**Developmental Biology and Basic Research**

**Introduction**

*Our research faculty includes developmental biologists, lung researchers, vascular biologists, and neurobiologists. The faculty have NIH-funded laboratories, and our senior investigators (Drs. Reddy, Raj, and Chauhan) have had over 36 years of independent NIH and VA-funded research and are leaders in their field. The current ongoing research focuses on providing new insights into the complex physiology and pathology of childhood and adult diseases, some of which originate in the fetus and newborn. We use preclinical models to develop new therapies and identify biomarkers for devastating lung diseases such as chronic lung disease of infancy and chronic pulmonary hypertension, Alzheimer's disease (AD), and Traumatic Brain Injury (TBI). In addition, there is active collaborative research ongoing with faculty in and outside UIC.*

**MEET THE TEAM**

Reddy, Sekhar PhD

Chief, Division of Developmental Biology and Basic Research

Professor of Pediatrics and Pathology

Raj, Usha MD, MHA

Anjuli S. Nayak Professor of Pediatrics, Professor of Pharmacology, Physiology and Biophysics and Anatomy and Cell Biology

Chauhan, Neelima PhD

Associate Professor of Pediatrics

Chen, Tianji PhD

Assistant Research Professor of Pediatrics

Ramasamy, Jagadeesh PhD

Research Assistant Professor of Pediatrics

Tamatam, Chandra Mohan, PhD

Assistant Research Professor of Pediatrics

**Programs/Projects**

* Neonatal Injury Repair and Remodeling
* Bronchopulmonary Dysplasia (BPD)
* Pathogenesis of Pulmonary Hypertension (PH)
* Traumatic Brain Injury (TBI)
* Alzheimer's Disease
* Development of therapeutic strategies for BPD, PH, TBI, Alzheimer’s, Sickle Cell Disease.

**Sekhar Reddy, PhD.**

**Chandra Tamatam, PhD.**

oxidant stress in vascular and alveolar remodeling attributed to chronic lung diseases in neonates and adults. He uses inflammatory and oxidant stress-induced preclinical neonatal and adult lung injury models to define mechanisms underlying optimal repair and impaired/abnormal repair after injury. His group recently demonstrated that preconditioning the immature lung with increased Nrf2 activity and its target cytoprotective gene expression protects from oxidant-stress-induced alveolar simplification, a significant hallmark of BPD pathogenesis. He also showed that Nrf2-deficiency results in persistent inflammation after injury and enhances susceptibility to infection. Current research explores the therapeutic potential of pharmacologic Nrf2 activation in accelerating lung repair and restoring homeostasis after damage. Additionally, in collaborative studies with Dr. Hamid Rabb (at Johns Hopkins), his lab investigates pathogenic mechanisms of abnormal tissue remodeling after kidney injury using preclinical models and clinical samples.

* Tamatam CM, Reddy MM, Potteti HR, Yamamoto M, Kensler TW, and Reddy SP (2020). Preconditioning the immature lung with enhanced Nrf2 activity protects against oxidant-induced hypo-alveolarization in mice. *Scientific Reports* *10:19034. PMID: 33149211*. DOI: [10.1038/s41598-020-75834-8](https://doi.org/10.1038/s41598-020-75834-8)
* Reddy NM, Tamatam CM, Ankireddy A and Reddy SP. Nrf2 Is Required for Optimal Alveolar-Macrophage-Mediated Apoptotic Neutrophil Clearance after Oxidant Injury. Antioxidants 2022, 11(2), 212.

<https://doi.org/10.3390/antiox11020212>

* Elangovan I, Vaz M, Tamatam C, Potteti H, Machireddy N and Reddy SP (2018). Fosl1 Promotes Kras-Induced Lung Cancer Through Amphiregulin and Cell Survival Gene Regulation. Am J Respir Cell Mol Biology 58:625-635. PMID: 29112457.

DOI: [10.1165/rcmb.2017-0164OC](https://doi.org/10.1165/rcmb.2017-0164oc)

* Potteti HR, Noone P, Tamatam CR, Reddy NM, Ankireddy A, Noel S, Rabb H, Reddy SP (2021). Nrf2 mediates hypoxia inducible HIF1α activation in kidney tubular epithelial cells. Am J Physiol Renal Physiol. 320(3):F464-F474. PMID: 33491566.  DOI: [10.1152/ajprenal.00501.2020](https://doi.org/10.1152/ajprenal.00501.2020)

**J. Usha Raj, MD, MHA**

**Tianji Chen, PhD.**

Drs. Raj and Chen work in close collaboration on studying the pathobiology of pulmonary hypertension in both newborns and adults. Their work has focused on the specific genetic pathways that modulate pulmonary vascular smooth muscle function. In recent years they have focused on the role of microRNAs and extracellular vesicles in the initiation and maintenance of pulmonary vascular disease. They recently identified a novel new microRNA, miR-212, induced in pulmonary endothelial cells in PH, which acts as a protective molecule. Loss of this miRNA results in devastating disease. They are engineering extracellular vesicles to deliver miR-212 to treat severe PH. Additionally, in collaborative studies with Dr. Hubbell (at the University of Chicago), they are developing methods to engineer the vesicles to target them specifically to pulmonary vessels for more directed therapy to the diseased blood vessels.

Chen T, Sun MR, Zhou Q, Guzman AM, Ramchandran R, Chen J, Ganesh B, Raj JU. Endothelium-derived extracellular vesicles contribute to the hypoxia-induced PASMC proliferation in-vitro and pulmonary hypertension in mice. *Pulmonary Circulation*, December, 2021.

Chen T, Zhou G, Zhou Q, Tang H, Ibe JC, Cheng H, Gou D, Chen J, Yuan JX, Raj JU. Loss of miR-17~92 in smooth muscle cells attenuates experimental pulmonary hypertension via induction of PDLIM5. *Am. J. Resp. Crit. Care.*191:678-92, 2015. PMID: 25647182

**Neelima Chauhan, PhD**

Dr. Chauhan's research aims to promote the repair of degenerated neurons under pathological conditions such as Traumatic Brain Injury (TBI) and Alzheimer's disease (AD). Her research team uses candidate, dietary, and pharmacologic, interventional strategies, and preclinical models. Additionally, she focuses on testing North Indian Classical Music (NICM) to alleviate cognitive disability in the cognitively compromised aged population.

Gatto, R., Chauhan, M., Chauhan, N. (2015). Anti-edema effects of rhEpo in experimental traumatic brain injury. Restor. Neurol. Neurosci., 33(6): 927-941.

Chauhan M.B., Chauhan N.B. (2015). Brain Uptake of Neurotherapeutics after Intranasal versus Intraperitoneal Delivery in Mice. J Neurol Neurosurg. 2(1): 1-9. PMID: 26366437

Xiao C. and Chauhan N.B. (2020). “Ameliorative effects of intranasal antagomir-125b in AD", Alzheimer’s disease & dementia, 4 (1): 105-112.

Chauhan N.B. (2020). MicroRNA silencing: A promising therapy for Alzheimer’s disease. Neurosci Chron; 1(1):11-15.

Chauhan NB, Mahesh Kale, Purva Gujar (2020), Alzheimer’s Sound Health, MedDocs eBooks: *Alzheimer’s Disease & Treatment*, pp 1-9, MedDocs Publishers.

**Jagadeesh Ramasamy, PhD.**

Dr. Ramasamy's research focuses on the impact of erythrocyte's mitochondrial retention in sickle cell disease (SCD) pathophysiology. His group first discovered an abnormal mitochondria number in erythrocytes of SCD patients and its potential contribution to elevated levels of ROS and hemolysis. In another area of translational research, his group is actively involved in developing epigenetic drugs, micronutrients, and siRNA-based therapeutic approaches to reduce the need for opioid medications to prevent pain and improve vascular health in pediatric and adult SCD patients.

Jagadeeswaran R and Rivers A. Evolving treatment paradigms in sickle cell disease. Hematology Am Soc Hematolol Educ Program. 2017 (1):440-446; PubMed PMID: 29222291.

Jagadeeswaran R, Vazquez BA, Thiruppathi M, Ganesh BB, Ibanez V, Cui S, Engel JD, Diamond AM, Molokie RE, DeSimone J, et al. Pharmacological inhibition of LSD1 and mTOR reduces mitochondrial retention and associated ROS levels in the red blood cells of sickle cell disease. Exp Hematol. 2017 Jun;50:46-52. PMID: 28238805.

***"Exploring the body's complex processes and translating the research findings to the bedside is a constant source of satisfaction. We're never done asking questions and discovering why dysfunctions occur and how we can stop them and find ways to repair the process."***

–Sekhar Reddy, PhD; Professor and Division Chief for Basic Research