

Gregory M. Lanza, M.D., Ph.D.

Date: May 9, 2017

Citizenship: USA

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Present Position: Professor of Medicine, Biomedical Engineering and
Biology and Biomedical Sciences
Oliver M. Langenberg Distinguished Professor of the
Science and Practice of Medicine

Education:

1975: Bachelor of Arts
Colby College
Waterville, Maine 04901

1978: Masters of Science
Department of Poultry Science
University of Georgia
Athens, Georgia 30606

1981: Doctor of Philosophy
Department of Poultry Science
University of Georgia
Athens, Georgia 30606

1992: Doctor of Medicine
Northwestern University Medical School
Chicago, Illinois 60611

Academic Positions/Employment:

6/13 - Present Oliver M. Langenberg Distinguished Professor
of the Science and Practice of Medicine
Washington University Medical Center
St. Louis, Missouri 63110

7/08-Present: Professor of Medicine/Cardiology

Washington University Medical Center
St. Louis, Missouri 63110

- 7/08-Present: Professor of Biomedical Engineering
Washington University Medical Center
St. Louis, Missouri 63110
- 7/08-Present: Professor of Biology and Biomedical Sciences
Washington University Medical Center
St. Louis, Missouri 63110
- 2016-Present Kalocyte, LLC, Board Member
Biogenerator
4320 Forest Park Ave
St. Louis, MO 63108
- 2016-Present Capella Imaging, LLC, Co-founder
Biogenerator
4320 Forest Park Ave
St. Louis, MO 63108
- 2005-2015: Chief Science Officer
Kereos, Inc. (Co-founder)
St. Louis, MO 63108
- 9/04-6/08: Associate Professor of Medicine/Cardiology
Washington University Medical Center
St. Louis, Missouri 63110
- 9/04-6/08: Associate Professor of Biomedical Engineering
Washington University Medical Center
St. Louis, Missouri 63110
- 1/00-9/2004: Assistant Professor of Biomedical Engineering
Washington University Medical Center
St. Louis, Missouri 63110
- 7/99-9/2004: Assistant Professor of Medicine/Cardiology
Washington University Medical Center
St. Louis, Missouri 63110
- 1999-2005: Board Member
Kereos, Inc. (Co-founder)
St. Louis, MO 63108
- 2005-2015: Chief Scientific Officer (non-executive)
Kereos, Inc. (Co-founder)
St. Louis, MO 63108
- 7/96-6/99: Research Instructor of Medicine
Washington University Medical Center

St. Louis, Missouri 63110

6/94-6/99: Cardiology Fellowship Program
Barnes-Jewish Hospital
Washington University Medical Center
St. Louis, Missouri 63110

6/92-6/94: Medical Residency Program
Department of Medicine
Barnes Hospital
Washington University Medical Center
St. Louis, Missouri 63110

8/88-6/92: Northwestern University Medical School
303 Chicago Avenue
Chicago, Illinois

6/81-8/88: Animal Sciences Division
Monsanto Company
700 Chesterfield Parkway
St. Louis, Missouri

1985-1988: Product Biology Research Manager

Budget: \$2.9 Million/yr; Responsibility: Establish and direct a preclinical product development research program for dairy use of recombinant bovine somatotropin in support of US and ex-US regulatory approvals. The position was responsible for supporting the development and optimization of the product, designing, conducting and analyzing target and model animal pharmacodynamic (efficacy and physiology), pharmacokinetic, safety (toxicology, clinical and anatomical pathology) and metabolism residue studies. Statistics and Quality Assurance groups were also created and managed between 1983 and 1988.

1984-1985: Senior Research Group Leader

1983-1984: Research Specialist

1981-1983: Senior Research Biologist

1976-1981: Department of Poultry Science
University of Georgia
Athens, Georgia 30602

Research at the MS and PhD levels focused on biochemically quantifying resistance/susceptibility of *Gallus domesticus* to aflatoxicosis and developing corresponding genetic selection programs.

1978: International Research in Greece

Responsibility: Provide consultation and conduct research in Greek agricultural environment concerning the incidence of tibial dyschondroplasia, an issue of international litigation between Voktas, Inc. and Central Soya, Inc. (P.I. Drs. Leo Jensen and Roland Leach)

Medical Licensure and Board Certification:

Diplomat of the National Board of Medical Examiners, Parts I, II and III
Missouri Medical License: #101080 (1993)
Diplomat of American Board of Internal Medicine, 1995-12/2005, 2006-12/2015
Diplomat of American Board of Internal Medicine, Cardiology, 11/99-12/2009, 2009-12/2019
American Society of Echocardiography, Specialty Certification in Echocardiography, 1999-12/2009, 2009-12/2019

Honors and Awards:

Phi Kappa Phi Honor Society
Gamma Sigma Delta Agricultural Honor Society
Hubbard Farms Charitable Foundation Scholarship
Poultry Science Association Graduate Student Award
Northwestern University Medical Student Research Grant
NIH Research Festival for Outstanding PGY1 Researchers
American Heart Association Fellowship, Missouri Affiliate (1995-1997)
Bristol-Myers Squibb Fellowship Award (1997)
Bracco Diagnostics Inc./Society for Cardiac Angiography and Interventions Fellowship (1998)
1998 ACC/Littmann Scholarship Award
American Heart Association, Missouri Affiliate – Beginning Grant (1999-2001)
American College of Cardiology, Searle Career Development Award (2000)
Barnes-Jewish Hospital Research Foundation Award (1999-2001)
Biophys-NSERC Strategic Network for Bioplasmonics Systems University of Toronto, Expert Advisor 2010-2013
Numerous NIH and DOD grants, NIH and ex-US study groups annually.
Currently active NIH GDD study group (Gene and Drug Delivery), NCI U01 study group (2015-2017)
GeniSphere, LLC –Scientific Advisory Board 2014-present
American Society of Nanomedicine – Board of Directors 2013-2016.

Editorial Boards (Active):

WIRES: Nanomedicine and Nanobiotechnology – Wiley - (IF 4.09) (2010-Present)
Nanomedicine: Nanotechnology, Biology, and Medicine – Elsevier- (IF 5.67) (2009-2015)
Theranostics - Ivyspring (IF 8.85) (2011-present)
Contrast Media and Molecular Imaging – Wiley – (IF 3.28) (2009-2015)

Professional Societies and Organizations (Active)

Missouri Board of Healing Arts
American Heart Association
American College of Cardiologists
Society of Cardiovascular Magnetic Resonance
International Society for Magnetic Resonance in Medicine
American Society of Echocardiology
Society for Molecular Imaging
Society of Nuclear Medicine
American Society of Nanomedicine (Board Member)
American Society of Pharmacology and Experimental Therapeutics

Invited Presentations (since 1997)

1. Invited Speaker: Contrast Media Research, Kyoto, Japan, 5/97 - Enhanced detection of thrombi with a novel fibrin targeted magnetic resonance imaging agent.
2. Invited Speaker: Nycomed Imaging, Inc, Oslo, Norway, 6/97 - Review of targeted contrast applications for ultrasonic imaging.
3. Invited Speaker: NIH Seminar, Washington, DC, 9/97 - A novel targeted contrast agent for ultrasonic and magnetic resonance imaging.
4. Invited Speaker: Abbott, Inc, Chicago, IL, 10/97 - Review of targeted contrast technology for ultrasonic and MRI imaging.
5. Invited Speaker: Imclone Systems, Inc, Chicago, IL, 2/98 - Review of targeted contrast technology for ultrasonic and MRI imaging.
6. Invited Speaker: Acoustic Society of America, Seattle, WA 5/98 - Targeted acoustic contrast agents: new opportunities for ultrasound in medical diagnosis and therapy.
7. Invited Speaker: Abbott, Inc, Chicago, IL, 12/99- Updated review of targeted contrast technology for ultrasonic and MRI imaging.
8. Invited Speaker: WU Biochemical Engineering Seminar 12/99 - Molecular Imaging with Ligand-Targeted Immunoemulsions.
9. Invited Speaker: Schering AG, Inc, Berlin, Germany 5/2000- Updated review of targeted contrast technology for ultrasonic and MRI imaging.
10. Invited Speaker: Allerton Conference, Acoustic Contrast Agents, Allerton, Illinois 6/2000- Targeted acoustic contrast agents: new opportunities for ultrasound in medical diagnosis and therapy.
11. Invited Speaker: FMC Technology Review –2000, Princeton, NJ 9/2000 – Angiogenesis and Wound Healing.
12. Invited Speaker: Imaging in 2020 (NCI) – 9/2001 – “Molecular Imaging and Targeted Drug Delivery with a Novel Perfluorocarbon Nanoparticle”.

13. Invited Speaker: CMR 2001, 10/2001 Capri, Italy – “Molecular Imaging and Targeted Drug Delivery with a Novel, Ligand-Directed Paramagnetic Nanoparticle Technology”.
14. Invited Speaker: International Society for BioMEMS and Biomedical Nanotechnology 9/2001, Columbus, OH – “Magnetic Resonance Molecular Imaging and Targeted Drug Delivery with Site-specific Nanoparticles”.
15. Invited Speaker: NCI Unconventional Innovative Projects Program – Washington, DC - 2/2002 – “Molecular Imaging and Local Drug Delivery With a Novel $\alpha_v\beta_3$ -Targeted Nanoparticle Emulsion for Noninvasive Detection and Treatment of Cancer”.
16. Invited Speaker: Vulnerable Plaque Symposium 3/2002 Atlanta, GA “MR Imaging of Fibrin to Detect Plaque Mural Thrombi”.
17. Invited Speaker: Saint Louis University Cardiology Seminar Series 5/2002 St. Louis, MO – ““Molecular Imaging and Targeted Therapy”.
18. Invited Speaker: Molecular Imaging Workshop 6/2002 Helsinki, Finland “Molecular Imaging and Targeted Therapy”.
19. Invited Speaker: Joint NASA-NCI Biomolecular Physics and Chemistry Program – Monterey, CA - 7/2002 – “Unconventional Innovative Projects Lessons Learned”.
20. Invited Speaker: NCI Unconventional Innovative Projects Program – San Diego, CA - 2/2003 – “Molecular Imaging and Local Drug Delivery With a Novel $\alpha_v\beta_3$ -Targeted Nanoparticle Emulsion for Noninvasive Detection and Treatment of Cancer Update”.
21. Invited Speaker Seminar- Johns Hopkins Medical School - Department of Radiology 5/2003. Molecular Imaging and Targeted Drug Therapy.
22. Invited Speaker: Small Talk 2003. Molecular Imaging and Targeted Drug Delivery: Emerging Medical Paradigms.
23. Invited Speaker: American Chemical Society 2003. New York, NY. September, 2003. Molecular imaging and targeted drug therapy: merging paradigms in medicine.
24. Invited Speaker: IEEE -UFFC. Honolulu, HI. October, 2003. Molecular imaging and targeted drug delivery: merging medical paradigms.
25. Invited Speaker: Northwestern Echo 2003. Chicago, IL, October, 2003. Molecular Imaging.
26. Invited Speaker: AHA-Sunday Sessions. Orlando, FL. November, 2003. Molecular imaging and therapy; new paradigms for 21st century medicine.

27. Invited Speaker Society of Cardiac MRI. Barcelona, Spain February, 2004. State of the Art in Molecular Imaging and Targeted Therapeutics.
28. Invited Speaker: 5th Magnetic Microsphere Meeting Scientific and Clinical Applications of Magnetic Carriers. May, 2004. Lyon, France Molecular Imaging & Targeted Drug Delivery with a Site-specific Nanoparticle Platform Technology Emerging Opportunities for Non-invasive Diagnosis and Image-augmented Therapy.
29. Invited Speaker: International Symposium on Therapeutic Ultrasound. Kyoto, Japan, September, 2004. Molecular Imaging & Targeted Drug Delivery with a Site-specific Nanoparticle Platform Technology Emerging Opportunities for Non-invasive Diagnosis and Image-augmented Therapy.
30. Invited Speaker: 8th Annual Heart Failure Society of America. Toronto, Canada, September, 2004. Targeted Imaging and Therapeutics.
31. Invited Speaker: Gordon Research Conference. Waterville, Maine. June, 2004. Metals Meddle in Medicine.
32. Invited Speaker. Magnetic Nanoparticle Research Symposium, Baton Rouge, LA, June, 2004. Molecular Imaging & Targeted Drug Delivery with a Site-specific Nanoparticle Platform Technology Emerging Opportunities for Non-invasive Diagnosis and Image-augmented Therapy.
33. Invited Speaker: Evanston Hospital/Northwestern University Medical School. March, 2004. Ligand-Directed Nanoparticles in Molecular Medicine: Emerging Opportunities.
34. Invited Speaker: Society of Vascular Surgery/NHLBI Joint Workshop March, 2004, Bethesda, MD. Targeted Imaging and Therapeutics.
35. Invited Speaker. ISMRM Workshop on MR in Drug Development, McLean, VA April, 2004 MR Nanoparticles Technology Drug Development for Atherosclerosis.
36. Invited Speaker. American Society of Nuclear Cardiology. May, 2004, Bethesda, MD, Combined Therapeutic and Molecular Imaging Agent for Treatment and Monitoring of Plaque Angiogenesis in Atherosclerosis.
37. Invited Speaker. American Society of Nuclear Cardiology. May, 2004, Bethesda, MD, Nanotechnology and Molecular Imaging in Atherosclerosis.
38. Invited Speaker: Invited Speaker. AHA; Atherosclerosis, Thrombosis, and Vascular Biology. San Francisco, CA, May, 2004, Bethesda, MD, Combined Therapeutic and Molecular Imaging Agent for Treatment and Monitoring of Plaque Angiogenesis in Atherosclerosis.
39. Invited Speaker. Philips Medical Systems Molecular Imaging Users Group. September, 2004. Saint Louis, MO. Perfluorocarbon nanoparticles: a multimodal platform for targeted therapy and Molecular Imaging.

40. Invited Speaker: University of Virginia Cardiology Grand Rounds, Charlottesville, VA. September, 2004. Emerging Molecular Imaging and Targeted Therapy Opportunities.
41. Invited Speaker: University of Nebraska First Annual Biomagnetism Symposium. Lincoln, Nebraska, October, 2004. A Personalized Nanotechnology Approach to Cardiovascular Disease.
42. Invited Speaker: WU/Pfizer Retreat on Cardiovascular Disease October, 2004. A Personalized Nanotechnology Approach to Cardiovascular Disease.
43. Invited Speaker: NCI Nanotechnology Conference: Overcoming Barriers to Collaboration. Cleveland, OH, October, 2004. Development of Personalized Nanotechnology Approaches to Oncologic Disease.
44. Invited Speaker: University of Miami, Department of Medicine and Division of Cardiology Grand Rounds. December, 2004.
45. Invited Speaker: Ohio State University, Cardiology Grand Rounds. January, 2005.
46. Invited Speaker: Academy of Molecular Imaging, March, 2005.
47. Invited Speaker: Nanotech workshop at FDA. Personalized Medicine with -Ligand targeted Perfluorocarbon Nanoparticles, Shady Grove, MD March, 2005.
48. Invited Speaker, Clinical Diagnostics Program, San Francisco, CA April, 2005.
49. Invited Speaker, NCI Nanotechnology Workshop, Reno, NV, May, 2005.
50. Invited Speaker, Society of Nuclear Medicine, Toronto, CA, June, 2005.
51. Invited Speaker, Philips Medical Systems, Andover, MA, July, 2005.
52. Invited Speaker, American Association of Physicists in Medicine (AAPM), July, 2005.
53. Invited Speaker, Society of Molecular Imaging, Cologne, Germany, September, 2005.
54. Invited Speaker - 11th Samsung Intl Symposium of Molecular Imaging, Seoul, Korea, September, 2005.
55. Invited Speaker, Contrast Media Research Meeting, Evian, France, October, 2005.
56. Invited Speaker, Global Cardiovascular Interventions, Frankfurt, Germany November, 2005.
57. Invited Speaker, CHI- Clinical Biomarkers, Boston, MA, November, 2005.

58. Invited Speaker, New York Academy of Sciences, NY, NY December, 2005.
59. Invited Speaker, Philips Medical Systems, High-Risk Profiling Initiative, Eindhoven, NL. February, 2006.
60. Invited Speaker, European COST collaboration network on contrast agents, Orleans, France March, 2006.
61. Invited Speaker, 4th Fairberg's Cardiac Workshop, Charleston, SC, April, 2006.
62. Invited Speaker, Judkins Cardiac Imaging Symposium, Chicago, IL, May, 2006.
63. Invited Speaker, NIH Intramural Nanotechnology Conference, June, 2006.
64. Invited Speaker, SIS 2006: Emerging Technologies Symposium, Seattle, WA July, 2006.
65. Invited Speaker, MNiMBS Symposium, Ann Arbor, MI, September, 2006.
66. Invited Speaker, Missouri Nanotechnology Alliance, Columbia, MO, October, 2006.
67. Invited Speaker, Philips Life Sciences Symposium, Eindhoven, NL, October, 2006.
68. Invited Speaker, American Society of Cytopathology, Toronto, Canada, November, 2006.
69. Invited Speaker, FD & A, Washington, DC, November, 2006.
70. Invited Speaker, Wayne State University, Detroit, MI, December, 2006.
71. Invited Speaker, Georgia Tech, Atlanta, GA, January, 2007.
72. Invited Speaker, University of Turin, Turin, Italy, February, 2007.
73. Invited Speaker, European College of Radiology, Vienna, Austria, March, 2007.
74. Invited Speaker, Materials Research Society, San Francisco, CA, April, 2007.
75. Invited Speaker, CNST Nanotechnology Workshop, Champaign, IL, April, 2007.
76. Invited Speaker, University of North Carolina Medical School, Chapel Hill, NC, May, 2007.
77. Invited Speaker, International Society of Magnetic Research in Medicine, Plenary and Education Workshop, Berlin, May, 2007.
78. Invited Speaker, Nanomagnets Workshop, Madrid, Spain, June, 2007.
79. Invited Speaker, Evidence-Based Medicine Update at Hilton Head, July, 2007.

80. Invited Speaker, International Academy of Cardiology, Vancouver, CA, July, 2007.
81. Invited Speaker, "Targeted Therapeutics and drug delivery systems", University of Pennsylvania Seminar Series, Philadelphia, PA, November, 2007.
82. Invited Speaker, "Imaging Angiogenesis in Plaques", British Atherosclerosis Society Spring Meeting, Oxford, UK, April, 2008.
83. Invited Speaker, "Potential molecular imaging and targeting therapeutic applications with PFC nanoparticles", Mochtar Riady Institute for Nanotechnology Symposium, Jakarta, Indonesia, May, 2008.
84. Invited Speaker, 6th International Vulnerable Plaque Meeting, Vouliagmeni, Athens, June, 2008.
85. Invited Speaker, "Fibrin-targeted perfluorocarbon nanoparticles for targeted thrombolysis", International Sonothrombolysis Conference, Mannheim, Germany, July, 2008.
86. Invited Speaker, 1st Joint US-China Symposium on Nanobiology and Nanomedicine, Beijing, China, October, 2008.
87. Invited Speaker, "Theranostic Approaches to Cardiovascular Disease", SCMR 12th Annual Scientific Sessions, Orlando, FL, January, 2009.
88. Invited Speaker, Frontiers in Cutaneous Immunology 2009, Boston, MA, March, 2009.
89. Invited Speaker, "Molecular and nanoparticle based imaging: Part II: Cancer", Pittcon 2009 Symposium, Chicago, IL, March, 2009.
90. Invited Speaker, "Atherosclerosis imaging with nanoparticles", Symposium on Multimodality Cardiovascular Molecular Imaging, Bethesda, MD, April, 2009.
91. Invited Speaker, ISMRM 2009, Honolulu, HI, April, 2009.
92. Invited Speaker, "Atherosclerosis imaging with nanoparticles", Cardiovascular Molecular Imaging Symposium, Bethesda, MD, April, 2009.
93. Invited Speaker, "Nanomedicine: The evolution of a concept to a reality", JHMI, Baltimore, MD, May, 2009.
94. Invited Speaker, "Nanomedicine: From Theory to Application", Rome, Italy, June, 2009.
95. Invited Speaker, "Molecular imaging of atherosclerosis", 8th International Symposium on Highfield MR in Clinical Applications, Bonn, Germany, August, 2009.

96. Invited Speaker, Contrast Media Research '09, Copenhagen, Denmark, October, 2009.
97. Invited Speaker, "Diagnostics, imaging, and Therapeutics", 2009 International Institute for Nanotechnology (IIN) Symposium, Evanston, IL, October, 2009.
98. Co-Chair in session "Diagnostics: Imaging and Biosensors", American Society for Nanomedicine Conference, Potomac, MD, October, 2009.
99. Invited Speaker, Nanomedicine and Molecular Imaging Summit, Albuquerque, NM, February, 2010.
100. Invited Speaker, 4th Harbin International Molecular Imaging Summit Forum (HIMISF), Harbin, China, March, 2010.
101. Invited Speaker, "Nanomedicine approaches to image-guided drug delivery", CCRNP Nanobiology Seminar Series, Frederick, MD, April, 2010.
102. Invited Speaker, "Fibrin-specific thrombolytic nanoparticles", Princeton Conference, Boston, MA, April, 2010.
103. Invited Speaker, "Next Generation of Imaging Platforms: Clinical Validation of Nano Carriers/Probes/Agents", AAPM 52nd Annual Meeting, Philadelphia, PA, July, 2010.
104. Invited Plenary, 2010 World Molecular Imaging Congress, Kyoto, Japan, September, 2010.
105. Invited Speaker, "Nanotechnology: Pathway to the Clinic", The 2nd Joint US-China Symposium on Nanobiology and Nanomedicine, Washington, DC, September, 2010.
106. Invited Speaker, "Nanotechnology and Imaging of the Skin", Harvard Skin Disease Research Center's 4th International Conference on Skin Immunology, Boston, MA, March, 2011.
107. Plenary Speaker, Nanotechnology for Healthcare, Petit Jean Mountain, AR, April, 2011.
108. Invited Speaker, "Advancements in Nanomedicine Extend the Horizon of Diagnosis and Therapy", NanoDDS' 11, Salt Lake City, UT, October, 2011.
109. Session Chairman [Session 3: Theranostics (Part 2)] and Presenter, CMR 2011 Conference, Galveston, TX, October, 2011.
110. Invited Speaker, American Society for Nanomedicine (ASNM), Gaithersburg, MD, November, 2011.
111. Invited Speaker, 4th International Conference NanotechItaly 2011, Venice-Mestre, November, 2011.

112. Invited Speaker, “The Perfect Individual Image”, Symposium on Personalized Medicine, Austria, January, 2012.
113. BiopSys Expert Advisor, BiopSys All Network Meeting, Toronto, CA, January, 2012.
114. Invited Speaker, XVI School of Pure and Applied Biophysics on Multimodal Methods for Cell Imaging and Tracking, Venice, Italy, Jan/Feb 2012.
115. Session Chair, Society for Endocrinology BES 2012, Harrogate, UK, March, 2012.
116. Invited Moderator “Development and Evaluation of Targeted Imaging Probes- Part II” and Speaker “Imaging Angiogenesis and Arteriogenesis, “Multi-Spectral CT of the Vasculature”, 3rd Cardiovascular Molecular Imaging Symposium, Bethesda, MD, April, 2012.
117. Invited Speaker “Translational Preclinical Studies to First in Man”, SNM 2012 Annual Meeting, June, 2012.
118. Invited Speaker, “Development of MRI Theranostic Agents for Angiogenesis”, Founding Conference for Molecular Imaging Group of CSR & the 5th China Advanced Forum for Molecular Imaging, Harbin, China, July, 2012.
119. Invited Speaker “Development of MR Theranostic Agents for Angiogenesis”, 5th Annual Symposium on Integrating Nanotechnology with Cell Biology and Neuroscience, Albuquerque, New Mexico, August, 2012.
120. Invited Seminar Speaker “Nanomedicine Drug Delivery and Imaging Technologies from CTRAIN”, Bioengineering Fall Seminar Series, University of Maryland College, Hyattsville, MD, September, 2012.
121. Invited Speaker, 5th Image Guided Therapy Workshop, Boston, MA, September, 2012.
122. Invited Speaker, SRRSH 7th International Academic Week, Hangzhou, China, October, 2012.
123. Invited Speaker “Nanotheranostics for Cardiovascular Disease and Cancer”, Symposium on Nanomedicine, Boston, MA, November, 2012.
124. Invited Speaker “Therapeutic Nanotechnology”, AACR Annual Meeting, Washington, DC, April, 2013.
125. Invited Speaker “Nanocardiology – Cardiovascular Application”, British Cardiovascular Society Annual Conference, London Excel, June, 2013.
126. Invited Speaker, 2013 Cancer Nanotechnology Gordon Research Conference, Boston, MA, July, 2013.
127. Invited Speaker, “Approaching Unmet Medical Needs with Integrated Imaging

- and Therapy Technologies”, Yale University, New Haven, CT, October, 2013.
128. Invited Speaker “Emerging Technological Approaches to Cardiovascular and Pulmonary Disease”, Nanomedicine Day, Manhattan, NY, October, 2013.
 129. Invited Speaker, “Advanced Nanotechnologies Addressing Intractable Medical Issues”, University of Pennsylvania, October, 2013.
 130. Invited Speaker, “Characterization of Early Neovascular Response to Acute Lung Ischemia using Simultaneous $^{19}\text{F}/^1\text{H}$ MR Molecular Imaging” CMR, Beijing, China, November, 2013.
 131. Invited Speaker, Houston Methodist Research Institute, Houston, TX, January, 2014.
 132. Invited Speaker, American Society of Nanomedicine, Rockville, MD, March, 2014.
 133. Invited Speaker, “Targeted nanoparticles for imaging dynamic processes”, DDW 2014, Chicago, IL, May, 2014.
 134. Invited Speaker, “Imaging insights in atherosclerosis”, NYU Symposium, New York, NY, May, 2014.
 135. Invited Speaker, “Diagnosis of ventricular assist device (LVAD) thrombosis using fibrin-specific $^{99\text{m}}\text{Tc}$ imaging agent”, St. Louis, MO, June, 2014.
 136. Invited Speaker, “Development of Sn-2 lipase labile prodrugs for targeted Nanotherapy,” Liposome Research Days, Copenhagen, Denmark, August, 2014.
 137. Invited Speaker, NHLBI Biomedical Lecture Series, Bethesda, MD, June, 2015.
 138. Invited Speaker, “Imaging thrombus inside the VAD *In Situ*”, at the Gordon Research Conference on Assisted Circulation, Lucca (Barga), Italy, June 2015.
 139. Invited Speaker, 1st Photon Counting CT Workshop, Lyon, France, September 2015
 140. Invited Speaker, 2015 Chinese Congress of Radiology, Harbin, China, September 2015.
 141. Invited Speaker, United Imaging, Shanghai Pudong, China, September 2015
 142. Invited Speaker, American Society for Nanomedicine, Crystal City, VA, October, 2015.
 143. Invited Speaker, University of Nebraska Medical Center, Omaha, NE, November, 2015.

144. Invited Speaker, Keynote: "Fluorine magnetic resonance imaging with perfluorocarbon nanoparticles", ASME 5th NanoEngineering for Medicine & Biology, Houston, TX, February, 2016
145. Invited Speaker, 14th European Symposium on Controlled Drug Delivery, Egmond Ann Zee, the Netherlands, April, 2016
146. Invited Speaker, "Contact-Facilitated Drug Delivery of Lipase-Labile Prodrugs with Targeted Lipid-based Nanotherapies", Center for Nanotechnology in Drug Delivery Seminar, UNC Chapel Hill, April, 2016
147. Invited Speaker, "Contact-facilitated drug delivery of lipase-labile prodrugs with targeted lipid-based nanotherapies", 2016 Precision Nanomedicine Symposium, Beijing, China, July, 2016
148. Invited Speaker, "Photoacoustic neovascular imaging and treatment", 1st International Biophotonics Conference, Singapore, July, 2016
149. Invited Speaker, "Achieving effective extravascular targeted drug delivery in solid and liquid cancers", GRC Drug Carriers in Medicine and Biology Conference, Waterville Valley, NH, August, 2016
150. Invited Speaker, "Anti-angiogenic nanotherapy inhibits airway remodeling and hyper-responsiveness of dust mite triggered asthma in brown Norway rat", 14th International Nanomedicine & Drug Delivery Symposium (NanoDDS' 16), Baltimore, MD, September 2016
151. Invited Speaker, "US Clinical Nanotechnology - Update" Symposium on Nanotech for Cancer Research, NCI, Paris, France, November 2016.
152. Invited Speaker, "¹⁹Fluorine Magnetic Resonance Imaging with Perfluorocarbon Emulsions", University of Texas, Southwestern. Houston, February 2017.

Research Support:

ACTIVE

NIH U54 CA199092 (Achilefu/Lanza)

9/1/2015-7/31/2020

Center for Multiple Myeloma Nanotherapy

Administrative Core

Project 1 (Lanza)

Project 1: Preclinical and Clinical Imaging and Treatment of Multiple Myeloma with CMYC-MAX Nanoparticles

The overarching aim of this program will be to select and develop a transformative and clinically translatable VLA-4 targeted cMyc-Max antagonist PD nanotherapeutic candidate to maximize multiple myeloma survival.

NIH R01 HL122471-01A1 (Lanza/Achilefu)

04/01/2015-01/31/2019

Diagnosis of Left Ventricular Assist Device Intrapump Thrombosis

The specific aims of this project are: Aim 1. Utilize ^{99m}Tc-F4A prototype agent to quantify and characterize thrombus accumulation in LVAD circuits (i.e., inlet, pump, outlet components) and compare nuclear signal with pump histopathology results. Aim

2. Improve the current ^{99m}Tc -F4A probe to improve synthetic yield, increase production scale, and to permit simplified ^{99m}Tc chelation to N2S2 motif in the presence of a cyclic peptide. Aim 3. Correlate the fibrin nuclear signals and distribution patterns from the explanted LVADS using ^{99m}Tc -F4A or its analogues with patient clinical data.

SBIR HHSN268201400042C (Wang/Lanza) 09/08/2014-09/07/2017

National Institutes of Health (Subaward from Ocean NanoTech LLC)

Manganese-based MRI Contrast Agent for Risk Stratification of Atherosclerotic Plaque

This SBIR proposal supports the development of two, very closely related manganese-based nanoparticle agents designed to work in conjunction with current MRI plaque characterization techniques to triage patients with ruptured unstable and highly vulnerable carotid plaques to the most appropriate management strategy.

NIH R01 HL113392 (Lanza) 04/01/2012-02/28/2018

Theranostic Approach to Asthma Using Anti-Angiogenic Nanomedicine

The overarching hypotheses of this proposal are to use nanomedicine approach to noninvasively characterize bronchial angiogenesis (new vessel formation), to deliver acute antiangiogenic therapy to reduce airway remodeling and improve pulmonary function, and to maintain the acute benefits of this new treatment with standard-of-care low dose steroids.

Completed

NIH R01CA154737 (Lanza, Pan, Weilbaeher) 07/01/2011-04/30/2017 NCE

Next Generation Approaches to Breast Cancer Using Image Guided Drug Delivery

This proposal compares the anti-tumor effectiveness of anti-angiogenesis on tumor progression with and without zoledronic acid.

R42 HL112518 (Phase 2) (Wang/Lanza) 07/01/2012-07/31/2016

National Institutes of Health (Subaward from Ocean NanoTech LLC)

Bismuth-Organometallic Nanoparticles for Spectral CT Imaging of Coronary Ruptured Plaque

We propose the development of a novel thrombus-specific computed tomography (CT) nanoparticle (i.e., NanoK) approach for direct rapid assessment of coronary disease, which would complement parallel new advances in multidetector CT (MDCT), more specifically the development of Spectral (multicolored) CT.

CA100623 (Lanza) 09/1/2011-08/31/2014

US Army Medical Research Acquisition Activity

Treatment of Multiple Myeloma with VLA4-targeted Nanoparticles Delivering Novel c-

MYC inhibitor Prodrug The proposal describes a VLA-4, targeted nanomedicine to deliver c-Myc inhibitor prodrugs to MM cells with the expectation of minimizing off-target toxicity and extending life expectancy.

U01 NS073457 (Hourcade) 09/27/2010-08/31/2013

Characterization/bioinformatics-modeling of nanoparticle: complement interactions

The goal of this program is to develop QSAR models to predict complement and immune response to nanoparticle.

Role: Co-investigator

NIH U54 CA136398 (Wang) 09/01/2008-08/31/2013
Project 1 (Lanza): Photoacoustic/Optical/Ultrasonic Imaging of Sentinel Lymph Nodes and Metastases
The goal of this program is to provide a novel real-time noninvasive clinical imaging tool for sentinel lymph node mapping.
Role: Co-Investigator

NIH R01 AR056468 (Pham) 07/01/2008-04/30/2013
Targeted Nanotherapy in the Treatment of Inflammatory Arthritis
The goal of this study is to use the unique perfluorocarbon nanoparticle platform to impede and reverse inflammation in animal models of arthritis.
Role: Co-Investigator

NIH R01 HL094470 (Lanza) 09/01/2009-08/31/2012
Colloidal Iron-Oxide Nanobeacons for Theranostic Use in Atherosclerosis
The goal of this project is to develop colloidal iron oxide nanoparticles for molecular imaging and targeted therapy of thrombosis and angiogenesis in cardiovascular disease.

NIH R01 NS059302 (Lanza) 06/01/2007-05/31/2012
Fibrin-Specific Thrombolytic Nanoparticles for Acute Stroke
The goal of this project is to develop and evaluate fibrin-targeted thrombolytic nanoparticles for treatment of acute stroke.

R01 HL073646 (Wickline) 02/01/2010-01/31/2012
“Methods in Molecular Imaging and Targeted Therapeutics”
Development of Targeted Nanoparticles for Cardiovascular Imaging and Therapy.

NIH U54 CA119342 (Wickline) 09/30/2005-08/31/2010
SCCNE Core 3 - Biosignature and Vector Development Core (Lanza)
The purpose of this core is to implement Phage Display technology at Washington University.
Role: PI

NIH U54 CA119342 (Wickline) 09/30/2005-8/31/2010
SCCNE Project 1 - Neovascular-Directed Nanoparticles for Detection, Characterization and Treatment of Neoplasia with MRI (Project PI: Lanza)
The subject of this proposal is the application of a novel paramagnetic site-targeted contrast "platform technology" for sensitive and specific imaging of molecular epitopes expressed on tumor neovasculature alone and in combination with the local delivery of chemotherapeutic agents.
Role: PI

NIH U54 CA119342 (Wickline) 09/30/2005-08/31/2010
SCCNE Project 3 - Acoustic Nanobeacons for Targeted Detection and Treatment of Tumor Angiogenesis (Wickline)
The hypothesis of this project is that imaging with novel ultrasound contrast agents can delineate selected molecular epitopes associated with angiogenesis, inflammation, and metastasis in tumors at very early stages in the process of tumor expansion with the use of ligand-targeted, perfluorocarbon nanoparticle emulsion contrast agents.

Role: Co-Investigator

NIH R01 HL078631 (Lanza)

09/22/2004-08/31/2008

Combined Therapeutic-Imaging Agent for Atherosclerosis

This project explores the potential of HMG-CoA reductase inhibitors to sustain the acute "atherolytic" response of targeted fumagillin therapy and will evaluate the safety, pharmacokinetics, and pharmacodynamics of this technology.

Role: PI

NIH R01 EB001704 (Lanza)

04/01/2004-01/31/2009

Molecular Imaging of Angiogenesis by MRI

The goal of this project is to test the hypothesis that alpha(v)beta(3)-targeted paramagnetic nanoparticles will allow sensitive detection of the early molecular signatures of angiogenesis.

Role: PI

Additional Past Research Grant Support Detail

American Heart Association Fellowship, Missouri Affiliate (1995-1997):

Principal Investigator (PI)

Barnes Jewish Hospital Foundation (1996-1997): \$50,000, Principal Investigator

Bracco Diagnostics Inc/Society for Cardiac Angiography and Interventions Fellowship (1998-1999): \$25,000, Principal Investigator

American Heart Association, Missouri Affiliate – Beginning Grant (1999-2000):

\$35,000/yr, Principal Investigator

Barnes Jewish Hospital Foundation (1999-2000): \$50,000, Principal Investigator

American College of Cardiology Searle Award in Cardiovascular Disease (2000)

\$40,000, Principal Investigator

National Cancer Institute (2000-2003): \$2,092,153, Principal Investigator

Barnes Jewish Hospital Foundation (2000-2001): \$40,000, Principal Investigator

National Cancer Institute (2002-2005): \$2,782,905, Principal Investigator

National Cancer Institute (2003-2006): \$5,097,055, Principal Investigator

National Health Lung and Blood Institute (2004-2008): ~\$1,000,000,

Principal Investigator

National Institute of Neurological Disorders and Stroke (2007-2012) \$1,490,141,

Principal Investigator

Issued US Patents

(International Patents, provisional US, invention disclosures, and US applications in process excluded)

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2. DeGeeter M J, **Lanza GM**. Method for improved bovine milk production. 08/03/1983, Monsanto Company (St. Louis, MO). EEC Pat No. EP00085036A1.

3. **Lanza GM**, Alkan MH, Klegerman ME, Vonesh MJ, McPherson DD. Acoustically reflective liposomes and methods to make and use the same. 03/18/1997, Northwestern University (Evanston, IL), US Pat. No: 5,612,057.
4. **Lanza GM**, Wickline SA. Avidin-Biotin conjugated emulsions as a site specific binding system. 11/25/1997, Barnes-Jewish Hospital (St. Louis, MO). US Pat. No. 5,690,907.
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9. **Lanza GM**, Wickline SA. Site specific binding system, imaging compositions and methods. 04/15/2003, Barnes-Jewish Hospital (St. Louis, MO). US Pat No. 6,548,046.
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12. **Lanza GM**, Wickline SA. Paramagnetic particles that provide improved relaxivity. Barnes-Jewish Hospital (St. Louis, MO). 03/22/2005. US Patent No. 6,869,591.
13. **Lanza GM**, Hall CS, Wickline SA. Enhanced ultrasound detection with temperature-dependent contrast agents. 02/20/2007, Barnes-Jewish Hospital (St. Louis, MO). US Patent No. 7,179,449.
14. **Lanza GM**, Wickline SA. Methods for targeted drug delivery. 03/06/07, Barnes-Jewish Hospital (St. Louis, MO). US Patent No. 7,186,399.
15. **Lanza GM**, Wickline SA. Blood clot-targeted nanoparticles. 05/22/07, Barnes-Jewish Hospital (St. Louis, MO). US Patent No. 7,220,401.

16. **Lanza GM, Wickline SA.** Paramagnetic particles that provide improved relaxivity. 06/26/07, Barnes-Jewish Hospital (St. Louis, MO). US Patent No. 7,235,227.
17. **Lanza GM, Wickline SA, Harris T.** Integrin targeted imaging agents. 08/14/07, Barnes-Jewish Hospital (St. Louis, MO) US Patent No. 7,255,875.
18. **Lanza GM, Wickline SA, Athey PS, Gulyas G, Kiefer GE.** Chelating agents with lipophilic carriers. 10/9/07, Barnes-Jewish Hospital (St. Louis, MO) & The Dow Chemical Corporation (Midland, MI). US Patent No. 7,279,150.
19. **Lanza GM, Wickline SA, Harris T.** Integrin targeted imaging agents. 03/18/08, Barnes-Jewish Hospital (St. Louis, MO) US Patent No. 7,344,698.
20. **Lanza GM, Wickline SA, Harris T.** Integrin targeted imaging agents. 01/09/08, Barnes-Jewish Hospital (St. Louis, MO) & Bristol Myers Squibb Medical Imaging, Inc. (North Billerica, MA) US Patent No. 7,566,442.
21. **Lanza GM, Wickline SA, Athey PS, Gulyas G, Kiefer GE.** Chelating agents with lipophilic carriers. Barnes-Jewish Hospital (St. Louis, MO) The Dow Chemical Company (Midland, MI). 6/1/2010. US Patent No. 7,727,512.
22. **Lanza GM, Wickline, SA.** Targeted atherosclerosis treatment. Barnes-Jewish Hospital. 9/28/2010. US Patent No. 7,803,374
23. Schlessinger P, Soman N, **Lanza G, Wickline SA.** Nanoparticle delivery systems comprising a hydrophobic core and a lipid/surfactant layer comprising a membrane-lytic peptide. Washington University. 5/17/2011. US Patent No. 7,943,168.
24. **Lanza, GM, Wickline; Samuel A.** (St. Louis, MO), Kiefer; Garry E. (Richardson, TX), Athey; Phillip S. Targeted MR imaging agents. 8/23/11. US Patent No. 8,003,078.
25. Schlessinger P, Soman N, **Lanza G, Wickline SA.** Nanoparticle delivery systems for membrane-integrating peptides. Washington University (St. Louis, MO). 7/30/13. US Patent No. 8,496,945.
26. Hughes MS, McCarthy J, **Lanza G, Wickerhauser MV, Wickline S.** Applying renyi entropy to detect changes in scattering architecture. Washington University (St. Louis, MO). 8/6/13. US Patent No. 8,500,644.
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28. Wickline SA, **Lanza GM**. Methods for improving muscle strength. Washington University (St. Louis, MO). 8/4/2015. US Patent No. 9,095,521.
29. Wickline SA, **Lanza GM**. Methods for improving muscle strength. Washington University (St. Louis, MO). 8/16/2016. US Patent No. 9,415,018.
30. **Lanza GM**, Wickline SA, Pan D, Senpan A: Particles for imaging. Washington University (St. Louis, MO). 9/20/2016. US Patent No. **9,446,150**.
31. **Lanza GM**, Wickline SA, Pan D. Ligand directed toroidal nanoparticles for therapy and diagnostic imaging. Washington University (St. Louis, MO) 10/18/2016. US Patent No. 9,468,607.
32. **Lanza GM**, Pan D, Doctor A, Spinella P. Blood substitute composition and method of use. Washington University (St. Louis, MO) 11/8/16. US Patent No. 9,486,508.
33. **Lanza GM, Pan D**. Prodrug compositions, prodrug nanoparticles, and methods of use thereof, Washington University (St. Louis, MO) 11/22/16. US Patent No. 9,498,439.

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- characteristics of the descending thoracic aorta using transesophageal echocardiography. *J Am Soc Echo* 1991; 4 (1): 19-28. PMID: 2003933.
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Abstracts from Technical Meetings:

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