Departments of Cell Biology and Molecular Medicine, Rutgers New Jersey Medical School

Junichi Sadoshima

Rutgers New Jersey Medical School (NJMS; Figure A) is located in Newark, NJ. Rutgers NJMS is 1 of the 2 major medical schools in the state of NJ, and it belongs to Rutgers Biomedical and Health Sciences. The Department of Cell Biology and Molecular Medicine is 1 of 4 basic science departments in NJMS. Here, the author provides an overview of the department and discusses its strategies for conducting high quality research and improving research productivity.

The goal in this department is to perform high quality research into human diseases, including, but not limited to, cardiovascular disease. Although many investigators in this department focus on cardiovascular disease, others study stem cells, aging, cancer, and development, allowing for research using interdisciplinary approaches. Currently, our department has 21 faculty members (Figure B), 7 postdoctoral fellows, and 7 PhD students. In 2016, 53% of the departmental budget came from external grants, 32% from the state of NJ, and the rest from overheads and tuitions. Many of our investigators are supported by grants from the National Institutes of Health (NIH) and other sources, including the American Heart Association, the Muscular Dystrophy Association, and the Leducq Fondation. Our department ranked 21st of 78 cell biology/anatomy departments in allopathic medical schools in the United States in terms of NIH funding. The postdoctoral fellows and students are ethnically diverse and originate from 13 countries. PhD students recently trained in this department have obtained jobs in places, such as Harvard Medical School, Stanford University, University of Pennsylvania, University of Washington, Temple University, and the NIH.

The strength of the department stems from robust expertise in heart failure and cell signaling and a state-of-the-art facility for characterization of in vivo animal models (Figure C). The department is home to the Cardiovascular Research Institute, which was founded by Dr Stephen F. Vatner, a former editor of Circulation Research, and provides school-wide services to investigators working on cardiovascular disease through core facilities, including human inducible pluripotent stem cell, adeno-associated virus, and animal/physiology cores, directed by Drs Diego Fraidenraich, Gopal Babu, and Peiyong Zhai, respectively. Extensive experience with in vivo animal physiology experiments and highly skilled surgeons for mouse surgery and hemodynamic analyses are also important assets in this department. In addition to the aforementioned core facilities within the department, close collaboration with the NJMS core facilities for genome editing, proteomics, and bioinformatics allows us to conduct cutting edge research on heart failure. Furthermore, there are investigators within the department who work on yeast, Drosophila, and zebrafish, allowing collaborating faculty members to conduct genetic experiments in lower organisms and investigate evolutionarily conserved biological mechanisms, such as aging, stress resistance, and longevity. The convenient availability of specialized techniques useful for cardiovascular research allows for rapid planning and implementation of series of in vivo experiments.

The department has strong expertise in the fields of transcriptional control mechanisms, aging, and autophagy. The Abdellatif laboratory investigates transcriptional regulation of genes involved in cardiac hypertrophy and failure using chromatin immunoprecipitation sequencing analyses. The Vatner laboratory investigates adrenergic receptor signaling and the molecular mechanisms of aging in the heart and blood vessels. Adenylyl cyclase type 5 knockout mice exhibit an extended lifespan and, thus, are useful for the study of aging. The Sadoshima laboratory investigates the function of autophagy and mitophagy in the heart using unique indicator mouse lines, such as transgenic mice with cardiac-specific expression of tandem fluorescent LC3 and gain- and loss-of-function mouse models. A summary of NIH R01-funded studies currently being conducted in this department is found in Figure C and the Table.

How Does the Department Increase Productivity?

Efficiency is increased when a group of people think that they learn from each other every day by working on common goals. In the following, the author describes the unique characteristics of the department that help improve the learning environment and productivity.

Collegiality

The core facilities in the NJMS are user friendly. Investigators and the core facilities work together closely and provide training for graduate students, early career investigators, and visiting scientists. For example, ≈17 years ago, the transgenic animal core developed a transgenic mouse with cardiac-specific overexpression of the mammalian sterile 20 like kinase 1 gene for the Sadoshima laboratory. This was the first transgenic mouse generated at Rutgers NJMS. Similarly, a cardiac-specific Nox4...
knockout mouse was the first tissue-specific knockout mouse generated at Rutgers NJMS. When these mice were generated, the Sadoshima laboratory had no experience with genetically altered mice. However, the laboratory was also the first user of the core facility. By walking through the complexities of developing genetically altered mice, both researchers and core facility personnel shared ideas and worked closely together to solve difficult problems and to achieve the final goal. Similar user-friendly environments and collegiality are found in many of the core services in Rutgers NJMS, strongly assisting research personnel.

### Table. A List of NIH R01-Funded Investigators and Key Words

<table>
<thead>
<tr>
<th>Principal Investigators</th>
<th>Key Words</th>
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<tbody>
<tr>
<td>Maha Abbellatif</td>
<td>Transcriptional regulation, cardiac hypertrophy, mitochondria complex II</td>
</tr>
<tr>
<td>Gopal Babu</td>
<td>Sarcolipin, muscular dystrophy, gene therapy</td>
</tr>
<tr>
<td>Dominic Del Re</td>
<td>The Hippo pathway, neurofibromatosis 2, macrophage</td>
</tr>
<tr>
<td>Junichi Sadoshima</td>
<td>Autophagy, the Hippo pathway, Trx1, Nox4, GSK-3β, NAD⁺</td>
</tr>
<tr>
<td>Danish Sayed</td>
<td>Stress hormone glucocorticoid receptor, transcription</td>
</tr>
<tr>
<td>Dorothy Vatner</td>
<td>Adenylyl cyclase type V, SFRP</td>
</tr>
<tr>
<td>Stephen F Vatner</td>
<td>Adrenergic receptors, vascular stiffness, aging, RGS14</td>
</tr>
<tr>
<td>Lai-Hua Xie</td>
<td>Ca²⁺ regulation in mitochondria, arrhythmia</td>
</tr>
</tbody>
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NIH indicates National Institutes of Health; and SFRP, secreted frizzled-related protein.

### Special Meetings for Junior Faculty

The department places special emphasis on the training of junior faculty members. Although the department also recruits new faculty from outside Rutgers University, to date, the department has had great success in raising internal candidates within the department. The department has a weekly meeting for junior faculty at which the participants discuss strategic planning and preparing for successful grant applications. Summarizing hypotheses and specific aims in the form of a PowerPoint presentation during the early stages of grant preparation is a particularly effective tool for young investigators. Study sections that review grant proposals often include reviewers from a variety of backgrounds. Thus, presenting one’s research theme to other investigators who are unfamiliar with the particular area of research is helpful for grant writing because it highlights potential deficiencies and issues that need to be addressed to make the grant proposal easier to understand. This meeting also serves as an opportunity to discuss how to address reviewers’ criticisms. The meeting provides an ideal opportunity for young fellows to obtain feedback from their colleagues and, at the same time, learn more about their colleagues’ research activities. This venue is also helpful to foreign scholars who have no prior experience in grant writing but wish to develop their careers in the United States because there are many important tips and caveats that are important for foreign scholars to know when preparing grant applications in the United States. The department has had considerable success with the junior faculty’s grant applications since this meeting was initiated. Three junior faculty members, Drs Dominic Del Re, Danish Sayed,
and Gopal Babu, have recently received NIH R01 funding for their research on neurofibromatosis 2, Ras GTPase-activating protein-binding protein 1 (G3bp1), and Duchenne muscular dystrophy, respectively.

**Extensive Collaborations**

The geographic location, just half an hour away from New York City, allows members of the department to interact with investigators in the many institutions located in the New York Metropolitan Area, including Columbia, Cornell, Mount Sinai, New York University, Rockefeller, Sloan Kettering, Albert Einstein, New York Medical College, New York Institute of Technology, and Yale. Drs Richard Kitis (Albert Einstein), Geoffrey Pitt (Cornell), and the author (Rutgers) are in the process of establishing a cardiovascular interest group in the New York Metropolitan Area to facilitate interactions between the institutions, including joint seminars, retreats, and submission of multi-investigator grants. The kick-off meeting has been planned for October 2017. In addition, Drs Susan Steinberg (Columbia), Roger Hajjar (Mount Sinai), Richard Kitis, and the author have already jointly hosted guest speakers, and the Kitis and Sadoshima laboratories have held joint laboratory meetings. The fellows who participated found that these joint activities and meetings were helpful for expanding their social networks and receiving feedback from laboratories with different areas of expertise. Furthermore, these relationships between laboratories allow for acquisition of hands-on experience when learning new techniques simply by making a short trip across the Hudson River.

To vastly improve its international collaboration, the Sadoshima laboratory obtained a grant, which focuses on autophagy, from the Leducq Fondation Transatlantic Network of Excellence in 2016. Dr Luca Scorrano at the University of Padua in Italy serves as the European Coordinator, and the author serves as the North American Coordinator. The main objective of this Network is to facilitate transatlantic collaboration and raise leaders for the next generation. To this end, the network has semiannual face-to-face meetings, and junior investigators actively play a role in organizing their own teleconferences and inviting guest speakers. The grant has been especially valuable to the students and postdoctoral fellows because it provides opportunities to interact first-hand with prominent scientists and their trainees in North America and Europe. This grant has already yielded several fruitful collaborations for our department.

**Presentation Skills**

Meeting presentations are an important part of the life of scientists. The department strongly encourages young investigators to send abstracts and participate in scientific meetings, including Basic Cardiovascular Science meetings and American Heart Association Scientific Sessions, so that they have opportunities to summarize their progress periodically. Even if a project is still in an early stage, writing an abstract highlights what is missing and helps in prioritizing important issues. The peer review during the abstract selection process gives a sense of where the research stands and how attractive it is. In addition, scientific meetings allow interaction with other investigators and the exchange of ideas, which contribute to young investigators’ career development. Improving presentation skills is one of the most important training goals in this department. To this end, the department has intensive practice sessions for presentations before American Heart Association Scientific Sessions.

In addition, the department sends the best work to Young Investigator Award competitions. Young Investigator Award presentations not only benefit early career investigators’ career development but also provide them with invaluable experience through the intense practice sessions the department provides. During the past 15 Scientific Sessions, members of our department comprised 14 of the 150 finalists in the Louis and Arnold Katz Basic Science Prize and the Melvin Marcus Young Investigator Award competitions or 9% of all the Basic Cardiovascular Science Young Investigator Award presentations. In particular, Drs Tetsuro Ago and Shinichi Oka were awarded first prize in the Katz competitions and Drs Mitsutaka Yamamoto and Dan Shao were awarded first prize in the Marcus competitions.

**Concluding Remarks**

In summary, the department conducts highly productive research in the field of cardiovascular medicine. The cardiac physiology setup in this department is state-of-the-art and the faculty members have a wide variety of areas of expertise, making it possible to conduct comprehensive molecular analyses of the mechanisms of cardiovascular disease. In addition, the exceptionally collaborative environment in the department and at NJMS is particularly helpful for the career development of young investigators.

**Acknowledgments**

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**Disclosures**

None.

**References**


