



Chair's message

Dear Biomedical Engineering Colleagues, Alumni, and Friends,

As we approach the beginning of a new academic year, I would like to thank the faculty, staff, and students of the University of Alabama at Birmingham (UAB) School of Medicine and School of Engineering for coming together in countless ways during the inaugural 2015-2016 year of the joint Department of Biomedical Engineering (BME) at UAB. Your essential contributions, both within and outside of the UAB campus, have given us many reasons to celebrate, including prestigious state, national, and international awards that have been described in this and previous issues of our eNewsletter (available [here](#)). I also wish to express my heartfelt gratitude for the generosity of philanthropists such as the Goodrich family in supporting BME at UAB.

Strategic planning for a research-oriented department, particularly one whose goals and aspirations are as high as those of BME, can be both daunting and exhilarating. Our first year saw the establishment of initiatives such as the Cardiovascular Tissue Engineering (CVTE) Symposium, the new Frontier Lectureship in Tissue Engineering, the BME Youth Summer Camp, and our new Molecular Cardiology Program, which will be led by

new faculty members professor Dr. Gangjian Qin (director) and associate professor Dr. Prasanna Krishnamurthy. For the fall semester of 2016, we welcome professors Dr. Joel Berry and Dr. Ho-Wook Jun as our new directors of undergraduate and graduate education (respectively), and our BME leadership committee has identified a new set of initiatives that will enhance our ability to serve our students and communities; the details of these new initiatives will be shared with you shortly.

I look forward to seeing all our students as we embark upon the second year of our mission to be an internationally recognized, research-oriented department of biomedical engineering, and a top choice for undergraduate and graduate education.

Best Wishes,

Jianyi "Jay" Zhang, M.D., Ph.D., F.A.H.A.

Chair, UAB Department of Biomedical Engineering

Dr. Zhang Gets \$3-Million Grant to Engineer Heart Tissue

Biomedical Engineering Department Chair Jianyi "Jay" Zhang, M.D., Ph.D., brought his expertise to UAB to fix hearts.

His dream — and the dream of other heart experts at major research universities around the world — is creating new tissue that can replace or protect damaged muscle after a heart attack.

Zhang already took a major step toward that goal when he and colleagues protected pigs from post-heart attack heart failure. As described in his 2014 [Cell Stem Cell paper](#), the researchers placed a mat of fibrin over the area where muscle had died and injected three types of cardiovascular cells underneath the mat. This is somewhat akin to starting new lawn by scattering grass seeds beneath a protective layer of hay. The fibrin helped some of the injected cells survive and grow, and they in turn protected the heart from further damage.

While Zhang's colleague at the University of Paris Descartes, Philippe Menasché, M.D., Ph.D., is currently testing this approach on five patients, Zhang is launching a new effort in biomedical engineering to improve heart repair, supported by a new \$3 million grant from the National Heart, Lung and Blood Institute of the NIH.

Instead of injecting individual cells and hoping they take seed, Zhang plans to robotically build and grow a mat of heart tissue made from individual cells, using a custom 3-D printer. Surgeons will then place this custom mat of living cells over the dead, infarcted tissue of the heart, somewhat akin to starting a new lawn by laying sod.



[Read More](#)

On-going need for surgical implant research

Dr. Jack Lemons, UAB University Professor, Dentistry, Engineering and Medicine

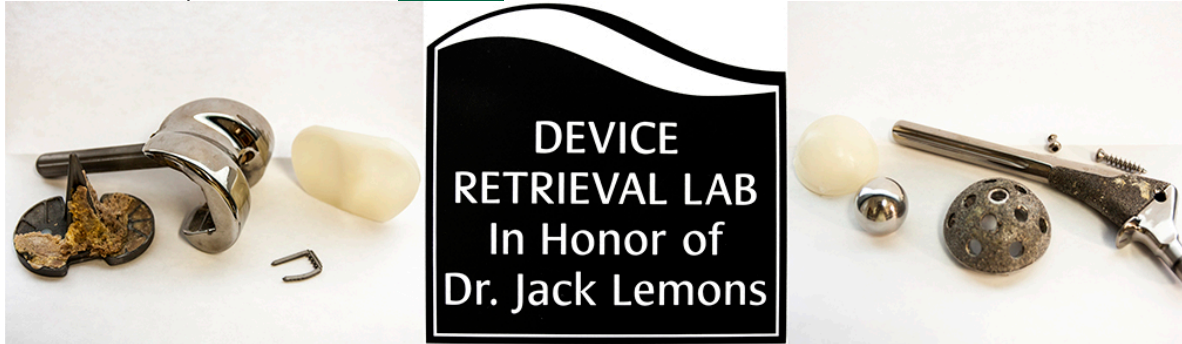
Reconstruction and replacement of body parts due to disease, trauma, genetic and other circumstances evolved into successful and predictable clinical outcomes in the early 1970s, based in part on advanced biomaterials and biomechanics. Results from numerous consensus conferences have demonstrated that the majority devices remain in-place and provide adequate function after a decade or more for 90 percent of those treated. In many situations, the devices remain functional without pain, for the lifetime of the individual treated.

Because of the multiple complexities associated with treatments including implant devices, it was realized that continued research and development are needed to enhance outcomes for an ever expanding patient population, including younger and more obese people. Today, records show that more than 17 million procedures are provided each year, where some type of implant is utilized.

The UAB faculty proposed a program in the early 1970s where the various devices removed at revision surgeries could be studied using engineering approaches, whereby projects, theses and dissertations might result in peer reviewed publications for students, staff and faculty participants. This program was called "Device Retrieval and Analysis" and many participated in the various studies after protocol and IRB approvals were completed.

The active collection of explants at UAB for research purposes was terminated in 2010, after completion of a NIH-funded program where retrievals included devices and tissues from organ/implant donors. The collection of mostly orthopaedic and dental systems includes about 8,000 of the older devices. These are now being transferred to the Department of Biomedical Engineering for possible use as historical displays and for additional research studies lead by Dr. Alan Eberhardt.

If interest exists, please contact Drs. [Eberhardt](#) or Lemons at UAB.



Latest Research Featured at 2016 CVTE Symposium



On March 28, 2016, more than 100 people attended the NIH Cardiovascular Tissue Engineering (CVTE) Workshop and Symposium, an event hosted by the UAB Department of Biomedical Engineering. The symposium was part of the NIH National Blood, Heart, and Lung Institute's Progenitor Cell Biology Consortium (PCBC) and featured information on the field's latest techniques and cutting-edge research.

"Seven years ago, many of the things we are discussing today were not possible," said BME Department Chair Jianyi (Jay) Zhang, M.D., Ph.D., in his opening remarks. "It is very exciting to look at the levels of knowledge and expertise here today and imagine where we might be seven years from now."

The goal of the 2016 CVTE Symposium was to identify novel potential CVTE therapy products and to discuss new approaches to repair a damaged heart and vasculature. Significant advances in understanding of how to coax stem cells towards a cardiovascular cell fate as well as scaffold technologies have made it possible to now consider when and how these CVTE products are ready for clinical trials.

[Read More](#)

AIMTech Unveils 1st Product at ACSM Conference

Robert Hergenrother, Ph.D., director of AIMTech and professor in the Department of Biomedical Engineering

A unique treadmill designed by an interdisciplinary team of researchers at UAB lead by [Dr. David A. Brown](#) and Southern Research made its debut at the American College of Sports Medicine Annual Meeting in Boston from May 31-June 4.

The device, ResistX, is the first product produced by the Alliance for Innovative Medical Technology (AIMTech), a partnership between [Southern Research](#) and the UAB [Department of Biomedical Engineering](#).

"ResistX is different from anything on the market, and represents a significant milestone for AIMTech and the physical therapy and rehab communities," said Robert Hergenrother, Ph.D., director of AIMTech and professor in the Department of Biomedical Engineering.

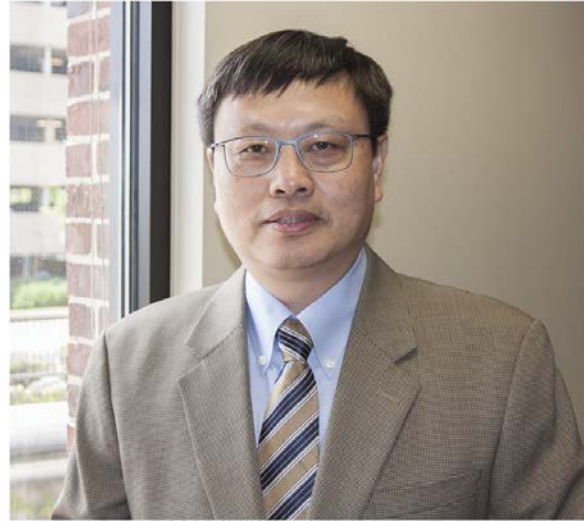


[Read More](#)

New Faculty

Gangjian Qin, M.D., F.A.H.A., joined UAB in July as Professor and Director of the Molecular Cardiology Program in the Department of Biomedical Engineering, University of Alabama at Birmingham. Before joining UAB, Dr. Qin served as tenured associate professor at Feinberg Cardiovascular Research Institute, Department of Medicine – Cardiology, Northwestern University, Chicago. Dr. Qin's research program is dedicated to defining the molecular mechanisms that underlie cardiovascular biology and contribute to the recovery from cardiovascular disease, and to translating the results from these basic science investigations to clinical applications. A portion of his research focuses on the transcriptional networks and genetic pathways that control the growth and function of blood vessels. His lab for the first time described the roles of the E2F oncogenes in the ischemic angiogenesis and blood pressure regulation. Another focus of Dr. Qin's research is to improve the reparative capacity of endogenous stem cells, including bone marrow stem cells and cardiac stem cells, for the treatment of ischemic heart disease. His work has contributed to the advancement of the field by characterizing the molecular interactions between bone marrow stem cells and their microenvironment and by establishing the significance of specific mobilization of stem cells in the ischemic tissue repair. Additionally, Dr. Qin's lab has identified a unique population of cardiac stem cells in the rodent heart and systemically evaluated the impact of ischemia/hypoxia on their regenerative capacity. Other ongoing research in Qin lab includes epigenetic mechanisms of cardiac differentiation of embryonic and induced-pluripotent stem (ES and iPS) cells, development of peptide-based nanoparticles for enhancing the therapeutic benefit of human CD34 cells in pre-clinical models, and novel signaling pathways linking adipogenesis and obesity. Dr. Qin has published over 90 original research articles in major international journals and numerous reviews, book chapters, and editorials. He serves on the editorial boards of 12 international journals in the fields of stem cell biology and cardiovascular sciences and as an expert reviewer for over 40 biomedical journals. He has been frequently invited to speak at national and international meetings. Dr. Qin's research is supported by NIH, the American Heart Association (AHA), and the American Diabetes Association (ADA).

Dr. Qin is also committed to teaching students and providing academic services. During last 10 years, he has mentored over 30 young researchers including postdoctoral fellows, PhD students, and medical students in his laboratory. His trainees have successfully competed for many nationally and internationally research awards. While in Northwestern, he served on the Medical Scientist Training Program (MSTP) admission committee, student research committee, faculty senate, and IACUC committee. In addition, Dr. Qin serves in the review of grant applications for the NIH, VA, AHA, Center for the Advancement of Science in Space (CASIS), and a number of international funding agencies.



Gangjian Qin, M.D.
*Director of Molecular Cardiology Program
Department of Biomedical Engineering
Professor of Medicine, of Engineering
School of Medicine, School of Engineering*

BME Summer Camp 2016



This summer the Department of Biomedical Engineering (BME) debuted its first summer camp. The four-week camp was offered to high school juniors and seniors, and incoming college freshmen to provide an immersive experience in biomedical research and to promote young engineers and diversity in the biomedical engineering community. Summer campers hailed from area schools - Hoover High School, Indian Springs, Jefferson County International Baccalaureate, Alabama School of Fine Arts, and Shades Valley High School - and from as far as Northridge High School (Tuscaloosa), and Stratford Academy (Georgia). The camp had good representation from underrepresented minorities, including six females and one African-American student, consistent with the diversity of UAB Biomedical Engineering. Students were immersed in labs that exposed them to many areas of BME research, including the growing area of cardiovascular tissue engineering, under the direction of new department chair Dr. Jay Zhang. Each Friday of the four-week camp, the students enjoyed lunch together as a group and heard from professionals working in the field of biomedical engineering. The inaugural camp was a great success and UAB BME summer camps will be offered annually. For more information on the UAB BME summer camp program contact Julie Calma (green shirt, jcalma@uab.edu) or click [here](#).

Biomedical Engineering Graduate Student Society (BMEGS)

The BMEGS of the Department of Biomedical Engineering conducted the 5th Annual Biomedical Engineering Research Symposium to raise awareness about BME's exciting new research while simultaneously providing a forum to develop collaborations between UAB researchers and companies interested in advancing current biomedical technology. This year the two-day symposium was held on March 29 and 30. The 6th Annual Biomedical Engineering Research Symposium will be held in early February in 2017. To learn more about the BMEGS student organization, click [here](#).



BMEGS Symposium 2016. left to right: Dr. Jianyi Zhang, Dr. Richard N. Kitsis, Nicholas Pensa (BME graduate student)

BMEGS Officers 2016-2017. left to right: Amanda Rusho (Secretary), Grant Alexander (President), Andy Curry (Symposium Head), Wes Labarge (Treasurer)

Awards

1. Jianyi "Jay" Zhang, M.D., Ph.D., F.A.H.A., has been awarded a NIH R01 grant (Total \$3M) for his work on *Stem Cell Therapy for Myocardial Repair*. The proposed studies will utilize pre-differentiated myocytes and vascular progenitor cells derived from human cardiac induced pluripotent stem cells (hciPSCs) in a porcine model of postinfarction LV remodeling with immune suppression to examine whether the cell transplantation can result in the improvement of myocardial perfusion, metabolism, and contractile function of the failing heart.
2. Wuqiang "Wuk" Zhu, M.D., Ph.D., has been awarded an American Heart Association (AHA) Scientist Development Grant in the amount of \$214,500 for his research on "*Enhancing Post-infarction Myogenesis via Transplantation of Cyclin D2 Expressing iPS-derived Cardiomyocytes*". The objective of this highly competitive award is to support exceptionally promising beginning scientists in cardiovascular research between their initial research training and their complete independence.
3. Hanyu Zhang, graduate student at Dr. Jack M. Roger's lab has been awarded with GSA Winter 2016 predoctoral fellowship from the American Heart Association. Title: *Optical Mapping of Cardiac Electromechanics*. The objective of his research is to improve our understanding on the mechanisms underlying arrhythmogenesis during cardiac acute regional ischemia. The new insights from his study would lead to the improvement in prevention/treatment protocols for arrhythmia during acute regional ischemia.
4. Romone Fancy, graduate student in Dr. Yuhua Song's lab, has been awarded the Comprehensive Minority Faculty and Student Program Fellowship from UAB Office of Vice President for Diversity, Equity, and Inclusion to pursue his Ph.D. degree in Biomedical Engineering.
- 5.

Events

Frontiers of Cardiovascular Tissue Engineering Seminar by Dr. Victor Dzau

Victor J. Dzau, M.D., [President of the National Academy of Medicine \(NAM\)](#), formerly the Institute of Medicine (IOM), will present "*Rebuilding the Failing Heart: Bypassing Roadblocks in Cardiac Cell Therapy*" as part of the Frontiers of Cardiovascular Tissue Engineering Seminar series at UAB on **Friday, August 19th, 2016 at 8:30 AM** in the West Pavilion Conference Center, Room WP-E, located at 615 18th Street South, Birmingham, AL 35294.

In addition to his position as President of NAM, Dr. Dzau serves as Chair of the Health and Medicine Division Committee of the National Academies of Sciences, Engineering, and Medicine. He is Chancellor Emeritus and James B. Duke Professor of Medicine at Duke University and the past President and CEO of the Duke University Health System. Previously, Dr. Dzau was the Hersey Professor of Theory and Practice of Medicine and Chairman of Medicine at Harvard Medical School's Brigham and Women's Hospital, as well as Chairman of the Department of Medicine at Stanford University.

Dr. Dzau has made a significant impact on medicine through his seminal research in cardiovascular medicine and genetics, his pioneering of the discipline of vascular medicine, and his leadership in health care innovation. His important work on the renin angiotensin system (RAS) paved the way for the contemporary understanding of RAS in cardiovascular disease and the development of RAS inhibitors as widely used, lifesaving drugs. Dr. Dzau also pioneered gene therapy for vascular disease, and his recent work on stem cell paracrine mechanisms and the use of microRNA in direct reprogramming provides novel insight into stem cell biology and regenerative medicine.

2017 PCBC CVTE Workshop – March 2nd, 2017

The NIH National Heart Lung and Blood Institute (NHLBI) will provide \$27,105 in funding for the 3rd annual Progenitor Cell Biology Consortium (PCBC) Cardiovascular Tissue Engineering (CVTE) Workshop, led by Dr. Jianyi "Jay" Zhang of UAB BME.

The 2017 PCBC CVTE Workshop, entitled "***Overcoming Roadblocks to CV Tissue Engineering Therapy***", will be held at the University of Alabama at Birmingham (UAB) on **Thursday, March 2nd, 2017**.

The workshop brings together a working group of leading investigators in the area of cardiovascular tissue engineering (CVTE) to address roadblocks to making CVTE therapy products and organize a Consensus Conference on CVTE. The aim is for biologists, engineers, and clinician-scientists to converge and conduct research related to cardiac repair or regeneration; enhance continuing synergies between PCBC investigators; and foster development of young investigators and junior faculty in these areas. Additional information will be available on the CVTE Symposium [page](#) at a future date.

Fellowship Opportunities

Predocctoral Fellowship:

- National Institute of Health provides several predoctoral fellowships in specified health and health-related areas. For eligibility and application click [here](#).
- National Science Foundation (NSF) graduate research program supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited United States institutions. For eligibility and other details click [here](#).

- To help students initiate careers in cardiovascular and stroke research American Heart Association provides multiple predoctoral fellowships. For eligibility and application click [here](#).

Postdoctoral Fellowship:

- To provide postdoctoral research training to individuals to broaden their scientific background and extend their potential for research in specified health-related areas, National Institute of Health provides several fellowships. For eligibility and application click [here](#).
- National Science Foundation (NSF) provides several postdoctoral research fellowships in biology. Application deadline November 8, 2016. For details click [here](#).
- American Heart Association provides multiple postdoctoral fellowships to empower postdoctoral trainees who are not independent with assistance and training from a mentor to initiate careers in cardiovascular and stroke research. For eligibility and application click [here](#).
-

PhD Graduations

1. Carlos Carmona Moran successfully defended his Ph.D. thesis, "*Development and Evaluation of Formulations for Transdermal Drug Delivery Systems*" in January 2016 and received his degree in May 2016. He is currently a Postdoctoral Fellow, NanoScience Technology Center, University of Central Florida.
2. Didarul Bhuiyan received his Ph.D. in December 2015. His thesis is titled "*Synthesis and Characterization of a Collagen-Based Biodegradable Polymer Initiated by Hydroxyapatite-Nanoparticles for Bone Regeneration*". He is currently a Postdoctoral Fellow in the Department of Biomedical Engineering, University of Minnesota.
3. Albert Jang, graduate student of Dr. Jay Zhang, successfully defended his Ph.D. in E.C.E. in June 2016 at the University of Minnesota. His Ph.D. thesis is titled "*Fast Spectroscopic Imaging and Field Compensation Using Frequency Modulation at Ultra-High-Field*".

Featured Publications

1. Romone M. Fancy, Lingyun Wang, Qinghua Zeng, Hong Wang, Tong Zhou, Donald J. Buchsbaum, Yuhua Song. Characterization of the Interactions between Calmodulin and Death Receptor 5 in Triple-Negative and Estrogen Receptor Positive Breast Cancer Cells: An Integrated Experimental and Computational Study. *The Journal of Biological Chemistry*, 2016, 291(24):12862-70.
2. Hongyi Yang, Yuhua Song. Structural insight for roles of DR5 death domain mutations on oligomerization of DR5 death domain – FADD complex in the death-inducing signaling complex formation: a computational study. *Journal of Molecular Modeling*, 2016, 22 (4): 89.
3. Hanyu Zhang, Kenichi Iijima, Jian Huang, Gregory P. Walcott, Jack M. Rogers. Optical Mapping of Membrane Potential and Epicardial Deformation in Beating Hearts. *Biophysical journal (in press)*.

4. Marcas M. Bamman, Timothy M. Wick, Carlos A. Carmona-Moran and S. Louis Bridges Jr. Exercise Medicine for Osteoarthritis: Research Strategies to Maximize Effectiveness. *Arthritis Care & Research*, 2016, 68(3), pp. 288.
5. Carmona-Moran, C.A., O. Zavgorodnya, A.D. Penman, E. Kharampieva, S.L. Bridges Jr, R.W. Hergenrother, J.A. Singh and T.M. Wick. Development of Gellan Gum Containing Formulations for Transdermal Drug Delivery: Component Evaluation and Controlled Drug Release using Temperature Responsive Nanogels. *International Journal of Pharmaceutics*, Available online June 1, 2016, doi:10.1016/j.ijpharm.2016.05.062.
6. Didarul B. Bhuiyan, John C. Middleton, Rina Tannenbaum and Timothy M. Wick. Exercise Medicine for Osteoarthritis: Research Strategies to Maximize Effectiveness. *Journal of Biomaterials Science: polymer edition*, Available online. doi:10.1080/09205063.2016.1184121.
 7. Angkasith P, Burgess JO, Bottino MC, Lawson NC. Cleaning Methods for Zirconia Following Salivary Contamination. *J Prosthodont*, 2016 Feb 2. doi: 10.1111/jopr.12441.
8. Sawlani K, Lawson NC, Burgess JO, Lemons JE, Kinderknecht KE, Givan DA, Ramp L. Factors influencing the progression of noncarious cervical lesions: A 5-year prospective clinical evaluation. *J Prosthet Dent*, 2016 Jan 7. pii: S0022-3913(15)00632-0. doi: 10.1016/j.prosdent.2015.10.021.
9. Lucas TJ, Lawson NC, Janowski GM, Burgess JO. Effect of grain size on the monoclinic transformation, hardness, roughness, and modulus of aged partially stabilized zirconia. *Dent Mater*, 2015 Dec;31(12):1487-92. doi: 10.1016/j.dental.2015.09.014.
 10. Menees TS, Lin CP, Kojic DD, Burgess JO, Lawson NC. Depth of Cure of bulk fill composites with monowave and polywave curing lights. *Am J Dent*, 2015 Dec;28(6):357-63.
 11. Sawlani K, Lawson NC, Burgess JO, Lemons JE, Kinderknecht KE, Givan DA, Ramp L. Factors influencing the progression of noncarious cervical lesions: A 5-year prospective clinical evaluation. *J Prosthet Dent*, 2016 Jan 7. pii: S0022-3913(15)00632-0. doi: 10.1016/j.prosdent.2015.10.021.
12. Kapnisis KK, Pitsillides CM, Prokopi MS, Lapathitis G, Karaiskos C, Eleftheriou PC, Brott BC, Anderson PG, Lemons JE, Anayiotos AS. In vivo monitoring of the inflammatory response in a stented mouse aorta model. *J Biomed Mater Res A*, 2016 Jan;104(1):227-38. doi: 10.1002/jbm.a.35560.
13. Verma S, Garikipati VN, Krishnamurthy P, Khan M, Thorne T, Qin G, Losordo DW, and Kishore R. IL-10 Accelerates Re-Endothelialization And Inhibits Post-Injury Intimal Hyperplasia Following Carotid Artery Denudation. *PLOS ONE* 2016 Jan 25;11(1):e0147615. PMID: 26808574.
 14. Lambers E, Arnone B, Fatima A, Qin G, Wasserstrom JA, Kume T. Foxc1 regulates early cardiomyogenesis and functional properties of embryonic stem cell derived cardiomyocytes. *Stem Cells* 2016. Jun;34(6):1487-500. PMID: 26824887.
 15. Du J, Zhang L, Wang Z, Yano N, Zhao YT, Wei L, Dubielecka-Szczerba P, Liu PY, Zhuang S, Qin G, Zhao TC. Exendin-4 induces myocardial protection through MKK3 and Akt-1 in infarcted hearts. *Am J Physiol Cell Physiol*. 2016;310(4):C270-83. PMID: 26739490.
 16. Chen N, Cen JS, Wang J, Qin G, Long L, Wang L, Wei F, Xiang Q, Deng DY, Wan Y. Targeted Inhibition of Leucine-Rich Repeat and Immunoglobulin Domain-Containing Protein 1 in Transplanted Neural Stem Cells Promotes Neuronal Differentiation and Functional Recovery in Rats Subjected to Spinal Cord Injury. *Crit Care Med*. 2016 Mar;44(3):e146-57. PMID: 26491860.
 17. Jiang QJ, Chen W, Dan H, Tan L, Zhu H, Yang G, Shen J, Peng YB, Zhao P, Xue L, Yu MF, Ma L, Si XT, Wang Z, Dai J, Qin G, Zou C, Liu QH. Cortex phellodendri Extract Relaxes Airway Smooth Muscle. *Evid Based Complement Alternat Med*. 2016;2016:8703239 PMID: 27239213 PMCID: PMC4863113.
 18. Albert Jang, Qiang Xiong, Pengyuan Zhang, and Jianyi Zhang. Transmurally Differentiated Measurement of ATP Hydrolysis Rates in the In Vivo Porcine Hearts. *Magnetic Resonance in Medicine*. 2016 May;75(5):1859-66. doi: 10.1002/mrm.26162.
 19. Albert Jang, Naoharu Kobayashi, Steen Moeller, J. Thomas Vaughan, Jianyi Zhang, and Michael Garwood. 2D Pulses using spatially dependent frequency sweeping. *Magn Reson Med*. 2015 Nov 27. doi:10.1002/mrm.25973.
- 20.

Editor-in-Chief: Ram Kannappan | ramkn@uab.edu
Associate Editor: Kelly Hillard | kellybme@uab.edu