BIOGRAPHICAL SKETCH

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NAME	POSITION TITLE
Rajini Rao	Professor of Physiology
eRA COMMONS USER NAME (credential, e.g., agency login) RRAO07	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Mount Carmel College, Bangalore, India	B.Sc.	1983	Chemistry & Biology
University of Rochester, Rochester, NY	Ph.D.	1988	Biochemistry
Yale University, New Haven, CT	Postdoc	1988-93	Genetics

A. Personal Statement

My academic activities are divided equally between education and research. As the Director of the Graduate Program in Cellular and Molecular Medicine, one of the largest and most prestigious of its kind in the country, I oversee a multi-departmental training program that includes over 125 faculty mentors and 130 graduate students (Ph.D., M.D./Ph.D. and D.V.M/Ph.D.). Our goal is to provide rigorous training in medical research as it applies to human disease. I am also a faculty mentor in other graduate programs at the School of Medicine (Biochemistry, Cell & Molecular Biology, and Cellular and Molecular Physiology) where I teach, direct courses and hold small group discussions. I also instruct first year Medical students in cellular physiology. I participate in numerous thesis committees and graduate board examinations both within and outside the University. In my own lab, I have mentored over 20 graduate students and postdoctoral fellows, many of whom have won national awards and fellowships.

My research is on ion transport mechanisms with a focus on uncovering new human transporters and their physiological roles in disease. We were the first to clone and recognize the intracellular $Na^+(K^+)/H^+$ exchangers as a separate group from the well-known plasma membrane NHE. These transporters control intravesicular pH and salt concentrations to regulate cellular trafficking pathways. Current work centers on understanding their roles in neurological disease, including autism and mental retardation. Another new family includes the NHA transporters that may be involved in essential hypertension. We have also pioneered studies on the Golgi/Secretory Pathway Ca^{2+}-ATPases, which are conserved from yeast to human. Our interests range from structure-mechanism studies and the molecular basis of ion selectivity to phenomics approaches that uncover physiological roles of novel ion transporters. Most recently we uncovered an oncogenic role for SPCA2 in breast cancer. A third area of study is to define the cellular pathway of calcium-mediated fungal cell death and to target this pathway for the development of antimycotic drugs. My experience and expertise in training and mentoring students and fellows, and my expertise in cell physiology and genetics are highly compatible with the goals and my participation in the Career Development Component of the JHU ICMIC Program.

B. Positions and Honors

Positions and Employment

1984-85	Teaching Assistant in the Department of Biochemistry, University of Rochester, for General Biochemistry, Advanced Biochemistry, and Proteins and Enzymes
1988-92	Postdoctoral Fellow with Dr. Carolyn W. Slayman, Department of Genetics, Yale University SOM
1992-93	Associate Research Scientist, Department of Genetics, Yale University School of Medicine
1993-98	Assistant Professor, Department of Physiology, Johns Hopkins University School of Medicine
1998-04	Associate Professor, Department of Physiology, Johns Hopkins University School of Medicine
2004-current	Professor, Department of Physiology, Johns Hopkins University School of Medicine
2008-current	Director, Graduate Program in Cellular & Molecular Medicine

Professional Activities and Recognition

1984-85	Program in Biology and Medicine Fellowship, University of Rochester, Rochester, NY
1987-88	Elon Huntington Hooker Graduate Fellowship in Chemistry, University of Rochester, Rochester, NY
1989	Walter Bloor Award for Excellence in Biochemistry, University of Rochester, Rochester, NY
1988-89	James Hudson Brown/Alexander B. Coxe Postdoctoral Fellowship, Yale University, New Haven, CT
1990-91	American Heart Association Postdoctoral Fellowship, Connecticut Affiliate
1993-94	American Cancer Society Institutional Research Award, Johns Hopkins University, Baltimore, MD
1994-97	American Cancer Society Junior Faculty Award, Johns Hopkins University, Baltimore, MD
2009	Teacher of the Year Award, Graduate Student Association of Johns Hopkins School of Medicine
2009	Johns Hopkins Professors Award for Excellence in Teaching in Preclinical Sciences
2009	Hans Prochaska Memorial Award
2000	Conference Organizer and Chair for the 2000 Mid-Atlantic Yeast Conference
2001, 03	Nico Van Uden Lecturer at the 19th and 21st Annual SMYTE in Crete and Bonn
2002	Conference Organizer and Chair for the 20th Annual SMYTE (International Meeting on Yeast Transport and Bioenergetics
1996, 00, 01	Session Chair for Ion Motive ATPases at the Annual Meeting of the Biophysical Society
2001, 02, 06, 08, 09	Abstract Sort Committee of the Biophysical Society
2006	Keynote speaker, Pan American Plant Membrane Biology Workshop, South Padre Island TX
2010	Conference Chair and Organizer, FASEB Summer Research Conference on Transport ATPases
2001-03	Regular Member of Cardiovascular Physiology and Pharmacology Study Section of the National American Heart Association
2002-06	Regular Member, NIH Study Section on Physical Biochemistry/Biophysics of Biological Membranes
2003-08	Editorial Board Member, Journal of Biological Chemistry
2010-12	College of CSR Reviewers
2006-09	Elected member of Biophysical Society Council,
2007-08	Executive Council
2009-10	Member: Womens Leadership Council (JHMI), Mentoring Committee (JHMI); Elected Chair, Biophysical Society Committee on Professional Development for Women (CPOW) and Elected Chair of Biophysical Society Nominating Committee (); Member of Federation of American Society of Experimental Biology (FASEB), Biophysical Society (BP), American Society for Biochemistry and Molecular Biology (ASBMB).

C. Selected Peer-reviewed Publications

Most relevant to the current application

1. Ton, V.-K. and Rao, R. Expression of Hailey-Hailey disease mutations in yeast J. Invest. Dermatol. 2004; 23, 1192-4.
2. Hill, J., Brett, C.L., Chyou, A., Kallay, L.M., Sakaguchi, M., Rao, R. and Gillespie, P.G. Vestibular hair cells control pH with $Na^+(K^+)/H^+$ exchangers NHE6 and NHE9. J. Neuroscience. 2006; 26, 9944-9955.
3. Xiang, M., Feng, M., Muend, S., and Rao R. A human Na^+/H^+ antiporter sharing evolutionary origins with bacterial NhaA may be a candidate gene for essential hypertension. Proc Natl Acad Sci USA. 2007; 104:18677-81.
4. Zhang, Y.Q., and Rao, R. A spoke in the wheel: calcium spikes disrupt yeast cell cycle. Cell Cycle 2008; 7: 870-873.

5. Gamarra, S., Rocha, E.M., Zhang, Y.Q., Park, S., Rao, R., Perlin, D.S. Mechanism of the synergistic effect of amiodarone and fluconazole in Candida albicans. Antimicrob Agents Chemother. 54, 2010; 1753-61. PMCID2863688 [Available on 2010/11/1].
6. Schushan, M., Xiang, M., Bogomiakov, P., Padan, E., Rao, R. and Ben-Tal, N. Model-guided mutagenesis drives functional studies of human NHA2, implicated in hypertension. J. Mol. Biol. 2010; 396, 1181-1196 PMCID2824056 [Available on 2011/3/12].
7. Zhang, Y.Q., Gamarra, S., Garcia-Effron, G., Park, S., Perlin, D.S. and Rao R. Requirement for ergosterol in V-ATPase function underlies antifungal activity of azole drugs. PLoS Pathog. 2010; 6: e100939 PMCID2880581.
8. Feng, M., Grice, D., Faddy, H.M., Ngyuen, N., Leitch, S., Wang, Y., Muend, S., Kenny, P.A., Sukumar, S., Roberts-Thomson, S., Monteith, G., and Rao, R. (2010). Store-independent activation of Orai1 by SPCA2 in mammary tumors. Cell, 2010 Oct 1;143(1):84-98. PMCID2950964 [Available on 2011/10/1].

Additional recent publications of importance to the field (in chronological order)

1. Sen Gupta, S., Ton, V.K., Beaudry, V., Rulli, S., Cunningham, K.W., and Rao, R. Antifungal activity of amiodarone is mediated by disruption of calcium homeostasis. J. Biol. Chem. 2003; 278, 28831-28839.
2. Brett, C.L., Tukaye, D.N., Mukherjee, S., Rao, R. The yeast endosomal $Na^+(K^+)/H^+$ exchanger Nhx1 regulates cellular pH to control vesicle trafficking. Mol Biol. Cell. 2005; 16, 1396-1405.
3. Xiang, M., Mohamalawari, D., Rao, R. A novel isoform of the secretory pathway Ca^{2+}, Mn^{2+}-ATPase, hSPCA2, has unusual properties and is expressed in brain. J. Biol. Chem. 2005; 280, 11608-11614.
4. Brett, C. L., Donowitz, M. and Rao, R. The evolutionary origins of eukaryotic Na^+/H^+ exchangers Am. J. Physiol. Cell Physiol. 2005; 288, C223-239.
5. Zhang, Y.Q., and Rao, R. Global disruption of cell cycle progression and nutrient response by the antifungal agent amiodarone. J. Biol. Chem. 2007; 282:37844-53.
6. Yadav, J., Muend, S., Zhang, Y., and Rao, R. A Phenomics Approach in Yeast Links Proton and Calcium Pump Function in the Golgi. Mol Biol Cell. 2007; 18, 1480-1489
7. Maresova, L., Muend, S., Zhang, Y.Q., Sychrova, H., and Rao, R. Membrane hyperpolarization drives cation influx and fungicidal activity of amiodarone. J. Biol. Chem. 2009; 284: 2795-2802 PMCID2631971.

D. Research Support

Ongoing Research Projects

2P50CA103175-06A2 (Bhujwalla) 09/22/11-07/31/16
NCI JHU ICMIC Program
This center grant funds an *in vivo* Cellular and Molecular Imaging Center at Johns Hopkins. The program consists of four research components, four developmental projects, one career development award and four resources.

T32GM008752-11(Rao) 07/01/00-06/30/15
Training Program in Cellular & Molecular Medicine
National Institutes of General Medicine (NIGMS)
The Graduate Program in Cellular & Molecular Medicine will prepare Ph.D. scientists for laboratory research at the cellular and molecular level on topics with a direct impact on the understanding, diagnosis, treatment and prevention of human diseases. The Ph.D. graduates of this program will have a rigorous training in scientific research and a thorough knowledge of human biology and human diseases. This is a multi-departmental program that includes more than 125 faculty mentors and 130 graduate students.

DK054214-09 (Rao) 07/01/08-06/30/12
Endosomal Na+/H+ Exchangers from Yeast and Human
Agency and Type: National Institute of Diabetes and Digestive and Kidney Disease (NIDDK)
The aims of this project are to measure the transport properties of human endosomal NHE6, examine structure-function relations in yeast Nhx1 and identify interacting proteins that modulate the expression and activity of both exchangers.

Completed Projects Within Last Three Years

R01AI065983 (Rao) 03/01/06-02/28/11
Cellular Basis for the Antifungal Activity of Amiodarone

National Institutes of Allergy and Infectious Diseases (NIAID)
The goal of this project is to elucidate the pathway of yeast cell death by amiodarone and to explore its use as an antimycotic adjunct. In Aim 1, we will determine the molecular identity and temporal order of death intermediates in yeast, in Aim 2 we will use genomic approaches to determine the cellular and transcriptional response to amiodarone in pathogenic fungi and in Aim 3 we will explore drug combination therapy in a murine model of Candidiasis.

R01GM62142 (Rao) 06/01/06-05/31/10 NCE
National Institute of General Medical Sciences (NIGMS)
Secretory Pathway Calcium and Manganese Pumps
The aims of this project are to investigate ion affinities of the secretory pathway pumps, understand the role of the C-terminus in ion dependent trafficking and conduct a genome-wide analysis of ion homeostasis in yeast.

United States- (BSF) (Padan/Rao) 09/01/06-08/31/10
Israel Binational Science Foundation
The NhaA Na+/H+ antiporters: structure and evolutionary-bioinformatic based study
The goal of this project is to exploit the recent X-ray crystallographic structure of E. coli NhaA and the evolutionary bioinformatics on newly discovered homologs in eukaryotes, including mammalian NHA1 and NHA2, to understand the mechanism of cation/H+ antiport in bacteria and human.

R01A1065983 (Rao) 06/01/09-08/31/10
ARRA Supplement to Cellular Basis for the Antifungal Activity of Amiodarone
National Institutes of Allergy and Infectious Diseases (NIAID)
This supplement will fund 4 summer undergraduate students to work on the parent grant listed above.