



YET TO BE CHARTED:

Lymphatic System in Health and Disease

September 19–20, 2022



Workshop Sponsored by the NIH
Hosted by NHLBI and NIDDK
September 19 and 20, 2022
8:25 AM – 3:30 PM Eastern Time

Videocast links

[September 19](#)

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Workshop Information

NIH is hosting a research workshop in September to help us better understand how the lymphatic system develops and functions in sickness and in health. The workshop aims to improve how we manage and treat lymphatic disorders. Hosted by the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) in coordination with the Trans-NIH Lymphatic Coordinating Committee (TNLCC), the workshop will bring together basic, clinical, and translational scientists, along with members of the lymphatics community, to explore the latest advances in the field and share research progress.

International experts will discuss current research, explore knowledge gaps, and identify opportunities in lymphatic disease research. People with lymphedema, lipedema, and other lymphatic diseases will share their personal experiences. Workshop organizers hope the event will build collaborative partnerships among scientists, clinicians, patients, and patient advocates. Featured topics include lymphedema and the role of lymphatics in obesity.

This virtual event is free and open to the public.

Highlights

David C. Goff, M.D., Ph.D., director of the NHLBI Division of Cardiovascular Sciences, and **Stephen P. James, M.D.**, director of the NIDDK Division of Digestive Diseases and Nutrition, will give opening remarks. Representatives from the Lymphatic Education & Research Network (LE&RN), the Lymphangiomatosis & Gorham's Disease Alliance, the Lipedema Foundation, and the Fascia Research Society will share the lymphatic community perspective.

Keynote Speakers

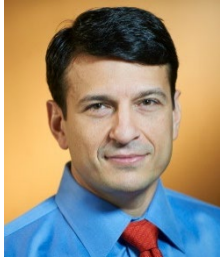
Michael J. Davis, Ph.D., a Curators' Distinguished Professor at the University of Missouri-Columbia, will highlight the mechanisms of lymphatic contractile and valve dysfunction in metabolic syndrome.

Stanley G. Rockson, M.D., a leading clinical lymphedema expert and professor from Stanford University will discuss the development of novel therapies for lymphedema.

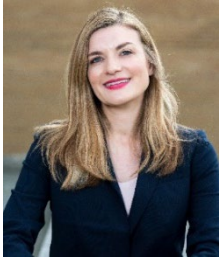
Session Topics

- State of Research in Lymphatics
- Lymphatic Development and Homeostatic Function
- Lymphatics in Inflammation and Diseases of the Gastrointestinal System
- Lymphatic Dysfunction Diseases
- Lymphedema
- The Community's Perspective: Living with Lymphatic Disease
- New Technologies in Lymphatic Imaging and Mapping

Organizing Committee



Babak J. Mehrara, M.D.
Memorial Sloan Kettering Cancer Center



Andrea Radtke, Ph.D.
National Institute of Allergy and Infectious Diseases/NIH



Gwendalyn J. Randolph, Ph.D.
Washington University in St. Louis



Selen Catania, Ph.D.
National Heart, Lung, and Blood Institute/NIH



Patricia Greenwel, Ph.D.
National Institute of Diabetes and Digestive and Kidney Diseases/NIH



Ilsa I. Rovira, M.S.
National Heart, Lung, and Blood Institute/NIH

Workshop Agenda

September 19, 2022

8:25 a.m. – 8:30 a.m.

- **Housekeeping Announcements**

8:30 a.m. – 8:35 a.m.

- **Welcome**
Chairs: Babak J. Mehrara, M.D., Memorial Sloan Kettering Cancer Center
Andrea Radtke, Ph.D., National Institute of Allergy and Infectious Diseases (NIAID), National Institutes of Health (NIH)

8:35 a.m. – 8:40 a.m.

- **Opening Remarks**
Stephen James, M.D., Director, Division of Digestive Diseases and Nutrition,
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), NIH

Session One: State of the Research in Lymphatics

8:40 a.m. – 8:55 a.m.

- **NIH Efforts to Facilitate Lymphatic Research and Current Knowledge in Lymphatic Mapping**
Zorina Galis, Ph.D., Chief, Vascular Biology and Hypertension Branch, National Heart, Lung, and Blood Institute (NHLBI), NIH

Keynote Address

8:55 a.m. – 9:15 a.m.

- **Mechanisms of Lymphatic Contractile and Valve Dysfunction in Metabolic Syndrome**
Michael Davis, Ph.D., University of Missouri School of Medicine

Session Two: Lymphatic Development and Homeostatic Functions

9:15 a.m. – 9:30 a.m.

- **Developmental Origins of Lymphatic Endothelial Cells**
Oliver Stone, Ph.D., University of Oxford

9:30 a.m. – 9:45 a.m.

- **The Left-Right Asymmetric *Pitx2* Gene Regulates Intestinal Muscular-lymphatic Morphogenesis and Protects against Fatty Liver Disease**
Natasza Kurpios, Ph.D., Cornell University

9:45 a.m. – 10:00 a.m.

- **Lymphatic Capillaries Act as a Signaling Hub in the Intestinal Stem Cell Niche**
Rachel Niec, M.D., Ph.D., The Rockefeller University

10:00 a.m. – 10:15 a.m.

- **A Novel Mechanism to Enhance Lymphatic Valve Formation**
Ying Yang, Ph.D., University of South Florida

10:15 a.m. – 10:30 a.m.

- **Targeting Cardiac Lymphatics for Treatment of Ischemic Heart Disease**
Xiaolei Liu, Ph.D., Temple University School of Medicine

10:30 a.m. – 10:45 a.m.

- **Molecular Regulation of Button Junctions in the Lymphatic Vasculature**
Joshua Scallan, Ph.D., University of South Florida

10:45 a.m. – 11:05 a.m.

- **Moderated Discussion**
Moderator: Natasza Kurpios, Ph.D., Cornell University

11:05 a.m. – 11:15 a.m.

- **Break**

Session Three: Lymphatics in Inflammation and Diseases of the Gastrointestinal System

11:15 a.m. – 11:30 a.m.

- **Roles of Intestinal Lymphatic Drainage and Remodeling in Health and Inflammatory Bowel Disease**
Rafael Czepielewski, Ph.D., Washington University School of Medicine in St. Louis

11:30a.m. – 11:45 a.m.

- **Impact of Intestinal Helminths on Duodenal Lymphatic Function**
Daria Esterhazy, Ph.D., The University of Chicago

11:45: a.m. – 12:00 p.m.

- **Lymphatic System in Chronic Liver Disease**
Yasuko Iwakiri, Ph.D., Yale School of Medicine

12:00 p.m. – 12:15 p.m.

- **Maintenance of Lymphatic Vessels Prevents Lymph Leakage and Obesity**
Nada Abumrad, Ph.D., Washington University School of Medicine in St. Louis

12:15 p.m. – 12:30 p.m.

- **Mechanisms of Impaired Lymph Transport in Obesity-induced Lymphedema**
Jorge Castorena-Gonzalez, Ph.D., Tulane University School of Medicine

12:30 p.m. – 12:45 p.m.

- **Moderated Discussion**
Moderator: Yasuko Iwakiri, Ph.D., Yale School of Medicine

12:45 a.m. – 1:45 p.m.

- **Lunch**

Session Four: Lymphatic Dysfunction Diseases

1:45 p.m. – 2:00 p.m.

- **Pathogenesis and Treatment of Kaposiform Lymphangiomatosis in Children**
Timothy Le Cras, Ph.D., Cincinnati Children's Hospital Medical Center

2:00 p.m. – 2:15 p.m.

- **Hyperactive RAS/MAPK Signaling in Complex Lymphatic Anomalies**

Michael Dellinger, Ph.D., University of Texas Southwestern Medical Center

2:15 p.m. – 2:30 p.m.

- **Elucidating the Role of Lymphatic Dysfunction in Arthritic Flare**
Edward Schwarz, Ph.D., University of Rochester Medical Center

2:30 p.m. – 2:45 p.m.

- **Kidney Lymphatics in Health & Disease: Friend or Foe?**
Susan E. Quaggin, M.D., Northwestern University

2:45 p.m. – 3:00 p.m.

- **Moderated Discussion**
Moderator: Timothy Le Cras, Ph.D., Cincinnati Children's Hospital Medical Center

3:00 p.m.

- **Adjournment of Day 1**

September 20, 2022

8:25 a.m. – 8:30 a.m.

- **Housekeeping Announcements**

8:30 a.m. – 8:35 a.m.

- **Welcome and Opening Remarks**
David C. Goff, M.D., Ph.D., Director, Division of Cardiovascular Sciences, NHLBI, NIH

Keynote Address

8:35 a.m. – 8:55 a.m.

- **Finding a Drug for Lymphedema: From Bedside to Bench and Another Round Trip**
Stanley Rockson, M.D., Stanford University School of Medicine

Special Interest Talk

8:55 a.m. – 9:15 a.m.

- **Mapping the Human Body One Cell AT a Time**
Sarah Teichmann, Ph.D., Wellcome Sanger Institute

Session Five: Lymphedema

9:15 a.m. – 9:40 a.m.

- **Preventing Breast Cancer-related Lymphedema: A Surgeon's Journey Highlighting the Importance of Lymphatic Anatomy**
Dhruv Singhal, M.D., Beth Israel Deaconess Medical Center

9:40 a.m. – 9:55 a.m.

- **Outcomes of Vascularized Lymph Node Transplant for Lymphedema Treatment**
Marc V. Schaverien, M.D., The University of Texas MD Anderson Cancer Center

9:55 a.m. – 10:10 a.m.

- **Translational Imaging of Sodium and Adipose Tissue in Lymphedema and Lipedema**
Rachelle Crescenzi, Ph.D., Vanderbilt University

10:10 a.m. – 10:25 a.m.

- **Pathways of Injury and Repair in Lymphedema**
Mark Nicolls, M.D., Stanford University School of Medicine

10:25 a.m. – 10:40 a.m.

- **Mechanisms of Lymphatic Dysfunction and Fibrosis in Secondary Lymphedema**
Raghu Kataru, Ph.D., Memorial Sloan Kettering Cancer Center

10:40 a.m. – 10:55 a.m.

- **Lymphatic Vessel Function and Bacterial Infection**
Timothy Padera, Ph.D., Massachusetts General Research Institute

10:55 a.m. – 11:15 a.m.

- **Moderated Discussion**
Moderator: Timothy Padera, Ph.D., Massachusetts General Research Institute

11:15 a.m. – 11:25 a.m.

- **Break**

Session Six: The Community's Perspective: Living with Lymphatic Disease

11:25 a.m. – 12:05 p.m.

- **Panel Discussion**
Moderators: Babak Mehrara, M.D., Memorial Sloan Kettering Cancer Center
William Repicci, M.A., Chief Executive Officer, Lymphatic Education & Research Network (LE&RN)
Panelists: Cameron (Cam) Ayala, LE&RN
Kasi Grosvenor, Lipedema Foundation (LF)
Cynthia Hudson
Taylor Lewis, Lymphangiomatosis & Gorham's Disease Alliance (LGDA)

Special Interest Talk

12:05 p.m. – 12:15 p.m.

- **SBIR/STTR Funding: Accelerating Your Technologies from Lab to Market**
Reema Railkar, Ph.D., I-Corps™ at NIH, National Cancer Institute

12:15 p.m. – 1: 30 p.m.

- **Lunch**

Session Seven: New Technologies in Lymphatic Imaging and Mapping

1:30 p.m. – 1:45 p.m.

- **Lymphatic Anatomical Variants as a Disease Mechanism: The Importance of Anatomical Mapping**
Maxim Itkin, M.D., University of Pennsylvania

1:45 p.m. – 2:00 p.m.

- **Lymphatic Flow Disorders in Systemic Disease: New Insights from Novel Imaging Techniques and New Treatment Options**
Yoav Dori, M.D., Ph.D., Children's Hospital of Philadelphia

2:00 p.m. – 2:15 p.m.

- **Integrative Visualization of Multi-modal and Spatially Resolved Single-cell Data in Lymphatic Tissue**

Nils Gehlenborg, Ph.D., Harvard Medical School

2:15 p.m. – 2:30 p.m.

- **3D-Imaging of Fluid and Waste Clearing from Brain in Experimental Models of Impaired Lymphatic Drainage**

Helene Benveniste, M.D., Ph.D., Yale School of Medicine

2:30 p.m. – 2:45 p.m.

- **Moderated Discussion**

Moderator: Andrea Radtke, Ph.D., NIAID, NIH

2:45 pm – 3:00 pm

- **Break**

Session Eight: Gaps, Opportunities, and Conclusions

3:00 p.m. – 3:20 p.m.

Andrea Radtke, Ph.D., NIAID, NIH

Babak Mehrara, M.D., Memorial Sloan Kettering Cancer Center

3:20 p.m.

- **Adjournment**

DISCLAIMER: This content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Speaker Information



Nada Abumrad, Ph.D.

Dr. Abumrad is currently the Dr. Robert Atkins Professor of Obesity Research in Medicine and a Professor of Cell Biology and Physiology at Washington University School of Medicine in Saint Louis, Missouri. She obtained her Ph.D. in Pharmacology at the State University of NY in Syracuse and conducted two consecutive postdoctoral fellowships at Syracuse University and then at Vanderbilt University. She joined the faculty of the Molecular Physiology Department at Vanderbilt as Assistant and then Associate Professor before moving first to Stony Brook University and then to Washington University School of Medicine. Since 2004, she holds the Robert Atkins endowed Professorship and she has served as Associate Director of the Nutrition and Obesity Research Center (NORC) at Washington University from 2006-2021. She directs the NORC Adipocyte Biology and Molecular Nutrition Core since its initiation in 2006. Dr. Abumrad is recognized for her work on cellular fatty acid transport and signaling, and the role they play in regulating metabolism and tissue homeostasis. She identified the scavenger receptor CD36 as a membrane fatty acid transporter and uncovered its role in metabolic signaling and energy homeostasis. More recently, she uncovered critical vascular roles of CD36: Deletion of endothelial cell CD36 impaired tissue fatty acid uptake and caused leaky capillaries. CD36 deletion in lymphatic endothelial cells resulted in lymph leakage into the mesenteric area with the development of spontaneous visceral obesity, inflammation and glucose intolerance. Her work in humans documented that CD36 genetic variants influence the lipid profile, orosensory fat taste perception, and susceptibility to diabetes-associated complications. Recent findings link low tissue CD36 mRNA to several gastrointestinal diseases.



Cameron (Cam) Ayala

In 2001, Cam was diagnosed with primary lymphedema that has affected his right leg since he was 11-years old. Despite several bouts of infection, 17 surgeries, including a recent above-knee-amputation, Cam continues to fight through the daily challenges that this disease presents. He was put in the public spotlight in 2019 as a contestant on ABC's *"The Bachelorette"* and *"Bachelor in Paradise."* Despite having his lymphedema testimony edited out from every episode, Cam decided to use this public notoriety to bring awareness to lymphedema and other lymphatic diseases.

It was during a dinner meeting with LE&RN President & CEO, William Repicci and LE&RN National Spokesperson, Kathy Bates, that Mr. Ayala graciously accepted their invite to join LE&RN as a Celebrity Ambassador. From presenting the keynote speech at Harvard Medical School Hospital's Lymphedema Patient Symposium, to giving a TED Talk at his alma mater, Texas A&M University, Cam has a passion for educating the public about LE&RN's mission. As of February 2022, Cam became LE&RN's first full-time Director of Development & Marketing.



Helene Benveniste, Ph.D.

Helene Benveniste received her B.Sc. in Denmark majoring in Mathematics & Physics, and went on to the University of Copenhagen, for her MD and Ph.D. (Doctor Medicinae). As a Research Fellow she trained in high field magnetic resonance imaging (MRI) at Duke University Medical Center and developed techniques for brain imaging focused on neurodegenerative disease processes including Alzheimer's Disease. She then went on to residency in Anesthesiology at Duke University. Dr. Benveniste started her own lab at Brookhaven National Laboratory in 2001, before moving to a faculty position in the Departments of Anesthesiology and Biomedical Engineering at Yale School of Medicine. Dr. Benveniste's laboratory explores the functioning of the 'lymphatic system' – the waste disposal system of the brain. Foremost, she and close scientific collaborators studies how the brain gets rid of toxic waste and she has developed imaging platforms to examine how cerebrospinal fluid (CSF) circulates in the brain and how waste solutes exits and drain to the cervical lymph nodes in healthy brain and in neurodegenerative diseases. The overall goal is to develop therapeutic strategies to sustain optimized brain waste clearance from through the given life span to prevent dementia. She has received a number of honors including the Paul Beeson Physician Faculty Scholarship award; NYS Office of Science, Technology & Academic Research, Faculty Award; "Best Doctor in New York" Award 2009; and is an Elected Member, American College of Neuropsychopharmacology.



Jorge A. Castorena-Gonzalez, Ph.D.

Dr. Jorge A. Castorena-Gonzalez received his B.Sc. and M.Sc. degrees in Physics from the Universidad de Guanajuato in León, Mexico. In 2014, he graduated from the Biological Engineering Ph.D. program at the University of Missouri. As a postdoctoral fellow, Dr. Castorena trained under the mentoring of Dr. Michael J. Davis, an expert vascular physiologist and one of the leading investigators in lymphatic research worldwide. At the Davis's lab, Dr. Castorena acquired highly technical skills that allow for the characterization of the function of lymphatic micro-vessels from mice and humans ex vivo, this includes quantitative characterization of lymphatic contractility/pumping and valve competence, as well as in vivo assessment of lymph transport. In 2020, Dr. Castorena-Gonzalez was recruited by the Department of Pharmacology at Tulane University School of Medicine, where he leads an independent lymphatic biology research lab. Dr. Castorena's research is currently funded by an NIH R00 grant, and his research focuses on the study and understanding of the mechanisms leading to dysfunction of the lymphatic system in connection with metabolic syndrome, obesity, and diabetes. Other interests of Dr. Castorena include the development of novel experimental techniques in physiology and software tools for the automated processing and analyses of data/images, and drug development and testing for the treatment of lymphatic system diseases.

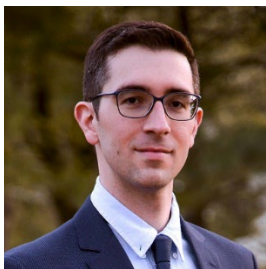


Rachelle L. Crescenzi, Ph.D.

Rachelle L. Crescenzi, Ph.D. is a translational imaging scientist and Assistant Professor of Radiology and Biomedical Engineering at Vanderbilt University Medical Center (VUMC). Dr. Crescenzi studied Physics at the University of Delaware where she received a B.S. with honors in 2009. She completed her doctoral thesis in 2015 in the Department of Biochemistry and Molecular Biophysics at the University of Pennsylvania. During her doctoral research, she received interdisciplinary training in the Center for Magnetic Resonance and Optical Imaging (CMROI) where she focused on developing chemical exchange saturation transfer (CEST) magnetic resonance imaging (MRI) methods to image neuronal glutamate in preclinical models of neurodegeneration. Her postdoctoral training in the Vanderbilt University Institute of Imaging Science (VUIIS) focused on clinical vascular imaging in patients with lymphatic disease. She was awarded a postdoctoral research fellowship through the Lymphatic Education & Research Network (LE&RN) in partnership with the Fat Disorders Resource Society (FDRS) to apply imaging science to study lipedema in 2016. She received a career development award (2018-2022) and concurrent innovative project award (2019-2022) through the American Heart Association, before joining the VUMC faculty in 2018.

Dr. Crescenzi currently leads an independently funded research program as a primary faculty member of the Vanderbilt University Institute of Imaging Science. Her research centers around capabilities to visualize the lymphatic network together with tissue sodium in small animals and humans using noninvasive magnetic resonance imaging (MRI). Dr. Crescenzi's lab is supported by the NIH/NHLBI (1R01HL155523, 1R01HL157378) to define the complex relationship between peripheral sodium storage and lymphatic clearance in patients with lower-extremity lymphedema or lipedema who suffer from poorly understood vascular disease pathways.

Dr. Crescenzi is a mentor to postdoctoral fellows in Imaging Sciences, graduate students in Biomedical Engineering, and medical students and residents in Radiology. Dr. Crescenzi maintains active collaborations with physician scientists across VUMC departments of Radiology, Cardiovascular Medicine, Physical Medicine and Rehabilitation, Clinical Pharmacology, Nephrology and Pediatric Nephrology. Dr. Crescenzi is a member of the International Society for Magnetic Resonance in Medicine (ISMRM, since 2009), the Fat Disorders Resource Society (FDRS, since 2015), the Lymphatic Education & Research Network (LE&RN, since 2015), the American Heart Association (AHA, since 2018), The Obesity Society (TOS, since 2018), and The Microcirculatory Society (since 2021).



Rafael Czepielewski, Ph.D.

Dr. Rafael Czepielewski is a Brazilian immunologist and intravital microscopist. He began science at PUCRS University in Brazil, receiving a master's and Ph.D. degree studying neutrophil chemotaxis in acute and chronic inflammation. Next, Dr. Czepielewski conducted postdoctoral work under the mentorship of Dr. Gwendalyn Randolph at Washington University School of Medicine in St Louis, where he combined his immunology background with vascular biology to investigate the role of lymphatic vessels and tertiary lymphoid organs in the pathology of inflammatory bowel diseases. He is currently an instructor at the Department of Pathology & Immunology at Washington University School of Medicine in St Louis, where he is studying the mechanisms of intestinal-derived factors controlling collecting lymphatic vessel remodeling, the lymphatic and immune cell crosstalk during inflammation,

and exploring specific physiological roles of lymphatics in the colon. Dr. Czepielewski has received several awards, i.e., the Young Investigator Award from the Lymphatic Forum 2021 meeting and the Career Development Award 2022 from Crohn's & Colitis Foundation.



Michael J. Davis, Ph.D.

The consistent theme of my research career has been mechanisms underlying vascular mechanotransduction. My laboratory was one of the first to develop isolated vessel methods to study small arterioles, as well as patch clamp / calcium imaging methods to study the roles of ion channels in mechanotransduction by endothelial and vascular smooth muscle cells. In recent years we have pioneered methods to study mechanotransduction in the mouse lymphatic system. My work now focuses on the mechanical and electrophysiological properties of lymphatic smooth muscle and how its dysfunction contributes to lymphedema. Currently, I am funded by the NIH to study: 1) the contractile and valve properties of lymphatic vessels in mouse models of human diseases; 2) ion channels involved in pacemaking by lymphatic muscle; and 3) the conduction of electrical signals along and across the lymphatic wall. I also serve as a co-investigator on other NIH projects to contribute my expertise in assessing valve function in mouse models of human lymphatic disease, including lymphedema distichiasis, Cantú Syndrome and Ras-pathway mutations. I have trained over 20 graduate students and post-docs, most of whom now hold positions in academia or industry.



Michael Dellinger, Ph.D.

Dr. Michael Dellinger is an Associate Professor in the Departments of Surgery and Molecular Biology at UT Southwestern Medical Center. He is also the Director of Research for the Lymphatic Malformation Institute, a non-profit organization that funds research on complex lymphatic anomalies. Additionally, he works closely with The Lymphangiomatosis & Gorham's Disease Alliance (LGDA) and is the Research Leader for the LGDA's Rare as One Project sponsored by the Chan-Zuckerberg Initiative (CZI). Dr. Dellinger completed his Ph.D. work at the University of Arizona and his postdoctoral studies at UT Southwestern Medical Center. His lab is focused on identifying biomarkers and treatments for complex lymphatic anomalies. You can learn more about his research on his lab's website.



Yoav Dori, M.D., Ph.D.

Dr. Dori is a pediatric cardiologist and director of Pediatric Lymphatic Imaging and Interventions and Lymphatic Research at Children's Hospital of Philadelphia. He has a Ph.D. in chemical engineering from University of Minnesota and received his medical degree from Johns Hopkins School of Medicine. He is also Director of the Jill and Mark Fishman Center for Lymphatic Disorders Program, that has pioneered new imaging tools and a minimally invasive catheterization techniques to identify and treat complex lymphatic disorders.



Daria Esterhazy, Ph.D.

Dr. Daria Esterhazy is an Assistant Professor of Pathology in the Department of Pathology, at The University of Chicago. Her lab studies how tissue specific immunity is shaped in the digestive system under homeostatic conditions and how it can be perturbed to cause pathologies. The goal of the lab is to understand what drives niche specific, or local, immunological differences between not only functional segments along the gut, but also the liver-biliary system and the pancreas. Her lab postulates that this immune compartmentalization underlies the nature and site specificity of disease susceptibility, such as pathogen tropisms, food allergies, autoimmune diseases, chronic inflammatory diseases and cancers. Insight into how the immune system is wired in each niche will permit more tailored and potentially effective therapeutic strategies.

The Esterhazy's lab works on two main research areas using a wide range of techniques in mice, including lymph node dissection, microsurgery, lymphatic vessel cannulation, pancreatic islet isolation, multimodal imaging, single cell gene expression analysis, gnotobiotics, and genetic manipulation of mice to model diseases or track immune events. The lab uses a spectrum of gastrointestinal pathogens, and study human material to relate their work to human disease.



Zorina Galis, Ph.D.

Dr. Zorina Galis was trained in Physics, Biophysics, and Cell Biology, at University of Bucharest, in Pathology at McGill, Canada, and in Vascular Medicine at Harvard, followed by a career in academic research ([Google Scholar](#)), achieving tenured positions in Cardiology and Biomedical Engineering in Emory School of Medicine and at Georgia Institute of Technology, in industry, serving as Chief Scientific Officer for Cardiovascular R&D at Eli Lilly and Co, and currently serves in public health research administration at the NIH.

Dr. Galis serves as the Chief of the Vascular Biology and Hypertension Branch at National Heart Lung and Blood Institute (NHLBI) of the National Institutes of Health (NIH), that provides scientific leadership and enables extramural research, from basic discovery through technology development, translation, and multi-site clinical trials. Since joining the NIH in 2011, Zorina also has spearheaded and led large interdisciplinary scientific initiatives to create opportunities for the vascular community, such as the Trans-NIH Small Blood Vessels in Health and Disease Working Group, the Trans-NIH Lymphatic Coordination Committee, the NHLBI Vascular Interventions/Innovations and Therapeutic Advances ([VITA](#)) Program, accelerating development of biomedical products (devices, diagnostics, and drugs), and the NIH Common Fund Human BioMolecular Atlas Program ([HuBMAP](#)). Several of these initiatives were recognized with NHLBI and NIH Director Awards.



Nils Gehlenborg, Ph.D.

Nils Gehlenborg, PhD, is an Associate Professor in the Department of Biomedical Informatics at Harvard Medical School, Director of the Master in Biomedical Informatics program, and Director of the Biomedical Informatics and Data Science Research Training (BIRT) program.

Dr. Gehlenborg received his Ph.D. from the University of Cambridge and was a predoctoral fellow at the European Bioinformatics Institute (EMBL-EBI) in the Functional Genomics Group of Alvis Brazma. He completed his postdoctoral training as a Research Associate in the lab of Peter J. Park at the Center for Biomedical Informatics at Harvard Medical School.

The goal of Dr. Gehlenborg's research is to improve human health by developing visual interfaces and computational techniques that enable scientists and clinicians to efficiently interact with biomedical data. Tight integration of algorithmic approaches from biomedical informatics with advanced data visualization techniques is central to his efforts, as is close collaboration with clinicians and experimentalists. Currently, he is researching and developing novel tools to visualize 3D genome conformation data as well as heterogeneous data from large-scale cancer genomics studies. These efforts integrate visual and computational approaches to support sense-making in biology and to support reproducible, collaborative research. Dr. Gehlenborg is also a Co-Investigator for the 4D Nucleome Network Data Coordination and Integration Center hosted at Harvard Medical School.

Dr. Gehlenborg is a co-founder, former general chair, and current steering committee chair of BioVis, the Symposium on Biological Data Visualization, and co-founder of VIZBI, the annual workshop on Visualizing Biological Data. Currently, he co-chairs the Policy Working Group for the 4D Nucleome Network, an NIH Common Fund project. He has served on the program committees of several international bioinformatics and data visualization conferences and held multiple editorial roles, including his current role as associate editor of BMC Bioinformatics. He has also contributed to the "Points of View" data visualization column in Nature Methods.



David C. Goff Jr., M.D., Ph.D., FACP, FAHA

David C. Goff, Jr., M.D., Ph.D., is Director, Division of Cardiovascular Sciences, National Heart, Lung, and Blood Institute, National Institutes of Health. In this role, he leads a diverse team of scientists and administrators committed to turning discovery into cardiovascular health. Prior to joining the NHLBI, he served as Dean and Professor of Epidemiology in the Colorado School of Public Health and as Chair of the Department of Epidemiology and Prevention at the

Wake Forest School of Medicine. He received an M.D. from the University of North Carolina and a Ph.D. in epidemiology from the University of Texas-Houston School of Public Health. He trained in internal medicine at Baylor College of Medicine in Houston. He is an elected member of the American Epidemiological Society, and a Fellow of the American College of Physicians and the American Heart Association. He has published over 300 manuscripts, book chapters, and other scientific reports. The major focus of his research has been on developing, testing, and implementing better strategies for promoting cardiovascular health and preventing cardiovascular disease.



Kasi Grosvenor

Kasi Grosvenor is a patient advocate who has been living with Lipedema symptoms for more than 20 years, but was only formally diagnosed and began treatment in 2021. Living near Richmond, Virginia, Kasi is married with two children, and is an avid gardener who enjoys spending her spare time anywhere near water. With a 20+ year career in project management, Kasi has used her professional experience to advocate for her own health and raise Lipedema awareness by sharing her journey on her blog and social media (@thrivingwithlipedema). Kasi is passionate about sharing the effectiveness of conservative treatments for managing Lipedema symptoms to slow the progression of the disorder and regularly engages with Lipedema research, patient roundtables, and related medical conferences and outreach. Most recently, she has completed the first of several planned Lipedema reduction surgeries working with Johns Hopkins University's plastic surgery team.



Cynthia Hudson

Cynthia Hudson is a patient/advocate who has been living with the disabling symptoms of lymphedema since 2000. She works closely with groups such as Memorial Sloan Kettering Cancer Center (MSKCC) Cancer-Related Lymphedema Support Group and New York Medical College (NYMC) Rehabilitation Medicine in efforts to advance research on secondary lymphedema and improve patient outcomes. She had a career in the advertising industry for over 20 years, holding managerial positions overseeing client finance. After leaving the advertising industry, she commenced a career in secondary education, where she taught students with disabilities for 13 years. She has recently retired from teaching and has started a small medical billing business. She is participating in this workshop in a personal capacity and not as a representative of MSKCC or NYMC.



Maxim Itkin, M.D.

Dr. Itkin is a Professor of Radiology and Pediatrics at the University of Pennsylvania, where he is the director of the Center for Lymphatic Imaging and Interventions. Dr. Itkin is nationally and internationally recognized for his clinical and research expertise in interventional treatment of lymphatic disorders. Dr. Itkin has been actively involved in the development of image guided interventions of the lymphatic system (i.e., thoracic duct embolization, liver lymphatic embolization, interstitial lymphatic embolization, etc.) as a treatment for lymphatic disorders. Dr. Itkin developed internodal lymphangiogram as a substitute of pedal lymphangiogram. This method opened new horizons for lymphatic interventions. He developed contrast-enhanced magnetic resonance (MR) lymphangiogram for noninvasive dynamic imaging of the lymphatic anatomy. This technique led to the discovery of pathophysiology and treatment of plastic bronchitis, neonatal chylothorax, congenital limb lymphodysplasia, and protein losing enteropathy. Dr. Itkin has lectured extensively nationally and internationally and has over 90 peer-reviewed publications, reviews and editorials in leading journals. He is a member of multiple national and international professional societies and in 2011 was inducted to the Society of the Interventional Radiology as a Fellow member, in recognition of significant contributions to the field of cardiovascular and interventional radiology.

Dr. Itkin is nationally and internationally recognized for his clinical and research expertise in an interventional treatment of the lymphatic disorders. Over the past 20 years, Dr. Itkin has been actively involved in the development of image-guided interventions of the lymphatic system (Thoracic Duct Embolization, liver lymphatic embolization, interstitial lymphatic embolization etc.) as a treatment of lymphatic leakage disorders. Dr. Itkin popularized intranodal lymphangiogram—a simple ultrasound guided puncture of groin lymph nodes in order to opacify the lymphatic system, as a substitute to the more technically challenging pedal lymphangiogram. Being well within the skill set of most interventionalists, this method allowed for wide dissemination and opened new horizons for lymphatic interventions. Dr. Itkin was instrumental in development of Dynamic Contrast Enhanced MR lymphangiogram for non-invasive imaging of the lymphatic anatomy. This technique led to the discovery of pathophysiology of several diseases such as plastic bronchitis, neonatal chylothorax, congenital lymphodysplasia and protein losing enteropathy. This knowledge led to further development of novel percutaneous treatments of these conditions.

Dr. Itkin has lectured extensively nationally and internationally and has 130 peer reviewed publications, reviews and editorials in leading journals. He is a member of many national and international professional societies and in 2011 was inducted into the Society of the Interventional Radiology as a Fellow member as recognition of significant contributions to the field of cardiovascular and interventional radiology. In 2015 he was presented with University of Pennsylvania, “Luigi Mastroianni, Jr. Clinical Innovator Award” and in 2018 “Award of Excellence and Innovation in IR” by Cardiovascular and Interventional Society of Europe”.



Yasuko Iwakiri, Ph.D.

Dr. Iwakiri is a Professor of Medicine at Yale School of Medicine, conducting basic and translational research in various liver diseases with particular interest in liver fibrosis, portal hypertension and lymphatic vascular systems. She is currently an Associate Editor for Hepatology Communications, one of the flagship journals of the American Association for the Study of Liver Diseases (AASLD), and has served as an Associate Editor for Hepatology twice and as an editorial board member on major Hepatology journals including Hepatology, Journal of Hepatology, Hepatology International, Liver International, Liver Research and JHEP Reports. She has been serving as members for numerous grant review committees, including the Biomedical Research Review Subcommittee (AA-1) at National Institute of Alcohol Abuse and Alcoholism (NIH/NIAAA), Hepatobiliary pathophysiology (HBPP) at National Institute of Diabetes and Digestive and Kidney Diseases (NIH/NIDDK), Liver Cancer Review Panel at Department of Defense (DOD), Small Business Panel [ZRG1 DKUS-N(10) B] at NIH/NIDDK, Research Grants Council (RGC) of Hong Kong, the Netherlands Organization for Scientific Research (NWO/ZonMw) and AMED (Japanese governmental grant). She has served as a mentor for more than 50 lab members over 16 years since she started her independent career.



Stephen P. James, M.D.

Dr. James is the Director of the Division of Digestive Diseases and Nutrition in the National Institute of Diabetes & Digestive & Kidney Diseases (NIDDK) of the National Institutes of Health in Bethesda, Maryland, a position he has held since 2004.

Dr. James received his undergraduate degree from Cornell University and M.D. degree from Johns Hopkins. After medical residency training at Johns Hopkins he completed further fellowship training in gastroenterology and liver diseases at the University of Maryland and NIDDK and training in immunology in the National Cancer Institute. From 1981 to 1991 he was an intramural scientist in the Laboratory of Clinical Investigation in the National Institute of Allergy and Infectious Diseases (NIAID), where he specialized in research in immunological aspects of diseases of the digestive system, particularly inflammatory bowel diseases. He returned to the University of Maryland in 1991 and served as the Helen and Moses Paulson Professor of Medicine and Head of the Division of Gastroenterology until 2001, when he returned to the NIH. Dr. James has served on numerous committees of different organizations including the AGA, the Crohn's & Colitis Foundation of America, Chairman of the National Commission on Digestive Diseases and the Institute Advisory Board for the CIHR Institute of Nutrition, Metabolism, and Diabetes (INMD). He has published over 200 original research articles, reviews, and book chapters.



Raghu Kataru, Ph.D.

Dr. Kataru is an Assistant Attending / Assistant Lab Member at the Department of Surgery, Memorial Sloan Kettering Cancer Center (MSKCC), New York. He has a doctoral degree in Vascular biology from the Biomedical Research Center in the Korea Advanced Institute of Science and Technology (KAIST) in South Korea. Over the past 17 years, his research has revolved around lymphatic circulation and its role in inflammation, cancer-related secondary lymphedema, obesity, anti-tumor immunity and aging. He has made significant contributions to lymphatics research, particularly on lymphatic vessel remodeling during inflammation, interactions between immune cells and lymphatic vessels in lymph nodes, and, more recently, the role of lymphatic vessel function in the regulation of the tumor microenvironment and anti-tumor immunity. Dr. Kataru has generated several lymphatic-specific mice models that allow the manipulation of the lymphatics in the tumor microenvironment, inflammation, obesity, and aging. In addition to basic research activities, Dr. Kataru has been actively involved in training the next generation of scientists. Even though his research interest spans the whole lymphatic system in several pathologies the overarching goal of his research is to understand the cellular mechanisms that regulate lymphatic dysfunction in secondary lymphedema. His expertise is broadly applicable to lymphatic dysfunction in other scenarios (e.g., obesity, aging and cancer) and developing novel therapeutic strategies to treat lymphatic diseases.

Natasza Kurpios, Ph.D.

Dr. Kurpios grew up in Poland and moved to Canada at age fourteen. She completed her Ph.D. in Biochemistry at McMaster University, in Ontario, Canada. Dr. Kurpios completed postdoctoral training at Harvard Medical School with Dr. Cliff Tabin - where she became fully invested in studying developmental

biology. She joined the Cornell University faculty in 2009 and since that time has led a research laboratory that explores how organs, including the vasculature, are shaped during embryogenesis. Her work has focused on left-right organ asymmetry, as errors of organ laterality are fundamentally linked to life-threatening birth defects. Since laterality pathways are largely conserved through evolution, she has used chicken embryos and mouse genetics to gain insight into the critical symmetry-breaking events that dictate organ shape and function.



Timothy Le Cras, Ph.D.

The goal of Dr. Le Cras' research program is to investigate the mechanisms underlying vascular anomalies in children and adults. He has been working in the field of vascular biology and disease for over 30 years and has extensive expertise studying the molecular and cellular pathways underlying human diseases. More recently his work has focused on the role of vascular growth factors and gene mutations in human endothelial cells and how they contribute to the pathogenesis of vascular anomalies. The strength of his research is the use of human cells and samples to determine signaling pathways, identify disease biomarkers and test potential novel targeted therapies. Dr. Le Cras collaborates with physicians and other scientists both at Cincinnati Children's and other major medical centers who are world-experts in the investigation and treatment of vascular anomalies.



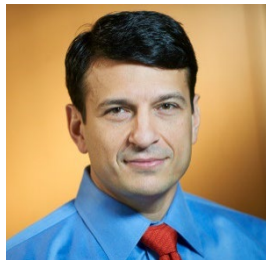
Taylor Lewis, B.S., MSW, LCSW

Taylor Lewis is a 27 year old with a generalized lymphatic anomaly (GLA). She is a mental health therapist by day and a proud goldendoodle mom to Chewie and wife to her caring and supportive husband Alex. Taylor was a competitive tennis player whose journey took a shift due to her disease. She has since grown a passion for helping others. Through her young adult support group and involvement with the LGDA she has been able to highlight the importance of mental health support and reproductive issues of chronic disease. She has since connected with her peer through LGDA Liz Bovee and the two have branched off to Co-found and host the "Not So Rare Podcast" focusing on shedding light to all things rare disease. Through her journey of having a rare chronic disease she has experienced many highs and lows through college, relationships, and the workplace. Taylor has learned two great lessons through living with a chronic disease: 1. The importance of advocacy and believing that coming together will provide hope and change for the future & 2. When one opportunity is taken away in life, another will present itself and you may find it to be even more fulfilling.



Xiaolei Liu, Ph.D.

Dr. Liu received her bachelor and master degrees in China, where she developed a strong interest for cardiovascular research. She pursued her Ph.D. at Oklahoma University Health Sciences Center, where she developed a strong interest in lymphatic studies and realized that this poorly investigated topic was also important in the cardiovascular field that she wanted to focus on. She therefore did her postdoctoral training in the laboratory of Dr. Guillermo Oliver, a renowned scientist in the field of lymphatic development and disease. During the valuable years of training in his lab, her work focused on early lymphatic development and lymphatic function in health and disease. Particularly, her postdoctoral work has uncovered a novel paracrine signal from lymphatics that regulates heart development and promotes cardiac repair. This work revealed a novel mechanism on how lymphatics are involved in heart repair. Following the strong passion in the field of lymphatic research, Dr. Liu has started an independent career at the Lemole Center for Integrated Lymphatics Research at Temple University. Her laboratory focuses on the development and function of cardiac lymphatics in the pathologic progression of cardiovascular diseases. The ultimate goal is to develop novel therapeutic approaches for the treatment of cardiovascular disease.



Babak J. Mehrara, M.D.

Babak J. Mehrara, M.D., is the Chief of the Plastic and Reconstructive Surgery Service and the Peter G. Cordeiro Endowed Chair in the Department of Surgery at Memorial Sloan Kettering Cancer Center (MSK), with a joint appointment as Professor of Surgery at Weill Cornell Medical College. Dr. Mehrara is an oncologic reconstructive surgeon with a broad background in both the clinical management and the biology of cancer. His research interest is lymphedema and lymphatic biology and has authored more than 300 peer-reviewed publications. He serves as the Director of the National Institutes of Health-funded Lymphatic Biology Laboratory at MSK.



Mark Nicolls, M.D.

Dr. Nicolls is Chief of the Division of Pulmonary, Allergy, and Critical Care Medicine at Stanford University Medical Center. His research centers primarily on lung transplantation, pulmonary hypertension, and lymphedema and evaluates how immune injury to circulatory systems contributes to disease pathogenesis. He helps lead the T32 training grant focused on pulmonary biology. His laboratories are based at the VA Palo Alto and Stanford University.



Rachel Niec, M.D., Ph.D.

Rachel Niec is a physician scientist at the Jill Roberts Center for Inflammatory Bowel Disease at Weill Cornell Medicine and in the Laboratory of Mammalian Cell Biology with Elaine Fuchs at The Rockefeller University. Her clinical practice is focused on the care of patients with Inflammatory Bowel Disease. Her research focuses on defining the cellular communication networks within the intestinal epithelium that underly inflammatory bowel disease. She has expertise in mucosal immunology and epithelial and stem cell biology.



Timothy Padera, Ph.D.

Dr. Padera earned dual Bachelor's Degrees in Chemical Engineering and Biomedical Engineering from Northwestern University. He earned his Ph.D. in Medical Engineering from the Harvard-MIT Health Sciences and Technology program and performed his thesis work at Massachusetts General Hospital. He was appointed to the faculty of Harvard Medical School as an Instructor and has risen through the ranks and is now Associate Professor of Radiation Oncology at Harvard Medical School and a PI in the Edwin L. Steele Laboratories, Department of Radiation Oncology at Massachusetts General Hospital. In 2011, he was awarded an NIH Director's New Innovator Award. In 2021, he was named the Rullo Family MGH Research Scholar.

Dr. Padera is recognized as a leader in the field of functional lymphatic imaging, particularly with respect to tumor growth and lymphatic metastasis. He has seminal papers describing the role of functional peritumor lymphatic vessels in tumor dissemination and the source of lymphatic dysfunction in tumors. His group has also developed a novel method to study the autonomous contraction of collecting lymphatic vessels in mice. This work opened the door to the wide array of genetic mouse models to study underlying functional lymphatic deficits in lymphedema, states of inflammation and bacterial infection. His group has also developed the first chronic lymph node window in a mouse. Using this novel model, his lab has shown that lymph node metastases do not require sprouting angiogenesis for their growth and suppress immune function in the lymph node. Further, they have shown the lymph node metastasis can spread to distant organs by invading lymph node blood vessels, contributing to the progression of cancer.



Susan E. Quaggin, M.D.

Susan E. Quaggin, MD, FRCP(C), FASN, is a graduate of the University of Toronto where she completed her residency and served as chief medical resident for the University's St. Michael's Hospital. She completed her nephrology fellowship at the University of Toronto and Yale University, where she also completed research and post-doctoral training. Dr. Quaggin's research focuses on fundamental processes needed to establish and maintain the integrity of the specialized vascular beds in the kidney, cardiovascular system and eye. Translation of her group's findings regarding the vasculature reveals pathogenic mechanisms and new therapeutic targets for a number of diseases, including diabetic kidney and eye disease, nephrotic syndrome, microangiopathic thrombotic disorders and glaucoma.

Currently she is the Charles Horace Mayo professor of medicine at Northwestern University where she serves as the Chief of the Division of Nephrology & Hypertension and the Director of the Feinberg Cardiovascular and Renal Research Institute. Dr. Quaggin was elected to the American Society for Clinical Investigation in 2006, the Association of American Physicians in 2013, the National Academy of Medicine in 2019 and the National Academy of Inventors in 2021 and is President of the American Society of Nephrology and councilor of the Association of American Physicians.



Andrea Radtke, Ph.D.

Dr. Andrea Radtke obtained her Ph.D. from Johns Hopkins University in the Department of Molecular Microbiology and Immunology where she studied anti-malaria CD8+ T cell responses. She trained as a post-doctoral fellow in the laboratory of Dr. Ronald Germain at the National Institutes of Health from 2013-2018 before transitioning to a Staff Scientist. In 2021, she was awarded the honorific title of Associate Scientist in recognition of her scientific achievements at the NIH. Within the Germain laboratory, Andrea specializes in advanced microscopy techniques including a multiplexed antibody-based imaging method, IBEX, that she developed with colleagues. IBEX is an open-source method that enables highly multiplexed imaging in diverse human and mouse tissues. IBEX is compatible with over 250 commercially available antibodies, 16 unique fluorophores, and can be easily adopted to different imaging platforms using slides and non-proprietary imaging chambers. The overall protocol consists of iterative cycles of antibody labelling, imaging, and chemical bleaching that can be completed at relatively low cost in 2-5 days by biologists with basic laboratory skills. This method is supported as a spatial biology application by BioLegend, a global manufacturer of antibodies. Andrea's images have been featured on the covers of the *Journal of Experimental Medicine*, *Nature Protocols* and *Nature Methods*. She has worked with colleagues to apply IBEX to create detailed atlases of human lymphoid organs including normal and malignant lymph nodes and the developing thymus. Andrea is passionate about team science, open science, and mentoring. To this end, she is working with NIH colleagues to create an IBEX Knowledge Base to serve the spatial biology community. Additionally, she is leading efforts to standardize multiplexed tissue imaging and steward resources through community validated antibody panels (OMAPs) with her Human BioMolecular Atlas Program (HuBMAP) colleagues.



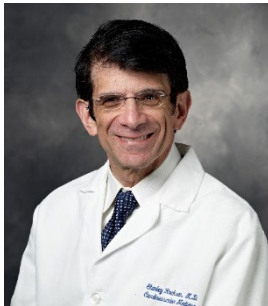
Reema Railkar, Ph.D.

Dr. Reema Railkar is a Scientific Program Manager in the NCI SBIR Development Center. She is also the Program Manager for I-Corps™ at NIH program. She is actively engaged in guiding small businesses to develop applications, provides programmatic and analytical support or various resources available for small businesses at NCI SBIR. She is a cancer biologist with over 15 years of experience in biochemical, biophysical, and bioanalytical platform solutions and has extensive experience in preclinical studies/application of antibodies and small molecules for anti-cancer therapies. Dr. Railkar received her Ph.D. in Molecular Endocrinology from Indian Institute of Science, Bangalore. She was a post-doctoral fellow with National Cancer Institute.



William Repicci, M.A.

William Repicci is President & CEO of the New York City based Lymphatic Education and Research Network (LE&RN) whose mission is to fight lymphatic diseases (LD) such as lymphedema, lipedema and lymphatic anomalies through education, research and advocacy. His career has focused on executive positions associated with social change, from running organizations for the developmentally disabled and the deaf, to producing issue-oriented plays during his many years in the theatre and publishing worlds. He wrote the United States Senate bill that established **World Lymphedema Day on March 6th** and the New York State first-in-nation bill obligating all hospitals to distribute lymphedema information booklets to any at-risk patient. He also secured activist actor Kathy Bates as LE&RN's international spokesperson. He has focused his ten years at LE&RN on deconstructing the obstacles to LE awareness and building a campaign to make it a global priority.



Stanley Rockson, M.D., FACP, FACC

Dr. Rockson is the Allan and Tina Neill Professor of Lymphatic Research and Medicine at Stanford University School of Medicine. After earning his medical degree from Duke University School of Medicine, Dr. Rockson completed his internship and residency training in internal medicine at Brigham and Women's Hospital of Harvard Medical School, and fellowship training in the cardiac unit of Massachusetts General Hospital, Harvard Medical School. As a principal investigator or co-investigator, he has been involved in numerous clinical trials researching various aspects of lymphatic disease, vascular biology and cardiovascular medicine. His basic research involves the investigation of disease pathogenesis and identification of biomarkers of lymphatic diseases, as well as research into molecular and pharmacologic therapeutics. As a Professor of Medicine, Dr. Rockson serves concurrently as the Stanford's Chief of Consultative Cardiology and the Director of the Stanford Center for Lymphatic and Venous Disorders. Dr. Rockson is Editor-in-Chief of *Lymphatic Research and Biology*.



Joshua Scallan, Ph.D.

Dr. Joshua Scallan is currently an Assistant Professor in the Department of Molecular Pharmacology and Physiology in the Morsani College of Medicine at the University of South Florida. His laboratory is funded by the NIH to investigate how shear stress signaling through endothelial junction proteins regulates lymphatic valve formation and how VEGF receptors control the development of specialized button junctions in lymphatic capillaries. Both of these topics are relevant to the pathogenesis of lymphedema. Additionally, his laboratory is funded by the Department of Defense to investigate the role of junction proteins in lymphatic malformations caused by KRAS mutations. Dr. Scallan completed his Ph.D. at the University of Missouri before performing postdoctoral training at St. Jude Children's Research Hospital and returning to the University of Missouri where he obtained a K99/R00 grant.



Edward M. Schwarz, Ph.D.

Dr. Edward Schwarz is the Burton Professor of Orthopaedics and Director of the Center for Musculoskeletal Research at the University of Rochester Medical Center, in Rochester, NY. His laboratory focuses on inflammatory bone loss, such as that seen in rheumatoid arthritis, infections, tumor metastasis and wear debris-induced osteolysis around loose prosthetic implants. Dr. Schwarz is also a leader in orthopaedic biologic therapy and stem cell research, for which his lab has developed a novel passive immunization for MRSA and revitalizing allograft approaches for bone and tendon regeneration. Dr. Schwarz's lab is also interested in developing translational *in vivo* imaging outcome measures include near infrared imaging of lymphatic flow to detect arthritic flare, and cone beam CT to assess bone healing in patients with orthopaedic implants. More recently, Dr. Schwarz's lab has combined these biologic therapy technologies and outcome measures with biocompatible carriers and stem cells to generate novel tissue engineering constructs for bone, cartilage, ligament and tendon.



Mark V. Schaverien, M.D.

An expert in complex reconstruction and microsurgery, in particular breast reconstruction and lymphedema surgery, Dr. Mark Schaverien received his Board Certification from the Royal College of Surgeons of England in the UK. His expertise and experience enabled him to join the faculty in the Department of Plastic Surgery at The University of Texas MD Anderson Cancer Center in Houston where he is an Associate Professor. Dr. Schaverien has over 100 publications and 60 invited national and international presentations.

After receiving his medical degrees from the University of Edinburgh, Dr. Schaverien completed his Plastic Surgery training in the UK, during which he undertook a clinical research fellowship in the Department of Plastic Surgery at The University of Texas Southwestern Medical Center in Dallas. He completed four clinical fellowships including in Microvascular Reconstructive Surgery at The University of Texas MD Anderson Cancer Center in Houston. He was elected as a Hunterian Professor by the Royal College of Surgeons in England and was an Attending Plastic and Reconstructive Surgeon at Ninewells Hospital and Medical School in the UK.

Additionally, Dr. Schaverien is an active researcher with interests in outcomes and translational research, including funded research in lymphedema surgery, and he is Co-Director of Translational Research. He is an Associate Member of the American Society of Plastic Surgeons and a Member of American Society for Reconstructive Microsurgery.



Dhruv Singhal, M.D.

Dr. Dhruv Singhal completed all of his formal surgical training in Boston. He is Board Certified in General Surgery having completed his general surgery training at the Brigham and Women's Hospital (Boston, MA). Dr. Singhal is also Board Certified in Plastic and Reconstructive Surgery having completed further training in plastic surgery in the Harvard Combined Plastic Surgery Program. He then pursued a fellowship in adult craniofacial surgery at the Chang Gung Memorial Hospital (Taipei, Taiwan) and microsurgery at the China Medical University Hospital (Taichung, Taiwan). Currently, Dr. Singhal serves as Co-Director of the Boston Lymphatic Center and the Director of Lymphatic Surgery at the Beth Israel Deaconess Medical Center (Boston, MA) and Associate Professor of Surgery at Harvard Medical School. Dr. Singhal was previously the Director of Microsurgery at the University of Florida (Gainesville, Florida).

Dr. Singhal's clinical focus is cancer and trauma reconstruction. He performs the entire gambit of breast reconstruction from oncoplastic procedures to perforator flap operations (e.g., DIEP flaps). Dr. Singhal is a pioneer in immediate lymphatic reconstruction for the prevention of lymphedema in high-risk patients and performs liposuction, lymphovenous bypass, and lymph node transplantation for the treatment of chronic lymphedema.

Dr. Singhal's research focus is on lymphatic reconstruction. He has also published extensively on breast reconstruction, the role of integrative medicine in the care of the plastic surgery patient, and surgical ergonomics. Over the past few years, Dr. Singhal has been the recipient of research grants from the Plastic Surgery Foundation, American Society of Reconstructive Microsurgeons, Lymphatic Education and Research Network, Osher Center for Integrative Medicine (Harvard Medical School), and from the NIH/NHLBI.



Oliver Stone, Ph.D.

During embryonic development, dynamic interplay between cell growth, differentiation and morphogenesis establishes diverse specialized cell types with unique functions. My research aims to understand how these developmental processes specify the array of heterogeneous cell subtypes found within the vertebrate vasculature. Following a Ph.D. at the University of Bristol studying neovascularization of adult tissues with David Bates, I undertook postdoctoral training with Didier Stainier at the University of California, San Francisco and Max Planck Institute for Heart and Lung Research. Using zebrafish and mouse models, I identified the earliest known transcriptional regulator of endothelial/blood cell differentiation from mesoderm (Reischauer*, Stone* et al., Nature, 2016), and found the mesodermal source of endothelial cells to be a key determinant of their eventual fate (Stone and Stainier, Developmental Cell, 2019). At the University of Oxford, my group investigates the impact of lineage history on the terminal fate and function of endothelial cells in blood and lymphatic vessels.



Sarah Teichmann, Ph.D.

Sarah Teichmann is interested in global principles of regulation of gene expression and protein complexes, specifically in the context of immunity. Sarah did her Ph.D. at the MRC Laboratory of Molecular Biology, Cambridge, UK and was a Beit Memorial Fellow at University College London. She started her group at the MRC Laboratory of Molecular Biology in 2001. In 2013, she moved to the Wellcome Genome Campus in Hinxton/Cambridge, jointly with the EMBL-European Bioinformatics Institute and the Wellcome Sanger Institute (WSI). In January 2016 she became Head of the Cellular Genetics Programme at the WSI. Sarah co-founded and is co-leader of the “Human Cell Atlas” (HCA) international consortium. She is an EMBO member, a Fellow of the Academy of Medical Sciences and a Fellow of the Royal Society. Her work has been recognized by a number of prizes, including the Lister Prize, Biochemical Society Colworth Medal, Royal Society Crick Lecture, EMBO Gold Medal and the Mary Lyon Medal.



Ying Yang, Ph.D.

Dr. Ying Yang is an Assistant Professor in the Department of Molecular Pharmacology and Physiology in the Morsani College of Medicine at the University of South Florida. The main research focus of her laboratory is to understand the biological functions of the transcription factor FOXO1 during lymphatic development and disease. Her NIH-funded laboratory is the first to stimulate the growth of new lymphatic valves in a physiological manner by deleting the Foxo1 gene, which has the potential to treat several types of primary lymphedema where valves regress or disintegrate. Dr. Yang is the recipient of the 2021 NAVBO Springer Junior Investigator Award.

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