine, Houston, TX, 2008.
- 59. Rodriguez M, Zhou H, **Graves E**, Keall P, Van den Haak F, Xu J. Dosimetry of a Novel MicroCT/RT System for Small Animal Conformal Radiotherapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Houston, TX, 2008.
- 60. Dhatt HS, Kim B, Rosenberg J, **Graves E**, Mittra E, Behera D, Do B, Biswal S. 18F-FDG Uptake Within the Spinal Canal Follows a Predictable Pattern. Presented at the World Molecular Imaging Congress, Nice, France, 2008.
- 61. Behera D, Kamaya S, Lee SW, Graves E, Yeomans DC, Dhatt H, Gold GE, Biswal S. Manganese-Enhanced Magnetic Resonance Imaging (MEMRI) Highlights Injured Peripheral Nerves in Neuropathic Pain. Presented at the World Molecular Imaging Congress, Nice, France, 2008.
- 62. Behera D, Kamaya S, Lee SW, **Graves E**, Yeomans DC, Dhatt H, Gold GE, Biswal S. Functional Nerve-Related Changes Observed in Opioid-Induced Hyperalgesia Can Be Detected With Manganese-Enhanced Magnetic Resonance Imaging (MEMRI). Presented at the World Molecular Imaging Congress, Nice, France, 2008.
- 63. Teo BK, Abelson J, Teo A, **Graves EE**, Guerrero T, Loo BW. Time Interval to FDG PET/CT after Mediastinal Radiation Impacts the Dose Response of Pneumonitis Related Metabolic

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Activity. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Boston, MA, 2008.

- 64. La TH, Filion EJ, Turnbull BB, Chu JN, Lee P, Nguyen K, Maxim P, Loo BW, Graves EE, Le Q. Metabolic Tumor Volume Predicts for Recurrence and Death in Head and Neck Cancer. Presented at the Annual Conference of the American Society of Therapeutic Radiology and Oncology, Boston, MA, 2008.
- 65. Apte SD, Chin FT, **Graves EE**. Synthesis of a New PET Radiotracer Targeting Carbonic Anhydrase IX. Presented at the 18th International Symposium on Radiopharmaceutical Sciences, Edmonton, Canada, 2009.
- 66. Chin FT, Subbarayan M, Sorger J, Gambhir SS, **Graves EE**. Automated Radiosynthesis of [18F]EF5 for Imaging Hypoxia in Human. Presented at the 18th International Symposium on Radiopharmaceutical Sciences, Edmonton, Canada, 2009.
- 67. Nelson GS, Rodriguez MR, Zhou H, Lee A, Wu J, Tran PT, Felsher D, Keall PJ, **Graves EE**. In Vivo Biological Evaluation of Micro-CT Based 3D Conformal Radiotherapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 68. Graves EE, Nelson GS, Rodriguez MR, Zhou H, Keall PJ. An Open Source Software Tool for Treatment Planning for Small Animal Conformal Radiotherapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 69. Zhou H, Bazalova M, Rodriguez MR, Keall PJ, **Graves EE**. Monte Carlo Simulation of a MicroCT-Based Small Animal Radiotherapy System. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 70. Rodriguez MR, Nelson GS, Zhou H, Keall PJ, **Graves EE**. A Calibration Method for Positioning Small Animal Radiotherapy Subjects Using MicroCT. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 71. Rodriguez MR, Zhou H, Jogani R, Nelson GS, Keall PJ, **Graves EE**. Commissioning of a 3D MicroCT-Based Small Animal Radiotherapy System. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 72. Zhou H, Xu J, Rodriguez MR, van den Haak F, Zhu X, Xian Y, Nelson GS, Jogani R, Keall PJ, Graves EE. Evaluation of a Micro-CT Based 3D Conformal Small Animal Radiotherapy System. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 73. Motomura AR, Bazalova M, Zhou H, Keall PJ, **Graves EE**. Investigation of the Effects of Treatment Planning Variables on Small Animal Therapy Dose Distributions. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 74. Bazalova M, Zhou H, Keall PJ, **Graves EE**. The Influence of Material Assignment on Monte Carlo Dose Calculations for Kilovoltage Small Animal Radiotherapy. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.
- 75. Cui G, Maxim PG, **Graves EE**. Influence of Oxygen Tensions and Tissue Optical-Properties on Optical Reporter Genes. Presented at the Annual Conference of the American Association of Physicists in Medicine, Anaheim, CA, 2009.

Invited Presentations

1. "Magnetic Resonance Spectroscopic Imaging of Patients Undergoing Gamma Knife Radiosurgery". Brownbag lunch seminar, September 8, 1998, Department of Radiology, University of California, San Francisco.

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- "Magnetic Resonance Spectroscopic Imaging as a Prognostic Indicator in Gamma Knife Radiosurgery". Radiation Oncology Grand Rounds, February 14, 1999, Department of Radiation Oncology, University of California, San Francisco.
- 3. "Magnetic Resonance Spectroscopy and Spectroscopic Imaging". Technologist in-service session, May 15, 2000, Department of Radiology, University of California, San Francisco.
- 4. "Applications of ¹H Magnetic Resonance Spectroscopic Imaging in Radiation Therapy of Malignant Glioma". Seminar, February 5, 2001, Department of Diagnostic Radiology, Dartmouth-Hitchcock Medical Center, Hanover, New Hampshire.
- "Applications of ¹H Magnetic Resonance Spectroscopic Imaging in Radiation Therapy of Malignant Glioma". Seminar, March 19, 2001, Department of Bioengineering, University of California, Berkeley.
- 6. "Metabolic Imaging in Radiation Therapy". Seminar, January 4, 2002, Department of Radiation Oncology, Stanford University, Stanford, California.
- 7. "*In Vivo* Three-Dimensional Molecular Imaging Using Fluorescence". Seminar, November 12, 2002, Department of Radiation Oncology, Stanford University, Stanford, California.
- 8. *"In Vivo* Three-Dimensional Molecular Imaging Using Fluorescence". Seminar, November 15, 2002, Department of Radiology, University of California, San Francisco.
- 9. "PET-CT in Radiation Oncology". Varis Independent Users' Group Annual Meeting, June 3, 2004, Stanford University, Stanford, California.
- "In Vivo MRI and MRSI for Evaluation of Cancer Patients". Dual Modality Imaging symposium, American Association of Physicists in Medicine 46th Annual Meeting, Pittsburgh, PA, July 27, 2004.
- 11. "Molecular Imaging for Radiation Therapy: Biological and Technical Challenges". American Association of Physics Teachers National Meeting, August 3, 2004, Sacramento, California.
- 12. "Metabolic Imaging IV: QA and Managerial Aspects of PET/CT". Stanford Image-Guided Radiation Therapy Short Course, April 29, 2005. Department of Radiation Oncology, Stanford University, Stanford, California.
- 13. "Molecular Imaging in Radiation Oncology". Nuclear Medicine Grand Rounds, May 3, 2005. Department of Radiology, Stanford University, Stanford, California.
- 14. "Metabolic Imaging IV: QA and Managerial Aspects of PET/CT". Stanford Image-Guided Radiation Therapy Short Course, May 13, 2006. Department of Radiation Oncology, Stanford University, Stanford, California.
- 15. "Future Directions of Molecular Imaging: Molecular Imaging of Hypoxia". Featured lecture, Academy of Molecular Imaging Annual Meeting, Orlando, FL, March 26, 2006.
- 16. "Imaging Tumoral Hypoxia in the Laboratory and the Clinic". Pre-Clinical Molecular Imaging and Its Potential Impact on the Future of Oncology scientific symposium, American Society of Clinical Oncology Annual Meeting, Atlanta, Georgia, June 6, 2006.
- 17. "Molecular Imaging in Radiation Oncology: Laboratory and Clinical Developments". Radiation Oncology Grand Rounds, August 10, 2006, Department of Radiation Oncology, Duke University, Durham, North Carolina.
- 18. "Molecular Imaging in Radiation Oncology and Radiobiology". Seminar, March 28, 2007, Department of Radiology, University of California, San Francisco.
- 19. "Small Animal Radiotherapy Using a MicroCT Scanner". Invited lecture, May 1, 2008, American Association of Physicists in Medicine Focused Research Meeting, St. Louis, MO.
- 20. "Animal Models for Conformal Radiotherapy". Invited lecture, May 1, 2008, American Association of Physicists in Medicine Focused Research Meeting, St. Louis, MO.
- 21. "Treatment Planning for MicroCT-Based Radiotherapy". Invited lecture, May 2, 2008, American Association of Physicists in Medicine Focused Research Meeting, St. Louis, MO.

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- 22. "Functional and Molecular Imaging of Head and Neck Cancer". Invited lecture, June , 2008, American Society of Clinical Oncology Annual Meeting, Chicago, IL.
- 23. "MicroCT-Based Small Animal Radiotherapy". Small Animal IGRT: Systems and Studies Symposium, July , 2008, American Association of Physicists in Medicine Annual Meeting, Houston, TX.
- 24. "Applications of Molecular Imaging in Small Animal Radiotherapy". Invited lecture, October , 2008, Radiation Research Society Biannual Meeting, Boston, MA.
- 25. "Small Animal Image-Guided Radiotherapy Using a MicroCT Scanner". Invited lecture, November 18, 2008, MD Anderson Cancer Center, Houston, TX.
- 26. "New Imaging Tools for Radiotherapy Planning". Invited lecture, April 18, 2009, San Francisco Radiation Oncology Conference, San Francisco, CA.
- 27. "Small Animal Imaging and Radiotherapy Using a MicroCT Scanner". Invited lecture, June 26, 2009, Coalition of Bay Area Radionuclide Imagers meeting, San Jose, CA.
- 28. "Development of Preclinical Molecular Imaging and Conformal Radiotherapy Technologies". Invited lecture, April 18, 2010, American Nuclear Society Topical Meeting, Las Vegas, NV.

Affiliations

- Member, Tau Beta Pi (national engineering honor society), since 4/1995.
- Member, Society for Molecular Imaging, since 9/2004.
- Member, Academy for Molecular Imaging, since 3/2005.
- Member, American Society of Therapeutic Radiology and Oncology, since 6/2008
- Member, American Association of Physicists in Medicine, since 9/2008

Awards and Honors

- NIH Predoctoral Training Grant recipient, 1996, 1997, 1999.
- UC Berkeley Block Grant recipient, 1998.
- Achievement Rewards for College Scientists Scholar, 2000.
- First prize, student poster competition, ISMRM Experimental and Clinical Cancer Research in the New Millenium Workshop, Geiranger, Norway, August 10-12, 2000.
- NIH Postdoctoral Training Grant recipient, 2001, 2002.

Teaching

- Stanford Bioengineering 222A, yearly 2004-2009
 - Lectures: 3D Optical Imaging
 - Applications of Molecular Imaging in Radiation Therapy
- Stanford Bioengineering 222B, yearly 2006, 2009
 - · Lectures: Imaging Hypoxia
 - Imaging Radiation Response
 - Discussion section
- Stanford Radiation Oncology physics resident course, yearly 2004-2009
 - Lectures: Measurement of Ionizing Radiation
 - Electron Beam Therapy Radiation Protection
- Quality Assurance Stanford Cancer Biology 241, yearly 2007-2009
 - Course director, 2008
 - Discussion section leader, 2007-2009

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- Lectures: Cancer Imaging Stanford Cancer Biology survey course, 2007
 Lectures: Cancer Imaging