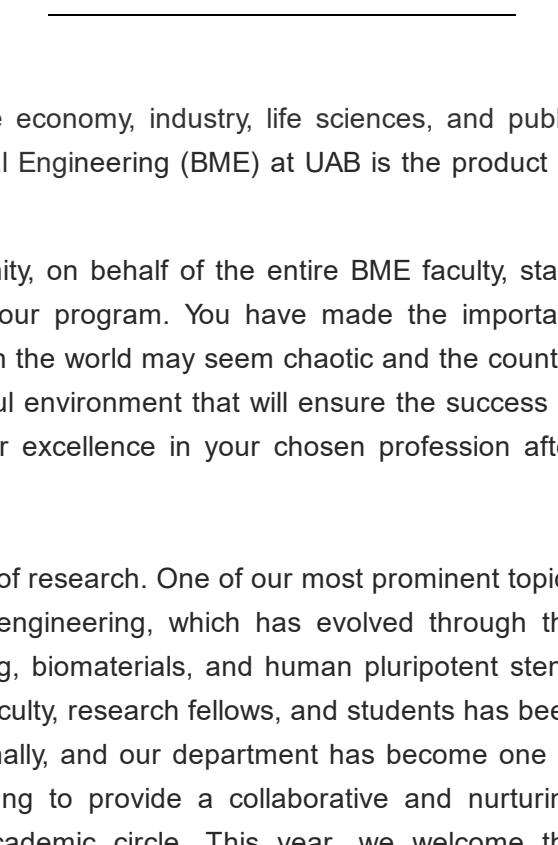


UAB
DEPARTMENT OF BIOMEDICAL ENGINEERING

Fall 2018 Newsletter | Department of Biomedical Engineering

Message from the Department Chair

Dear Colleagues, Alumni, Students, Staff, and Friends,



Jianyi (Jay) Zhang, MD, PhD
Chair and Professor,
Dept of Biomedical Engineering

Periods of great advancement in the history of civilization have often been propelled by a convergence between engineering and science, such as the development of paper in China, the steam engine in Europe (which gave birth to the industrial revolution), and computers in America.

The beginning of this new academic year occurs during the 3rd revolution in life sciences (the Convergence Revolution), as scientific and engineering discoveries made during the last handful of decades are having a revolutionary impact on the economy, industry, life sciences, and public health. The joint department of Biomedical Engineering (BME) at UAB is the product of the 3rd revolution.

To our new students, I take this opportunity, on behalf of the entire BME faculty, staff, and student body, to welcome you into our program. You have made the important choice to enroll at UAB during a time when the world may seem chaotic and the country divided. We are here to provide a peaceful environment that will ensure the success of your BME education and prepare you for excellence in your chosen profession after graduation.

Our department has grown in many fields of research. One of our most prominent topics of investigation is cardiovascular tissue engineering, which has evolved through the convergence of innovations in engineering, biomaterials, and human pluripotent stem-cell (hPSC) technology. The work of our faculty, research fellows, and students has been recognized both nationally and internationally, and our department has become one of the most prestigious of its kind by striving to provide a collaborative and nurturing environment for all members of our academic circle. This year, we welcome the expertise of our newly appointed joint faculty members, including Dr. Philippe Menasché, a prominent physician-scientist who has been a pioneer in the field of cardiac cell therapy for more than 20 years and has recently completed the first clinical trial to test the use of hPSC-derived cardiac muscle patches in patients with heart failure. The insights and discoveries of leading scientists from our own campus and around the world will continue to be highlighted through our series of groundbreaking seminars and at the annual NIH-sponsored Cardiovascular Bioengineering (CVBE) Symposium, which we have hosted each year since its inception in 2017 after two earlier years as annual workshops.

I am grateful to have witnessed first-hand the exceptional talent and dedication of all members of our education and research community, and I look forward to working with our new faculty and our new class of students.

With best wishes,

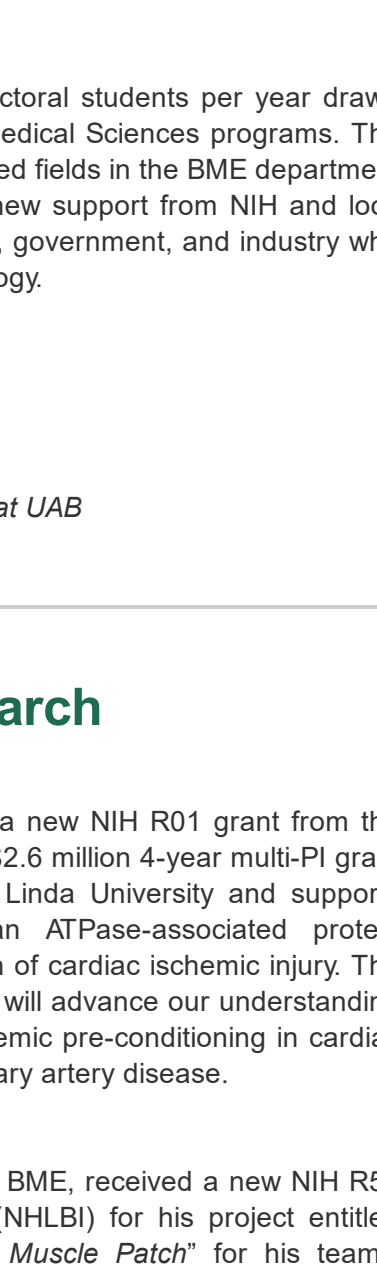
Jianyi (Jay) Zhang, MD, PhD
Chair, Department of Biomedical Engineering
T. Michael and Gillian Goodrich Endowed Chair of Engineering Leadership
Professor of Medicine, of Engineering
School of Medicine, School of Engineering
UAB | The University of Alabama at Birmingham

New NIH Training Grant in Cardiovascular Tissue Engineering

Dear Colleagues, Alumni, Students, Staff, and Friends:

Cardiovascular tissue engineering (CVTE) has tremendous, but as yet unrealized, potential to treat disease. Future scientists and engineers working in this area will need expertise in a broad range of subfields including cardiovascular pathophysiology, cell/scaffold engineering methods, and the diverse technologies needed to evaluate the electromechanical safety and efficacy of prototype therapies.

To help meet this need, the NIH National Institute of Biomedical Imaging and Bioengineering (NIBIB) has awarded UAB a new Ruth L. Kirschstein NRSA Institutional Research Training Grant (T32). The five-year grant, titled “*Development and Functional Assessment of Cardiovascular Tissue Engineering Therapy*,” will be co-directed by BME Chair Jay Zhang and myself. The program will support up to four predoctoral students per year drawn from UAB’s Biomedical Engineering and Graduate Biomedical Sciences programs. The new program builds on research strengths in CVTE-related fields in the BME department and across UAB. We are excited and thankful for the new support from NIH and look forward to training a cadre of professionals in academia, government, and industry who will accelerate the safe clinical adoption of CVTE technology.



Jack Rogers, PhD
Professor of BME

Best regards,

Jack Rogers, PhD
Professor, Department of Biomedical Engineering
Co-Director, NIH NIBIB T32 Research Training Program at UAB

New Grants Boost BME Research

Gangjian “GQ” Qin, MD, Professor of BME, received a new NIH R01 grant from the National Heart, Lung, and Blood Institute (NHLBI). This \$2.6 million 4-year multi-PI grant will be in collaboration with Dr. Hongyu Qiu at Loma Linda University and supports investigation of valosin-containing protein (VCP), an ATPase-associated protein previously uncharacterized in the heart, in the protection of cardiac ischemic injury. The project, titled “*Role of VCP in Coronary Ischemic Injury*,” will advance our understanding of molecular mechanisms underlying the benefit of ischemic pre-conditioning in cardiac protection and potentially lead to novel therapy for coronary artery disease.

Wuqiang “Wuk” Zhu, MD, PhD, Assistant Professor of BME, received a new NIH R56 grant from National Heart, Lung, and Blood Institute (NHLBI) for his project entitled “*Myocardial Repair with a Novel Engineered Cardiac Muscle Patch*” for his team’s recently developed novel strategy exploiting genetically induced donor myocyte proliferation to enhance graft size which resulted in improved cardiac function in a rodent model of ischemic injury (Zhu W, et al. *Circ Res*. 2018). In this grant, they will test the myocardial regenerative potency of this approach in a clinically relevant large animal model.

Massimo A. Fazio, PhD, Associate Professor in the Departments of BME and Ophthalmology, received a new NIH R01 grant from the National Eye Institute (NEI). This \$1.8 million 5-year multi-PI grant will be in collaboration with Dr. Christopher Girkin, Chair of the EyeSight Foundation of Alabama and UAB Callahan Eye Hospital. The study, titled “*Determinants of the Biomechanical Behavior of the Human Lamina Cristosa*,” aims at understanding some crucial aspect of the ocular tissue biomechanics that relates to onset and progression of glaucoma. Thanks to a collaboration with the Alabama Organ Center, the PIs built a testing platform to perform experimental imaging and mechanical tests directly in the living human eye.

Xiaoguang “Margaret” Liu, PhD, Associate Professor of BME, received a new two-year award from the North American Neuroendocrine Tumor Society (NANETS), to support her work with Co-PI Dr. Renata Jaskula-Sztul from UAB Department of Surgery. The aim of the project, titled “*Novel Antibody-Drug Conjugate (ADC) for Pancreatic Neuroendocrine Tumor (PanNET) Targeted Therapy*,” is to develop a novel targeted biotherapy to target a newly identified surface receptor and effectively kill NE cancer.

2019 NIH PCTC CVBE Symposium to be held in Sydney, Australia

The fifth NIH Progenitor Cell Translational Consortium (PCTC) Cardiovascular Bioengineering (CVBE 2019) Symposium will be held in Sydney, Australia on the 1st and 2nd of March 2019. The two day meeting, led by Dr. Jay Zhang of UAB and Dr. James Chong of the University of Sydney, will bring together a faculty of internationally leading scientists from North America, Europe, Asia, and Australia.

The symposium will cover a spectrum of fundamental and translational topics related to the fields of cardiac cell therapy, cardiovascular sciences, bioengineering, and stem cell biology. This meeting has previously been held at UAB in Birmingham, Alabama from 2016-2018. Details of previous meetings are published in *Science Translational Medicine*, *JACC*, and *Circulation Research* ^{1, 2, 3, 4}.

We anticipate a highly stimulating and informative meeting with attendees from a diverse spectrum of basic and translational scientists and cardiologists hailing from prestigious research centers from around the world. This meeting is a unique opportunity to join an international audience that will be developing the breakthroughs of the future. We are excited to invite you to join us in Sydney and look forward to sharing additional details of this exceptional event with you soon.

1. Ogale BM et al. *Sci Transl Med*. 2016;8:342ps13.
2. Kannappan R & Zhang J. *Circ Res*. 2016;119:981-983.
3. Zhu W & Zhang J. *Circ Res*. 2017;120:1709-1712.
4. Yanamandala M, et al. *J Am Coll Cardiol*. 2017;70:766-775.

GRADUATE NEWS

Hanyu Zhang, PhD, graduated from UAB with his doctorate in Biomedical Engineering and is staying on as a postdoctoral fellow in the laboratory of Professor Jack Rogers, PhD. Zhang was awarded an AHA grant entitled “*Optical Mapping of Cardiac Electromechanics*”.

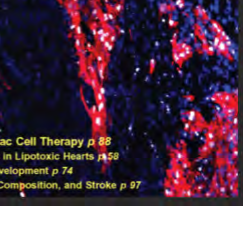


Jun Chen, PhD, postdoctoral fellow in the laboratory of BME Professor Ho-Wook Jun, won 1st Place in the Trainee Poster Award at the UAB Comprehensive Cardiovascular Center 7th Annual Symposium. Dr. Chen also received a prestigious American Heart Association Postdoctoral Fellowship.



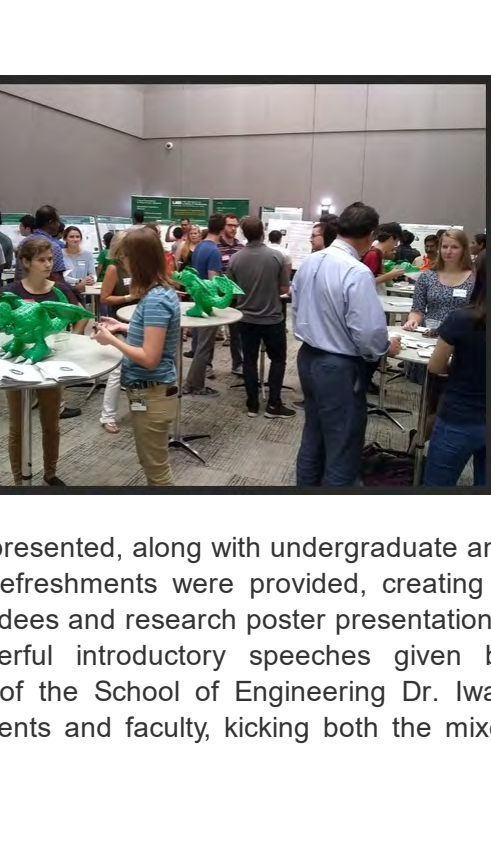
UNDERGRADUATE NEWS

Congratulations to BME undergraduate student **Jacob A. Garcia** on winning 1st place in the Engineering Category of the *UAB Undergraduate Research Summer Expo*. Jacob’s project is based on Type 1 Diabetes research in the laboratory of BME Professor Ho-Wook Jun and involves an in vitro study pertaining to pancreatic islet transplantation (PIT) methods to enhance its utilization as a treatment of diabetes.



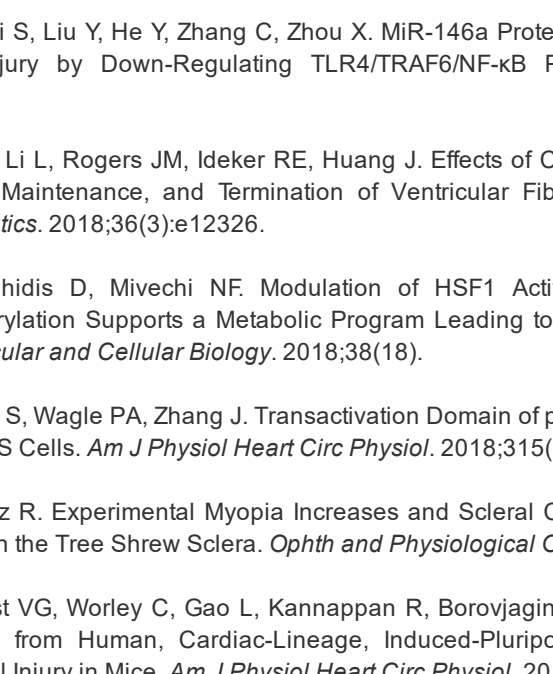
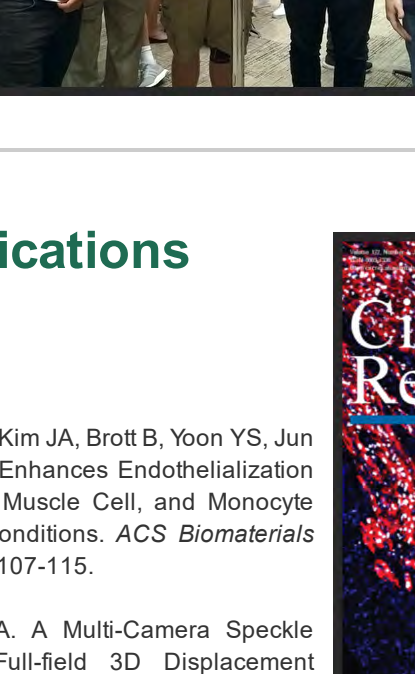
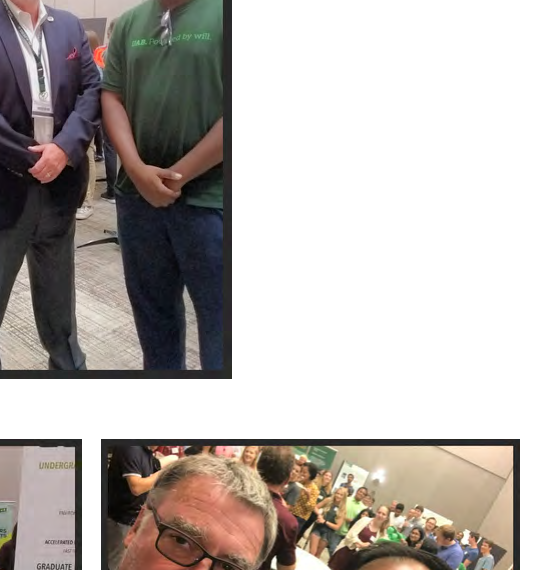
BME Student Design Wins 2nd at the World Congress of Biomechanics 2018

Recent UAB graduates **Seth Patterson** and **Jessica Pieczynski** (pictured, left) won 2nd place in the undergraduate design competition at the World Congress of Biomechanics in Dublin, Ireland. Thanks to Patterson, Pieczynski, and collaborators **Gerardo Hernandez** and **Tess Vessels**, wheelchair users may find help on rainy days with an automatic umbrella attachment engineered by the UAB BME students. The UAB team was one of six selected to present designs at the eighth *World Congress of Biomechanics* in Dublin, Ireland, and finished second in the competition. Congratulations to all!



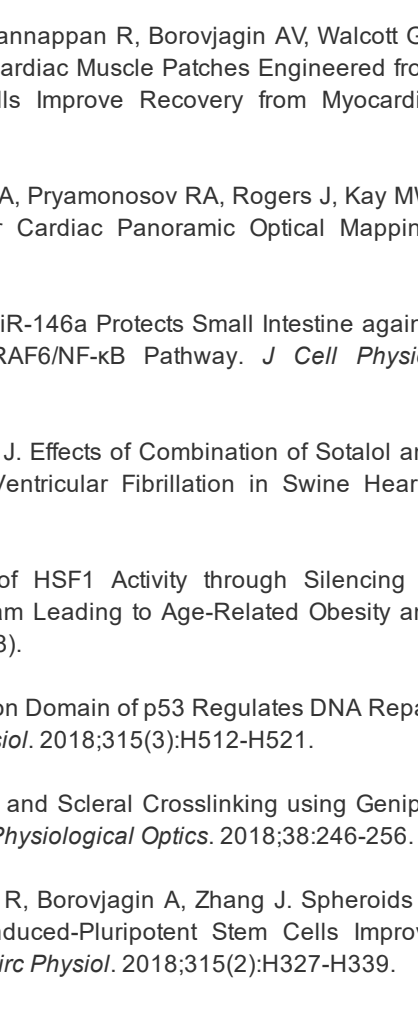
"Welcome Back" Mixer

On the evening of August 30th, the BME Department, Biomedical Engineering Student Organization (BMES), and Biomedical Engineering Graduate Student Organization (BMEGS) co-hosted the inaugural BME “Welcome Back” Mixer to kick-off the 2018-2019 academic year. Research presentations from labs of UAB BME faculty allowed students to learn about exciting new developments in the department. Primary and secondary BME faculty members presented, along with undergraduate and graduate students and postdocs. Food and refreshments were provided, creating a comfortable open setting for the over 100 attendees and research poster presentations. Highlights of the night included the wonderful introductory speeches given by Department Chair Dr. Jay Zhang and Dean of the School of Engineering Dr. Iwan Alexander, welcoming new and returning students and faculty, kicking both the mixer and new school year off to a great start.



Featured Publications

(new for 2018)



- Alexander G, Hwang P, Chen J, Kim JA, Brott B, Yoon YS, Jun HW. Nanomatrix Coated Stent Enhances Endothelialization but Reduces Platelet, Smooth Muscle Cell, and Monocyte Adhesion under Physiologic Conditions. *ACS Biomaterials Science & Engineering*. 2018;4:107-115.
- Bruno L, Bianco G, Fazio MA. A Multi-Channel Speckle Interferometer for Dynamic Full-field 3D Displacement Measurement Validation and Inflation Testing of a Human Eye Sclera. *Optics and Lasers in Engineering*. 2018;107:91-101.
- Fazio MA, Clark ME, Bruno L, Girkin CA. In vivo Optic Nerve Head Mechanical Response to Intraocular and Cerebrospinal Fluid Pressure: Imaging Protocol and Quantification Method. *NATURE Scientific Reports*. 2018;8:12639.
- Gao L, Gregorich ZR, Zhu W, Mattappally S, Oduk Y, Lou X, Kannappan R, Borovjagin AV, Walcott GP, Pollard AE, Fast VG, Hu X, Lloyd SG, Ge Y, Zhang J. Large Cardiac Muscle Patches Engineered from Human Induced-Pluripotent Stem-Cell-Derived Cardiac Cells Improve Recovery from Myocardial Infarction in Swine. *Circulation*. 2018;137(16):1712-1730.
- Glimosch C, Rasis R, Gupta S, Shi S, Liu Y, He Y, Zhang C, Zhou X. MiR-146a Protects Small Intestine against Ischemia/Reperfusion Injury by Down-Regulating TLR4/TRAF6/NF-κB Pathway. *J Cell Physiol*. 2018;233(3):2476-2488.
- Jin Q, Wu L, Dossdall DJ, Li L, Rogers JM, Ideker RE, Huang J. Effects of Combination of Sotalol and Verapamil on Initiation, Maintenance, and Termination of Ventricular Fibrillation in Swine Hearts. *Cardiovascular Therapeutics*. 2018;36(3):e12326.
- Jin X, Qiao A, Moskophidis D, Mivechi NF. Modulation of HSF1 Activity through Silencing of Ser303/Ser307 Phosphorylation Supports a Metabolic Program Leading to Age-Related Obesity and Insulin Resistance. *Molecular and Cellular Biology*. 2018;38(18).
- Kannappan R, Mattappally S, Waigle PA, Zhang J. Transactivation Domain of p53 Regulates DNA Repair and Integrity in Human IPS Cells. *Am J Physiol Heart Circ Physiol*. 2018;315(3):H512-H521.
- Levy AM, Fazio MA, Grytz R. Experimental Myopia Increases and Scleral Crosslinking using Genipin inhibits Cyclic Softening in the Tree Shrew Sclera. *Ophthalm and Physiological Optics*. 2018;38:246-256.
- Mattappally S, Zhu W, Fast VG, Worley C, Gao L, Kannappan R, Borovjagin A, Zhang J. Spheroids of Cardiomyocytes Derived from Human, Cardiac-Lineage, Induced-Pluripotent Stem Cells Improve Recovery from Myocardial Injury in Mice. *Am J Physiol Heart Circ Physiol*. 2018;315(2):H327-H339.
- Oduk Y, Zhu W, Kannappan R, Zhao M, Borovjagin AV, Aparil S, Zhang J. VEGF Nanoparticles Repair Heart after Myocardial Infarction. *Am J Physiol Heart Circ Physiol*. 2018;314(2):H278-H284.
- Palanisamy A, Kannappan R, Xu Z, Martino A, Friesse MB, Boyd JD, Crosby G, Culley DJ. Oxytocin Alters Cell Fate Selection of Rat Neural Progenitor Cells in vitro. *PLoS One*. 2018;13(1):e0191160.
- Valarmathi MT, Fuseler JW, Potts JD, Valdivia HM, Price RL. Functional Tissue Engineering: A Prevascularized Cardiac Muscle Construct for Validating Human Mesenchymal Stem Cells Engraftment Potential in vitro. *Tissue Eng Part A*. 2018;24:157-165.
- Xiao C, Wang K, Xu Y, Zhang N, Wang Y, Zhong Z, Zhao J, Li Q, Zhu D, Ke C, Zhong S, Wu X, Yu H, Zhu W, Chen J, Zhang J, Wang J, Hu X. Transplanted Mesenchymal Stem Cells Reduce Autophagic Flux in Infarcted Hearts via the Exosomal Transfer of mir-125b. *Circulation Research*. Epub 2018 Jun 19.
- Yang R, Ernst P, Song J, Liu XM, Huke S, Wang S, Zhang J, Zhou L. Mitochondrial-Mediated Oxidative Ca²⁺/Calmodulin-Dependent Kinase II Activation Induces Early Afterdepolarizations in Guinea Pig Cardiomyocytes: An in silico Study. *J Am Heart Assoc*. Epub 2018 Aug 3.
- Ye L, D’Agostino G, Loo SJ, Wang CX, Su LP, Tan SH, Tee EZ, Pua CJ, Pena EM, Cheng RB, Chen WC, Abdurrahim D, Lalic J, Tian RS, Lee TH, Zhang J, Cook SA. Early Regenerative Capacity in the Porcine Heart. *Circulation*. Epub 2018 July 20.
- Zhang H, Walcott GP, Rogers JM. Effects of Gadolinium on Cardiac Mechanosensitivity in Whole Isolated Swine Hearts. *NATURE Scientific Reports*. 2018;8(1):10506.
- Zhang H, Yu H, Walcott GP, Paskaranandavadivel N, Cheng LK, O’Grady G, Rogers JM. High-Resolution Optical Mapping of Gastric Slow Wave Propagation. *Neurogastroent & Motility*. Epub 2018 Aug 20.
- Zhang J, Abel DE. Effective Metabolic Approaches for the Energy Starved Failing Heart: Bioenergetic Resiliency via Redundancy or Something Else? *Circulation Research*. 2018;123(3):329-331.
- Zhang J, Zhu W, Radisic M, Vunjak-Novakovic G. Can We Engineer a Human Cardiac Patch for Therapy? *Circulation Research*. 2018;123(2):244-265.
- Zhao M, Fan C, Ernst PJ, Tang Y, Zhu H, Mattappally S, Oduk Y, Borovjagin AV, Zhou L, Zhang J, Zhu W. Y27632 Preconditioning Enhances Transplantation of Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes in Myocardial Infarction Mice. *Cardiovascular Research*. Epub 2018 Aug 13.
- Zhao YT, Wang J, Yano N, Zhang LX, Wang H, Zhang S, Qin G, Dubielecka PM, Zhuang S, Liu PY, Chin E, Zhao TC. Irisin Promotes Cardiac Progenitor Cell-Induced Myocardial Repair and Functional Improvement in Infarcted Heart. *J Cell Physiol*. Epub 2018 Sept 5.
- Zhou M, Wang M, Wang X, Liu K, Wan Y, Li M, Liu L, Zhang C. Abnormal Expression of MicroRNAs Induced by Chronic Unpredictable Mild Stress in Rat Hippocampal Tissues. *Mol Neurobiol*. 2018;55(2):917-935.
- Zhu W, Wu Q, Ni C, Zhang P, Zhong Z, Wu Y, Wang Y, Xu Y, King M, Cheng H, Liang H, Jiang Y, Huang J, Zhang F, Chen Q, Li Y, Zhang J, Yang HT, Hu X, Wang J. Lack of Remuscularization Following Transplantation of Human Embryonic Stem Cell-Derived Cardiovascular Progenitor Cells in Infarcted Nonhuman Primates. *Circ Res*. 2018;122(7):958-969.
- Zhu W, Zhang E, Zhao M, Chong Z, Fan C, Tang Y, Hunter JD, Borovjagin AV, Walcott GP, Chen JY, Qin G, Zhang J. Regenerative Potential of Neonatal Porcine Hearts. *Circulation*. Epub 2018 July 20.
- Zhu W, Zhao M, Mattappally S, Chen S, Zhang J. CCND2 Overexpression Enhances the Regenerative Potency of Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes: Remuscularization of Infarcted Ventricle. *Circulation Research*. 2018;122(1):88-96. (Cover image from this article shown above)
- Zhu Y, Cheng J, Min Z, Yin T, Zhang R, Zhang W, Hu L, Cui Z, Gao C, Xu S, Zhang C, Hu X. Effects of Fucosyllin on Autophagy and Apoptosis in SGC-7901 Cells and Mechanism. *J Cell Biochem*. Epub 2018 May 15.