Professional Biography

Michael Tweedle, PhD is the Stefanie Spielman Professor of Cancer Imaging and Professor of Radiology and Biophysics at The Ohio State University College of Medicine and James Comprehensive Cancer Center, adjunct Professor in the Chemistry and Biochemistry Department in the School of Arts and Sciences, and Director of the Wright Center Molecular Imaging Agent Laboratory. His education was at Knox College (BS Chemistry), Rice University (PhD Physical Chemistry) and Stanford University (NIH Research Service Fellow). His experience in diagnostic imaging began as a research scientist at New England Nuclear, Inc. In 1981 he invented the first catalyst for production of cationic Tc(III) radiopharmaceutical kits, and he worked on early targeted molecular imaging (MI) agents using monoclonal antibodies at NEN/DuPont Pharmaceuticals. In 1986, working with E.R. Squibb and Sons, he invented and developed the novel first generation macrocyclic Gd-based MRI agent, ProHance™ (gadoteridol), that is used in over a million patients annually. As President and chief scientist at Bracco Research USA Inc, he and his team created two new Molecular Imaging agents: a first in class targeted theranostic for prostate and breast cancer (LuAMBA) and a first in class VEGF-R2 angiogenesis receptor targeted US agent now in Phase-II clinical trials (BR55). His current work includes targeted theranostics, molecular imaging agents and Optical Surgical Navigation agents. He sits on the editorial boards of Magnetic Resonance Imaging and Investigative Radiology, has served on Expert Councils at the US Pharmacopeia, the elected Boards of Directors and as Officer of four professional societies, academic Scientific Advisory Boards in molecular Imaging, on Scientific Advisory Boards of public and private pharmaceutical and chemical companies, and the Dean's Scientific Advisory Board of New York University's School of Science. He has authored over 150 publications, including 38 US patents, 25 pending patent applications, and 20 book chapters and reviews. In 2005 he was awarded The Harry Fischer Medal for Excellence in Contrast Media Research.

Curriculum Vitae

Dr. Michael F. Tweedle

Office Address The Ohio State University
720 Biomedical Research Tower
460 W. 12th St., Office 720
Columbus, OH 43210
614 247-4427

Home Address .
40 N Parkview Ave
Bexley, OH 43209
609 937-0096 cell

Education

1969 - 1971 Joliet Junior College
1971 – 1973 BA Knox College (Chemistry)
1973 – 1977 PhD Rice University (Physical Chemistry)

Postgraduate Training and Fellowship Appointments

1977 – 1980 National Research Service Award Stanford University

Awards and Honors

1977	National Research Service Award (NIH), Stanford University, Palo Alto, CA
1988	Editor, Special Issue, Nuclear Medicine and Biology
1990 -	Editorial Board, Magnetic Resonance Imaging
1998 -	Editorial Board, Investigative Radiology
1998	Editor, Special Issue, Investigative Radiology (1998, 1999, 2000, 2005, 2009)
2003	Elected Board of Directors, Society of Noninvasive Imaging in Drug Development
2005	Awarded the Harry Fischer Medal For Excellence in Contrast Media Research (CMR – admin by RSNA)
2005, 2007	Spedding Award Committee, Rare Earth Research Conference
2006	Elected Vice Chairman of Society of Noninvasive Imaging in Drug Development
2007	Elected, Chairman of Society of Noninvasive Imaging in Drug Development
2007	Board of Directors of The Academy of Molecular Imaging
2007 - 2012	Science Dean's Advisory Board, New York University
2007, 2008	University of Arizona, ARIBI External Advisory Committee
2008	Elected, Secretary and Executive Committee, Academy of Molecular Imaging
2008-2011	Board of Trustees, Radiotracer Clearing House
2008	Most Notable person, RT-Image, Top 25 Most Influential in Radiology
2008 – 2011	Program Committee, World Molecular Imaging Congress
2009	Co-Organizer, Imaging in 2020 meeting, Jackson Hole, WY, USA

Awards and Honors (continued)

2009 –	Awarded Stefanie Spielman Chair in Cancer Imaging, Department of Radiology and The James Comprehensive Cancer Center at the Ohio State University
2009 – 2011	Centre for Probe Development and Commercialization, McMaster University, Canada
2010 - 2013	American Board of Science in Nuclear Medicine
2010	Mentor of the Year, Wright Center for Innovation
2011 - 2013	Chairman, Awards Selection Committee, Contrast Media Research Congress
2011 – 2013	Officer and Board Member, World Molecular Imaging Society
2012 -	Co-Chairman and founder, Optical Surgical Navigation Interest Group
2013	Distinguished Undergraduate Research Mentor, OSU
2011 - 2014	Board of Directors, Officer, World Molecular Imaging Society

Faculty Appointments

2009-	Professor, Department of Radiology (home), and Professor in Biophysics Program The Ohio State University College of Medicine Stefanie Spielman Chair in Cancer Imaging Radiology Department, The James Comprehensive Cancer Center Professor, Adjunct, Department of Chemistry and Biochemistry, College of Arts and Sciences, OSU
2013 – 2014	Entrepreneurial Scholar, Technology Transfer Department, OSU
2006 – 2009	Adjunct Associate Professor, Department of Radiology University of Pennsylvania Medical School

OSU Internal Faculty Committees

2012 –	Faculty Council OSUMC (Elected)
2013 -	College Assembly OSUMC (Elected)
2010 -	Pharmacy / formulary (OSU Wexner)
2010 -	Promotion and Tenure (OSU Radiology)
2014 -	Chairman, Promotion and Tenure Committee, Radiology
2010 - 2013	Contrast Agent use Guidelines (Radiology)
2010 – 2013	Safety & Risk Reduction Committee (Radiology)

Past Professional Appointments

1980-1983	Sr. Research Chemist, Radiopharmaceuticals New England Nuclear and E.I. DuPont de Nemours
1983 -1984	Section head, Contrast Agents The Squibb Institute for Medical Research
1984 - 1987	Assistant Director, Contrast Agents Research Department The Squibb Institute for Medical Research
1987 – 1989	Director, Contrast Media Research Department

	The Squibb Institute for Medical Research
1989 – 1992	Director, Contrast Media Research Department
	Bristol-Myers Squibb Pharmaceutical Research Institute
1992 – 1994	Director of Chemistry, Diagnostics Drug Discovery
	Division Bristol-Myers Squibb Pharmaceutical Research Institute
1992 – 1994	Promotion Review Board, Drug Discovery
	Bristol-Myers Squibb Pharmaceutical Research Institute
1994 - 2009	President and CEO, Bracco Research USA Inc

Memberships in Professional Societies

American Chemical Society
Society of Nuclear Medicine
International Society for Magnetic Resonance in Medicine
Radiological Society of North America
World Molecular Imaging Society

Consulting

2009 - 2014	Baker Sterchi Cowden and Rice, Attorneys at Law
2007- 2009	Gerhson Lehman

Scientific Advisory Boards

2009 - 2012	Marillion Pharmaceuticals
2009 – 2012	Macrocyclics Inc
2011 – 1012	Arroyo Biosciences Inc
2010 – 2014	Empirion
2015 -	Elyton, LLC (pending)

Corporate Boards of Directors

1994 - 2009	Bracco Research USA Inc (private)
2011 – 2014	Novelos Therapeutics (public) (now Cellectar Biosciences)

Honorary Positions

2012- 2014	OSU College of Medicine Technology Assessment Board (reviewer; twice selected for presentation)
2009 –2014	The Stefanie Spielman Chair in Cancer Imaging
2011 -2014	Gold Medal Awards Committee Chairman (CMR)

Conference Organizing Boards

1985 – 2014	Contrast Media Research biannual meeting
2002 -	Tc and other metals, Padua Italy
1988	Antibody and MRI agent Chemistry
2007, 2008	Rare Earth Research Society

Conference Organizing Boards (continued)

2009	co-Chairman Imaging in 2020
2008 – 2010	World Molecular Imaging Congress (Program Committee)
2008 – 2010	Therapy Emphasis Co-Chair,
2010 - 2011	Plenary Session Co-Moderator, WMIC
2011	Young Investigator Competition, WMIC

Academic Boards (elected:E; appointed:A)

2000 – 2005	USP Expert Committees on Radiopharmaceuticals and Medical Imaging Agents (A)
2003 – 2006	Board of Directors of Society of Noninvasive Imaging in Drug Development (E)
2005 - 2006	Newsletter Editor, SNIDD (A)
2006 – 2007	Vice-Chairman (Vice President) of SNIDD (E)
2007 – 2009	Chairman (President) of SNIDD (E)
2007 - 2011	Academy of Molecular Imaging (E)
2008 - 2011	Executive Committee & Secretary (E)
2010	Search Committee: Editor in Chief of Molecular Imaging in Biology Journal (A)
2006 – 2008	External Scientific Grant Advisor (Arizona Cancer Center) (A)
2007 - 2011	Science Dean's Board of Advisor's, New York University (A)
2008 – 2010	NYU Science Dean Board Chair, Technology Transfer and Intellectual property Committee (A)
2008 – 2010	Radiotracer Clearing House, Board of Trustees (A)
2009 – 2011	Centre for Probe Development and Commercialization, McMaster University, Canada 2010 (A)
2010 – 2013	Board of Directors of the American Board of Science in Nuclear Medicine (A)
2010 - 2011	Society for Molecular Imaging Council Member (A)
2011 - 2014	World Molecular Imaging Society, Board ofTrustees (A) World
2011- 2014	World Molecular Imaging Society Officer (Secretary) (E)
2015 –	**Board of Directors, International Society of Image Guided Surgery (ISIGS)**

Editorial Positions

1990 –	Editorial Board of Magnetic Resonance Imaging
1998 –	Editorial Board of Investigative Radiology
1988	Editor, Special Issue, Nuclear Medicine and Biology
1998 - 2000	Editor Special Issue, Investigative Radiology, Contrast Agents
2005,	Editor Special Issue, Investigative Radiology, Contrast Agents
2010	Editor Special Issue Investigative Radiology Contrast Agents
1990 – 2013	J. of Magnetic Resonance in Medicine (reviewer)
1990 –	Inorganic Chemistry (reviewer)
2001 –	J. Am. Chem. Soc. (reviewer)
1991 –	Radiology (consultant and Reviewer)

1984 –	Nuclear Medicine and Biology (reviewer)
2013 -	Molecular Imaging and Biology (reviewer)
2011 –	reviewer: PLOS One, Bioconjugate Chemistry, Inroganic Chemistry, J. Am.Chem. Soc., Org. Med. Chem. Lett., Acta Radiologica, Radiology, Mol. Imag. Biol.
2009 –	Cancer and imaging research (abstract reviewer) Abstract Reviewer: American Association Cancer Research, International Society of Magnetic Resonance in Medicine, Society for Noninvasive Imaging in Drug Development, Academy of Molecular Imaging, World Molecular Imaging Society
2006 – 2007	Editor, Newsletter of the Society of Noninvasive Imaging and Drug Development (2006-7)

Expert Panels and Study Sections

1990, 2009	NIH ad hoc Study Section: Program Project Grants and site visit
1991	NIH ad hoc grant Study Section: Tissue Specific Contrast Agents
1993	Diagnostic Imaging Research Branch Strategic Planning Advisor
2002	Tc in Chemistry in Nuclear Medicine, Padua, Italy 2002
2003	ISMRM Conf. on MRI in Cancer
2004	NCI panel on (DCE) MRI in Cancer
2005	NCI Conference on Diagnostics in Pharmacetical Development, Bethesda, MD
2005	Biochemical Imaging Agent Issues, International Society for Strategic Studies in Radiology
2005	Radiology: Creating strategies for the next decade
2008	Biomarkers Roundtable, by RSNA
2009	Imaging Biomarkers Workshop, AMI/SNIDD
2011	NIH NIBIB Ad Hoc Study Section S10 Grants
2012	NIH, NIBIB Ad Hoc Study Section P41 Grant and site visit
2011 – 2013	Denman Undergraduate Research Forum Faculty Judge
2012	OSU Molecular Life Sciences Interdisciplinary Graduate Programs Symposium Poster Judge
2014	**"Why are there no Molecular MRI agents?" International Society of Magnetic Resonance Imaging, Milan, Italy**
2015	**NIH, Ad Hoc Study Section P41 Grant and Site visit**
2015 -	**DOD, CM Breast Cancer Research Program study section**

Academic Funding

Drug Development Institute, James Cancer Center. Role: PI, Co-PI Josh Goldberger.
"Molecular Magnetic Resonance Imaging Probes that Self-Assemble in Malignant Tumors"
The $307,000 ($185,000 year 1, with evaluations quarterly) bridges and augments an R21 being re-submitted July, 2015, that targets early breast cancer and many others. It's aim is to generate the data required for a successful bid to venture capitalists from a start up company. It includes manufacturing drug product. Year 2 (funding ND)

Drug Development Institute, James Cancer Center. "Localized delivery of Peptide Receptor Radionuclide Therapy" (i.a.PRRT) for focal therapy of early prostate cancer without generating side effects, designed to work with Active Surveilance to avoid whole gland removal. $186,000 (1 year, evaluations quarterly). It's aim is to generate the data required for a successful bid to venture capitalists from a start up company.

Pelotonia Idea Grant, OSU. Role: co-PI with Charles Hitchcock, "Identification and development of new immunoagents for cancer diagnosis and therapy." 10/15 – 10/17, $100,000

Pelotonia Idea Grant, OSU. Co-PI with Ron Xu and A. Yilmaz "Wearable Navigation System for Image-guided Cancer Resection Surgery" $100,000, 10/14 – 10/16

2-U44-CA176664-02. NIH SBIR Phase II Contract. Role: Co-I. PI: M. V. Knopp; "Improved Metallofullerene MRI Contrast Agent for Cancer Diagnosis." –. $382,206. 2013-12/15

Role: PI. Enlyton PharmaceuticalsAn assessment of the tumor-targeting capability of Enlyton's antibody technology for use in PET imaging of cancer" $189,000. 10/12 – 6/15

TECH13-060 N043CO-2012-00059. Ohio Third Frontier Innovation Platform Grant. IPP-12-254. Role: Co-PI with M. V. Knopp and K. Kumar, "Next Generation Multi-Modal Molecular Imaging Technology Platform". $6,026,690. 2013 – 2018.

SBIR 2447-NIH-2S/OSU (sub) to 2 U44 CA176664-02 NIH SBIR Phase II Role: Co-I. "Improved metallofullerene MRI contrast agent for cancer diagnosis." PI; M. Knopp.

<u>Pending Submissions ($16,021,679)</u>

RO1 to NCI/NIBIB RFA 13-185, Image-guided drug delivery in cancer ($1,980,000, 4 years), to be submitted June 16, 2015, Role: PI, Co-PI: Thomas Rosol, Michael Knopp. "Image-guided, transcatheter Peptide Receptor Radiotheranostic for Prostate Cancer"

RO1 Grant GRT00039093. NIH. Co-I with PI: Miryam Lustberg, "Affective consequences of chemotherapy in breast cancer survivors"

R21 Grant 11679996. NIH. Role: Co-PI with J. Goldberger. "Molecular Magnetic Resonance Imaging Probes that Self-Assemble in Malignant Tumors"

R21 Grant GRT00038741. NIH. Co-PI with Chadwick Wright. "Innovative dual-function agent for image-guided cancer therapy."

SSTR Phase I. GRT00037702. NIH. PI: M. F. Tweedle. Sponsor Enlyton, LLC. "Creation and preclinical development of a real time, wide field Optical Surgical Navigation imaging agent specific for TAG-72+ adenocarcinomas."

DOD Grant GRT00035750. DOD. Role: Co-PI with Ron Xu and A. Yilmaz. "Intraoperative integrated navigation for targeted breast-conserving surgery"

RO1 grant GRT00037727. NIH Role: Co-PI. PI: Ron Xu. "Multifunctional drug-loaded activatable microbubbles for ultrasound mediated combination therapy in ovarian cancer."

RO1 grant. GRT00038811. NIH. Role: Co-I and PI on OSU subcontract. PI: James Basilion. "Theranostic gold nanoparticles for imaged-guided radical prostatectomy and PDT ablation."

RO1 grant GRT00038338. NIH. Role: Co-I. PI: Dario Palmieri. "A novel class of anti-Nucleolin immunoagents for cancer therapy."

RO1 grant GRT00038255. NIH. Role: Co-I. PI: Tonya Orchard. "Effect of omega 3 fatty acid supplementation and added sugars in the diet on chemotherapy-induced cognitive deficits."

Enlyton PharmaceuticalsAn assessment of the tumor-targeting capability of Enlyton's antibody technology for use in PET imaging of cancer" Role: PI. ~ $300,000 – 400,000. For roll up to IND submittal

Completed Funding

9872-12: National Collegiate Inventors Association.PI: M. Tweedle with Undergraduates, K. Mitra and B. Geiger. "Bringing the Cancer Detection Kit Home" Phase II, $25,000. 2014 - 2015

Bremmer CCTS, PI Chawick Wright. "^{123}Iodine-labeled HN1-800dye agents for dual-modality intraoperative surgical guidance during resection of head & neck squamous cell carcinoma" $70,000. 2013 - 2014

Wright Center Molecular Imaging Agents Laboratory (OSU, OSUMC, Radiology): "Create an IP protected Drug" OSU, OSUMC, WCI and Radiology, $5,200,000 2009 – 2014

Enlyton Pharmaceuticals. Contract PI, SBIR Contract No. HHSN261201200059C: "A Tunable Tumor Targeting Agent for SPECT Imaging" $66,366. 5/20/12 – 6/30/15.

N043CO-2012-00059: "A tunable agent for SPECT Imaging." PI: M. Tweedle $50,607. Enlyton Inc. SBIR Phase I Contract 2013 – 2014

Pelotonia Idea Grant, PI: M. Tweedle, J. Goldberger, "Pan-cancer MRI agents that self-assemble in malignant tumors" $100,000. 2012 – 2014

1R21CA159077 – 01. NCI. Co-PI with R. Xu, T Huang, R Shen, Radiology, Bioengineering, Exp. Genetics. “Multifunctional microbubbles for image-guided epigenetic therapy in cancer”. 2012-2014. $421,000

RISE Award. James Comprehensive Cancer Center.“Dosimetry modulated radiotherapy with 177LuAMBA, a new breast cancer theranostic.” Project V, Co-PI with J. White for a NCI Breast Cancer Spore Application. $7,000.

CCTS Pilot Award. Co-PI with J. Kuret. Cancer Center Technical Services, “Tauopathic Imaging Agents.” $25,000 2012

Lectures by Invitation (2008 – 2014)

Status of AMI’s Molecular Imaging projects; RSNA sponsored round table on Molecular Imaging, Chicago IL, April, 2008

Degenerative Diseases, a Challenge for Imaging Solutions
Italian Radiological Society Meeting; Rome, May 2008

Lu-AMBA, a ^{177}Lu-containing peptide conjugate for simultaneous imaging and radiotherapy
Rare Earth Research Conference; Tuscalusa, Alabama, June 2008

Lu-AMBA, a ^{177}Lu-containing peptide conjugate for simultaneous imaging and radiotherapy
International Macrocyclic Chemistry; Las Vegas, NV, July 2008

“Use of Multivalency in Drug Discovery in Molecular Imaging”
Metabolism in Cancer Lecture Series; University of Pennsylvania, October 2008

"Peptide Targeted Molecular Imaging Agents"
Molecular Imaging Seminar series; Stanford University, January 2009

“Matching the drugs to the patients”
A Christmas to Cure Cancer sponsored by the Stefanie Spielman Foundation
Columbus, OH, December 2009

“Cancer Discovery”
Spielman Cruise for Cancer, Columbus, OH, February, 2010.

“M-AMBA, a novel thernostic for breast and prostate cancer”
Imaging Research Seminar, Radiology Dept.; The Ohio State University, March, 2010

“The future of cancer detection and treatment through imaging technology”
Stefanie’s Champions Breast Cancer Research Symposium
Greater Columbus Convention Center, April 2010

"Comparative effectiveness of Contrast and Molecular Imaging agents"

Moffet Cancer Center; Tampa, Florida, May, 2010

"The future of cancer detection and treatment through imaging technology"
Stefanie's Champions Breast Cancer Research Symposium
The Ohio Union, Columbus, OH April 2011

"Cancer Imaging: Past, Present and Future"
Columbus Rotary Luncheon Meeting; Hyatt Regency Columbus, April 2011

"Molcular Imaging Agents: the Can, the Can't and the Won't"
Cooley Visiting Professor Lecture, Radiology Dept.; University of Texas Medical Branch, November 2011

"Can MRI Agents Compete in the Biochemical Arena?"
National American Chemistry Society Meeting; Dallas Tx, March 2014

"Optical Surgical Navigation Probes"
Cardinal Health Inc.; April, 2014, Dublin, Ohio

"Molecular Imaging MRI Probes that Self-Assemble in Malignant Tumors"
Bracco Group; Milan, Itlay, May 2014

"Clinical Applications, Workflow and Regulatory Issues: Intraoperative Guided Surgery with
Optical Probes" 9-14, at WMIC, Soeul, Korea.

Internal OSU Teaching (2014)

"Molecular Imaging Agents 101". Department of Radiology Residents' Seminar OSU presented annually.

"The Basic Principles and History of X ray and MRI Contrast Agents."
Department of Radiology Residents' Seminar, OSU Presented annually.
"Recent Research"

"Molecular Imaging Research" Department of Radiology Residents' Seminar, OSU presented bi-annually.

Individual Studies. The Ohio State University. 2014 GRA Christian Beutner (Chemistry and Biochamistry) Primary Instructor

"Preclinical Analysis of infrared fluorescence labeled Probe to target bombesin receptors" (poster at James CCC annual Event)

Research in Biophysics. The Ohio State University. Primary Instructor:

PhD Candidacy Examination. Xiaoli Liu, Biophysics. 11-24-14

PhD Oral Examination. Sara Lim. Biophysics.11-6-14.

Biophysics Rotation, Keyton Clayson. Biophysics. Nov. - Dec, 2014.

Xu Zhang. NSF I-Corps support. Bioengineering, 11-14

PhD. Pre-Oral. Maria Isabella Menendez. 12-17-14.

PhD. Oral Examination. Maria Isabella Menendez. June 16, 2015

Bibliography

Patents (only US Patent and published Applications listed)

1. M. F. Tweedle. Accelerators for Forming Cationic Tc Complexes Useful in Kits for Radiodiagnostic Heart and Hepatobiliary Tissue Imaging.
US Patent Number 4,455,291, 1984

2. M.F. Tweedle, G.T. Gaughan, J.H. Hagan. Substituted Triscarboxymethyl-tetraazacyclododecane and Analogs
US Patent Number 4,885,363, 1989

3. M.F. Tweedle, L.D. Bradshaw, L. J. Wilson. Paramagnetic Metalloporphyrins as Contrast Agents for Magnetic Resonance Imaging
US Patent Number 5,262,532, 1993

4. J.F. Desreux, M.F. Tweedle, P.C. Ratsep, T.R. Wagler, E.R. Marinelli. Hepatobiliary Tetraazamacrocyclic Magnetic Resonance Contrast Agents
US Patent Number 5,358,704, 1994

5. M.F. Tweedle, H.W. Strauss, A.D. Nunn. Methods for the In Vivo Measurement of the Concentration of non-Imaging NMR-Detectable Xenobiotic Compounds
US Patent Number 5,468,467, 1995

6. M.F. Tweedle, G.T. Gaughan, J.J. Hagan. Method for Imaging Mammalian Tissue using 1-Substituted-1,4,7-Tricarboxy-Methyl-1,4,7,10-Tetraazacyclo-Dodecane and Analogs
US Patent Number 5,474,756, 1995

7. R.S. Ranganathan, E. Marrinelli, R. Pilli, M. F. Tweedle. Aromatic Amide Compounds and Metal Chelates Thereof for Diagnostic Imaging
US Patent Number 5,573,752, 1996

8. M.F. Tweedle, H.W. Strauss, A.D. Nunn
Methods for the In Vivo Measurement of the Concentration of NMR-Detectable Xenobiotic Compounds
US Patent Number 5,603,917, 1997

9. M.F. Tweedle, G.T. Gaughan, J.J. Hagan
Method for Imaging Mammalian Tissue using 1-Substituted-1,4,7-Tricarboxy-Methyl-1,4,7,10-Tetraazacyclo-Dodecane and Analogs
US Patent Number 5,674,470, 1997

10. M.F. Tweedle, G.T. Gaughan, J.J. Hagan
Method for Imaging Mammalian Tissue using 1-Substituted-1,4,7-Tricarboxy-Methyl-1,4,7,10-Tetraazacyclo-Dodecane and Analogs
US Patent Number 5,846,519, 1998

11. R. Ranganathan, M.F. Tweedle, P. Wedeking. Methods and Compositions for Using Non-ionic Contrast Agents to Reduce the Risk of Clot Formation in Diagnostic Procedures
US Patent Number 5,869,024, 1999

12. R. Ranganathan, T. Arunachalam, M.F. Tweedle. N, N-Dimethyldiatrizoic Acid and its conjugates as Hepatobiliary agents for X ray CT Imaging
US Patent Number 6,051,210, 2000

13. J. Desreux, P. Jaques, P. Humblet, P. Herman, P. Comblin, P. Tholet, M. F. Tweedle. Self Assembling Heteropolymetallic Chelates As Imaging Agents and Radiopharmaceuticals
US Patent Number 6,056,939, 2000

14. P. Wedeking, T R. Wager, T. Arunachalam, R. Ramalingam, K. Linder, R. Ranganathan, A. Nunn, K. Raju, M.F. Tweedle. Metal Complexes Derivatized with Folate for use Diagnostic and Therapeutic Appllications
US Patent Number 6,093,382, 2000

15. M. Tweedle, G. Gaughan, J. Hagan. Method for Imaging and Radiopharmaceutical Therapy using 1-substituted-4,7,10-tricarboxymethyl-1,4,7,10-tetraazacyclododecane and analogs
US Patent Number 6,143,274, 2000

16. P. Wedeking, T R. Wager, T. Arunachalam, R. Ramalingam, K. Linder, R. Ranganathan, A. Nunn, K. Raju, M.F. Tweedle. Metal Complexes Derivatized with Folate for use Diagnostic and Therapeutic Appllications
US Patent Number 6,221,334, 2001

17. R. Ranganathan, T. Arunachalam, M.F. Tweedle. N, N-Dimethyldiatrizoic Acid and its conjugates as Hepatobiliary agents for X ray CT Imaging
US Patent Number 6,264,916, 2001

18. R. Ranganathan, X. Zhang, R. Shukla, M.F. Tweedle. Enhanced Relaxivity Monomeric and Multimeric Compounds
US Patent Number 6,693,190, 2004

19. R. Pillai, S. I. Kang, E. Marinelli, R. Ranganathan, M.F. Tweedle. Aminocarboxylate ligands having substituted aromatic amide moieties"
US Patent Number 6,875,864, 2005

20. M. A. Von Wronski, E.R. Marinelli, A. D. Nunn, R. Pillai, K. Ramalingam, M.F. Tweedle, K. Linder, P. Nanjappon, N. Raju. Compounds for targeting endothelial cells, compositions for the same and methods for their use
US Patent Number 7,109,167, 2006

21. R. Ranganathan, H. Fan, M.F. Tweedle. Conjugates of antioxidants with metal chelating ligands for use in diagnostic and therapeutic applications
US Patent Number 7,160,535, 2007

22. P. Wedeking, T R. Wager, T. Arunachalam, R. Ramalingam, K. Linder, R. Ranganathan, A. Nunn, K. Raju, M.F. Tweedle. Metal Complexes Derivatized with Folate for use Diagnostic and Therapeutic Appllications
US Patent Number 7,186,397, 2007

23. E. Cappelleti, L. Lattuada, K.E. Linder, E. Marinelli, P. Nanjappan, N. Raju, R. Swenson, M.F. Tweedle. Gastrin Releasing Peptide Compounds
US Patent Number 7, 226,577, 2007

24. R. Pillai, S. I. Kang, E. Marinelli, R. Ranganathan, M.F. Tweedle. Aromatic Amide Compounds and Metal Chelates Thereof
US Patent Number 7,351,389, 2008

25. C. A. Chang; K. Kumar, M.F. Tweedle. Dual functioning excipient for metal chelate contrast agents.
US Patent Number 7,385,041, 2008

26. P. Wedeking, T R. Wager, T. Arunachalan, R. Ramalingam, K. Linder, R. Ranganathan, A. Nunn, K. Raju, M.F. Tweedle. Metal Complexes Derivatized with Folate for use Diagnostic and Therapeutic Appllications
US Patent Number 7,399,460, 2008

27. R. Ranganathan, H. Fan, M.F. Tweedle. Conjugates of Antioxidants with Metal Chelating Ligands for use in Diagnostic and Therapeutic Applications
US Patent Number 7,407,644, 2008

28. R. Ranganathan, H. Fan, M.F. Tweedle, R.E. Swenson. Conjugates of Antioxidants with Metal Chelating Ligands for use in Diagnostic and Therapeutic Applications.
US Patent Number 7,582,280, 2009

29. E. Cappelleti, L. Lattuada, K.E. Linder, E. Marinelli, P. Nanjappan, N. Raju, K. Ramalingam, R. Swenson, M.F. Tweedle. Gastrin Releasing Peptide Compounds
US Patent Number 7,611,692, 2009

30. M.A. Von Wronski, E.R. Marinelli, A.D. Nunn, R.K. Pillai, K. Ramalingam, M.F. Tweedle, K.E. Linder, P. Nanjappan, N. Raju, F. Yan, M. Schneider.Compounds for targeting endothelial cells, compositions containing the same and methods for their use
US Patent Number 7,820,621, 2010

31. E. Cappelletti, L. Lattuada, K.E. Linder, E. Marinelli, P. Nanjappan, A.D. Nunn, N. Raju, K. Ramalingam, R.E. Swenson, M.F. Tweedle. Gastrin releasing peptide compounds
US Patent Number 7,850,947, 2010

32. M.A. Von Wronski, E.R. Marinelli, A.D. Nunn, R. Pillai, K. Ramalingam, M.F. Tweedle, K.E. Linder, P. Nanjappan, N. Raju. Compounds for Targeting Endothelial Cells, Compositions Containing the Same and Methods for Their Use
US Patent Number 7,884,183, 2011

33. E. Cappelleti, L. Lattuada, K.E. Linder, E.R. Marinelli, P. Nanjappan, A.D. Nunn, N. Raju, K. Ramalingam, RE.. Swenson, M.F. Tweedle. Gastrin Releasing Peptide Compounds
US Patent Number 7,922,998, 2011

34. M.A. Von Wronski, E.R. Marinelli, A.D. Nunn, R. Pillai, K. Ramalingam, M.F. Tweedle, K.E. Linder, P. Nanjappan, N. Raju. Compounds for Targeting Endothelial Cells, Compositions Containing the Same and Methods for Their Use
US Patent 8,263,739, 2012

35. E. Cappelletti, L. Lattuada, K.E. Linder, E.R. Marinelli, P. Nanjappan, N. Raju, R.E. Swenson, M.F. Tweedle. Gastrin Releasing Peptide Compounds
US Patent 8,420,050 2013, 2013

36. E. Cappelletti, L. Lattuada, K.E. Linder, E.R. Marinelli, P. Nanjappan, N. Raju, R.E. Swenson, M.F. Tweedle. Gastrin Releasing Peptide Compounds
US Patent 8,420,864,2013

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Recent Abstracts (2009 – 2014) 3 new in 2013/14 (Only External Abstracts included)

1.. K.E. Linder, E. Metcalfe, P. Nanjappan, T. Arunachalam, T. Skedzielewski, K. Ramos, A.D. Nunn, M.F. Tweedle, R.E. Swenson “Black Hole Quencher 3 (BHQ-3) quenches fluorescence from IRDye800 but is unstable in vivo - a tale of two compounds.” World Molecular Imaging Congress, Montreal, Canada, September 2009

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3.. R. Xu, J.S. Xu, J. Huang, M.F. Tweedle, C.Schmidt, S.P. Povoski, E.W. Martin "Targeted delivery of cancer-specific multimodal contrast agents for intraoperative detection of tumor boundaries and therapeutic margins" Design and Quality for Biomedical Technologies III. San Francisco, California, January 2010

4. R. Layman, N.C. Hall, J. Zhang, D. Barker, M. Natwa, M.F. Tweedle, M.V. Knopp. "Overview of current technology in clinical hybrid SPECT/CT" Society of Nuclear Medicine 57th Annual Meeting 2010. Scientific Poster Session: Educational Exhibit. Salt Lake City, Utah, June 2010

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6. Jeff Xu, Jiwei Huang, Ruogu Qin, Michael Tweedle, Ronald Xu. 2010. "Gold Nanoparticle Assisted Light Activation of Microbubbles for Photothermal Therapy Photonics West" 2010: 7551-32.

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8. K. Kumar, M. Matson, L.J. Wilson, M.F. Tweedle. "Loading and Human Plasma Stability of Gadonanotubes" World Molecular Imaging Congress, San Diego, California, September 2011

9. S.H. Wang, N. Raju, H. Ding, M.F. Tweedle. "Evaluation of biotinylated Bombesin analogs as tumor targeting probes" World Molecular Imaging Congress, San Diego, California, September 2011

10 K. Kumar, M. Matson, L.J. Wilson, M.F. Tweedle. "On the Stability of Gadonanotubes" Contrast Media Research Conference" Galveston, Texas, October 2011

11. Q. Ma, M.F. Tweedle. "X-ray AbsorptionSpectroscopy Study of Gd3+ loaded ultra short carbon nanotubes" 15th International Conference on X-ray Absorption Fine Structure (XAFS-XV), Beijing, China July 2012

12. Shrivastava A, Wang S-H, Natarajan, R, Gierach I, Tweedle M, "Heterobivalent chelating ligand for targeting GRP and NPY-1 receptors on tumor cells" World Molecular Imaging Society, Dublin Ireland, September, 2012

13. Mohd Yusof A, Kothandaraman S, Ding H, Tweedle M, Phay J. "DEVELOPMENT OF A CALCIUM-SENSING RECEPTOR MOLECULAR IMAGING AGENT".Annual AAES Meeting

Chicago, April 14 –16, 2013

14. A. Shrivastava, H. Ding, S. Kothandaraman, S. Wang, R. Natarajan, M. Williams, N. Raju, L. Gong, S. Zheng, K. Milum, M. F. Tweedle. “Near infrared fluorescent (NIRF) probes targeting bombesin receptors on breast and prostate cancers” Contrast Media Research 2013, November 2013. Beijing, China

15. C. Wright, R. Layman, M. F. Tweedle. “Optical Imaging of positron-emitting radionuclides using Cerenkov luminescence and its potential applications in radioguided surgery. Nafki , 2013

16. A. Ghosh, C. Beutner, M. Williams, H. Ding, A. Bratasz, K. Kumar, M. Tweedle, J. Goldberger. “Developing Pan Cancer Targeted MRI Contrast Agents that Self-Assemble in Malignant Tumors” ISMRM, Milan Italy, May, 2014

17. K. A. Collier, J. Zhang, K. Binzel, N. C. Hall, K. Kumar, M. F. Tweedle, P. Monroe, M. V. Knopp. “Neuroimaging PET tracers: An atlas based approachfor comparison in NHP PET/CT” SNM 2014, St. Louis, Mo.

18. Haiming Ding, Shankaran Kothandaraman , Li Gong, Michelle M. Williams, Wessel P. Dirksen, Thomas J. Rosol, Michael F. Tweedle. “NIRF Peptides Targeted to HuGRPr-tranfected Canine ACE-1 Prostate Cancer Tumors.” 2014 World Molecular Imaging Congress, Soel, Korea.

19. **Haiming Ding, willliam T. Drost, Li Gong, Shankaran Kothandaraman, Maria Menendez, Huyen nguyen, mitch phelps, Joshua Dowell, Robert R. Bahnson, Michael V. Knopp, Thomas J. Rosol, Michael F. Tweedle, “Orthotopic canine prostate cancer model for imaging agents to human cancer receptors” 2015 World Molecular Imaging Congress, Honolulu, Hawaii.**

20. **Chadwick L. Wright, Ricky R. Layman, Shankaran Kothandaraman, Nathan C. Hall, Michael V. Knopp, Michael F. Tweedle, “Buckeye-Boost: Cerenkov luminescence amplification by the wavelength-shifting Ohio Buckeye extract, esculin.” ACNM, 2015**

21. **Ashley Braddom, Timothy Richmond, Tyler Sheetz, Erika Reese, Anna Tessari, Kathleen Tober, Christin E. Burd, Claudia De Lorenzo, Edward W. Martin, Jr., Vincenzo Coppola,Charles Hitchcock, Michael F. Tweedle, Tatiana Oberyszyn, Carlo M. Croce and Dario Palmieri. “Anti-NCL scFv as a new tool for skin canmcer diagnosis and therapy.” James CCC Translational Therapeutics retreat. Oct 31, 2015, Columbus, Ohio**

22. **Tweedle, M.F. Dowell, J.; Bahnson, R.R.; Wright, C.L.; Ding, H.; Gong, L.; Kothandaraman, S.; Drost, T.; Dirksen, Wessel; Menendez, M.; Nguyen, H.; Phelps, M.; Knopp, M.V; .Rosol, T. J. “A versatile canine prostate cancer model that expresses human receptors” James CCC Translational Therapeutics retreat. Oct 31, 2015, Columbus, Ohio.**

23. **Tweedle, M.F., C Beuttner, A Wallace, M Williams, K Kumar, JE Goldberger Gd chelates that self-assemble in a low pH biological microenvironment. Contrast Media Research 2015, Berlin , Germany**

24. **John Phay, Steven Justiano, Haiming Ding, Kara Rossfeld, Shankaran Kothandaraman, Chadwick Wright, Matthew Ringel, Michael Tweedle. A novel imaging agent for medullary thyroid carcinoma in an orthotopic mouse model.**

External lectures

1. **2015 Case Comprehensive Cancer Center. "A versatile Canine Prostate Cancer Model" at Cancer Imaging Mini-Retreat, Friday October 16, 2015.**

2. Case Comprehensive Cancer Center. "Targeting Peptide Diagnostic Pharmaceuticals with Commercial Intent. November, 2013.

3. **Media Contrast Research 2015, Berlin, Germany "Gd chelates that self-assemble in a low pH biological microenvironment. Contrast"**

Internal Lectures

1. **Engineering 4891. Creativity and Innovation. "Entrepreneurial Attitudes." November, 2015.**

2. **James CCC Grand Rounds. "Pan-Cancer Targeting MRI Contrast Agents that Self-assemble in Malignant Tumors." May, 2015.**

3. **Residents Seminar. "History and Pharmacology of X ray and MRI Contrast Agents." July, 2015.**

4. **Radiology Safety Committee talk. "GBCA and Residual Gd." September, 2015.**

5. **Drug Development Institute. "Gd PA molecules as pan cancer imaging agents."**

   December 2015.

6. **Residenmts Seminar**

Educational Video

1. "ProHance, new Imaging Pharmaceutical for MRI." Bristol-Myers Squibb training VHS tape, 1989 (est.)

2. Prescription New Jersey, hosted by Sara Lee Kessler. "New Jersey Network Television documentary" Last aired July 28, 2005

3. 2011 Stefanie's Champions Awards Ceremony – "Continue to Fight" http://www.youtube.com/watch?v=NLDu94y3g6M

4. 2010 Stefanie's Champions Awards Ceremony – Opening Video http://www.youtube.com/watch?v=-XoN9GA-mGU&feature=plcp

5. **Radiological Society of North America. Interview and discussion. June 2015. Rrelease.**

Recent Press Reports (2009 – 2015 only) (Two new in 2013/14)

1. Columbus Post dispatch Article on Stefanie Spielman http://www.dispatch.com/live/content/local_news/stories/2009/11/24/Spielman_Funds.ART_ART_11-24-09_A1_FGFPJEU.html

2. WBNS-10/TV (Komen Race for the Cure special)
   As part of a 30-minute "behind-the-scenes" look at the upcoming Race for the Cure special, OSUCCC cancer researcher **Dr. Michael Tweedle** discusses his on-going research to develop a drug that would allow surgeons to know in real-time during surgery if they had removed all of the cancerous cells. "The drug would be like a bloodhound seeking out cancerous cells," said Tweedle, "and would glow when illuminated by a special light, thus allowing surgeons to see if they had clear margins before finishing the surgery."

   WBNS: http://bit.ly/ITCXAT

3. SNM Smart Brief with Jeff Kurate and Michael F. Tweedle
   Fall 2013 Re; Tauopathic Imaging Agents
   "Researchers create "designer" tracer for earlier diagnosis and better treatments of Alzheimer's" "Unlike beta amyloid, tau appears in specific brain regions in Alzheimer's," said Tweedle. "With a better view of how tau is distinct from amyloid, we'll be able to create a much more accurate view of disease staging, and do a much better job getting the right therapeutics into the right populations at the right time."
   http://www.news-medical.net/news/20130426/Researchers-create-designer-tracer-for-earlier-diagnosis-and-better-treatments-of-Alzheimers.aspx

4. **Internal CCTS Interview Online with Chad Wright and Michael Tweedle, Spring 2014 Re: Bremer Grant "^{123}Iodine-labeled HN1-800dye agents for dual-modality intraoperative surgical guidance during resection of head & neck squamous cell carcinoma." "Before a surgeon does any cutting, they will do imaging, like PET/CT, MRI or CT scans, to try to locate the cancer," Tweedle said. Wright and Tweedle's efforts have been strengthened by an outstanding team of multidisplinary collaborators, including Nathan Hall, MD, PhD, Quintin Pan, PhD,**

Ted Teknos, MD, and Michael Knopp, MD, PhD. Their novel, real-time imaging detection and treatment paradigm is critical to improving and personalizing cancer detection and care at Ohio State.https://ccts.osu.edu/node/4171

Optical Surgical Navigation workshop at the World Molecular Imaging Congress, co- organized http://www.wmis.org/optical-surgical-navigation-workshop-at-the-wmic-2014/

Synopsis. http://www.wmis.org/wp-content/uploads/2014/10/WMIC-2014-OSN-Workshop-RIs-Final.pdf