Lung as the Gateway for Environmental Exposures in Pulmonary and Cardiovascular Disease

January 26–27, 2026

Program Book

NIH National Heart, Lung, and Blood Institute

Contents

Welcome Letter

Dear Colleagues:

On behalf of the National Heart, Lung, and Blood Institute's Division of Lung Diseases, it is my pleasure to welcome you to the virtual workshop, "Lung as the Gateway for Environmental Exposures in Pulmonary and Cardiovascular Disease."

We are honored to have Dr. Nadia N. Hansel (Johns Hopkins University School of Medicine), Dr. Mary B. Rice (Harvard T.H. Chan School of Public Health/Harvard Medical School), and Dr. Emily Brigham (University of British Columbia, Canada) serving as co-chairs. Together with a diverse group of experts, they will guide discussions on the unique role of the lung as the interface with our environment and the pulmonary and cardiovascular consequences of inhalational exposures.

This workshop will convene leading basic scientists, clinicians, epidemiologists, environmental health specialists, data scientists, and community representatives to explore pressing research priorities. Areas of focus include mechanistic pathways, resilience and susceptibility of airway structures, multi-omic and biomarker discovery, epidemiologic data integration, and implementation science approaches to reduce disease risk.

We encourage active participation, cross-disciplinary exchange, and collaborative visioning as we work toward identifying gaps and opportunities to advance this critical field of research. Thank you for joining us in this important endeavor.

Sincerely,

Beena G. Sood, M.D., M.S.
Program Director
Neonatal and Pediatric Lung Disease/Critical Care Program
Lung Development and Pediatric Diseases Branch
Division of Lung Diseases
National Heart, Lung, and Blood Institute
National Institutes of Health
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Workshop Agenda (All Times Are EST)

DAY 1	MONDAY, JANUARY 26
9:00 a.m.	**Welcome** Beena G. Sood, M.D., M.S., Program Director, Neonatal and Pediatric Lung Disease, National Heart, Lung, and Blood Institute (NHLBI)
9:05 a.m.	**Opening Remarks** Gustavo Matute-Bello, M.D., Acting Director, Division of Lung Diseases, NHLBI
9:15 a.m.	**Workshop Overview and Introduction to Lung as a Sensory Organ for Inhalational Exposures and Respiratory Health** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School
9:30 a.m.	**Impact of Natural Disasters and Extreme Weather Events on Pulmonary Health** Hasan Bayram, M.D., ATSF, Koç School of Medicine, Istanbul, Türkiye
10:00 a.m.	**PANEL: CARDIOPULMONARY EFFECTS OF ENVIRONMENTAL EXPOSURES (10 min/panelist)**
	Intrauterine and Early Postnatal Environmental Exposures and Childhood Lung Function Rosalind Wright, M.D., M.P.H., Icahn School of Medicine at Mount Sinai **Host–Environmental Interactions: Dysanapsis as a Susceptibility Factor** Coralynn Sack, M.D., M.P.H., University of Washington **Environmental Influences on Fibrotic Interstitial Lung Disease Pathogenesis and Progression** Gillian Goobie, M.D., Ph.D., FRCPC, University of British Columbia, Canada/University of Pittsburgh **Bugs and Bad Air: Airway Interactions Between Pollution and Microbes** Christopher Carlsten, M.D., M.P.H., University of British Columbia, Canada **Sex-Specific Effects of Air Pollutants on Pulmonary Health** Meghan E. Rebuli, Ph.D., University of North Carolina at Chapel Hill **Health Effects of Air Pollution and Extreme Weather events in Children With Asthma** Ulrike Gehring, Ph.D., Utrecht University, The Netherlands
11:00 a.m.	**Panel Discussion Q&A** Moderators: Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Beena G. Sood, M.D., M.S., NHLBI Jacqueline Marzec, M.S., National Institute of Environmental Health Sciences (NIEHS)
11:30 a.m.	**BREAK**

12:00 p.m.	**PANEL: MECHANISMS OF INHALED ENVIRONMENTAL EXPOSURES AND CARDIOPULMONARY HEALTH (10 min/panelist)**
	Where There's Fire, There's Smoke John R. Balmes, M.D., University of California, San Francisco and Berkeley **Mechanisms of Climate and Air Pollution Exposures on the Immune System Leading to Allergic Disease and Asthma** Kari C. Nadeau, M.D., Ph.D., Harvard T.H. Chan School of Public Health **Metals in the Air: Impaired Inflammation Resolution in COPD and Emphysema** Ranu Surolia, Ph.D., The University of Alabama at Birmingham **Unraveling the Roles of Air Pollution–Induced Non-inflammasome NLR Signaling: Implications for Lung Health and Beyond** Salik Hussain, D.V.M., Ph.D., West Virginia University School of Medicine **Circadian Disruption as a Mediator of Cardiometabolic Risk in Air Pollution** Sanjay Rajagopalan, M.D., M.B.A., FACC, FAHA, Cardiovascular Research Institute, Case Western Reserve University **Interplay Between the Lung, Macrophages, and Lipid Oxidation in the Cardiometabolic Toxicity Induced by Particulate Matter** Jesús A. Araujo, M.D., Ph.D., Fielding School of Public Health, University of California, Los Angeles
1:00 p.m.	**Panel Discussion Q & A** Moderators: Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Jacqueline Marzec, M.S., NIEHS Taylor Poor, M.D., Ph.D., National Institute of Allergy and Infectious Diseases (NIAID)
1:30 p.m.	**BREAK**
1:45 p.m.	**Household Air Pollution, Multi-morbidity, and Cleaner Stove Solutions** Alison Lee, M.D., M.S., Icahn School of Medicine at Mount Sinai
2:00 p.m.	**When Heat Hurts: Cardiopulmonary Consequences of Extreme Heat** Meredith C. McCormack, M.D., M.H.S., Johns Hopkins University
2:15 p.m.	**Recap Day 1 and Adjourn** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Beena G. Sood, M.D., M.S., NHLBI Jaqueline Marzec, M.S., NIEHS
2:30 p.m.	**Adjourn Day 1**

DAY 2	TUESDAY, JANUARY 27
10:00 a.m.	**Recap Day 1** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Beena G. Sood, M.D., M.S., NHLBI Jacqueline Marzec, M.S., NIEHS
10:05 a.m.	**Community Perspectives** **The Weight of the Air We Breathe** Stacie Reveles, Cystic Fibrosis Research Institute **A Mother's Fight for Clean Air** Rosamund Adoo-Kissi-Debrah, The Ella Roberta Family Foundation
10:30 a.m.	**Genome-wide Gene-Air Pollution Interaction Analysis of Lung Function in 300,000 Individuals** Anna Hansell, M.P.H., Ph.D., MRCP, FFPH, University of Leicester, United Kingdom
11:00 a.m.	**Ambient Air Pollution and Early-Life Lung Function** Valérie Siroux, Ph.D., Inserm, France
11:30 a.m.	**Low-Cost Environmental Air Pollution Sensors for Personal Exposure Assessment and Exposure Assessment in Epidemiologic Studies** Kirsten Koehler, Ph.D., Johns Hopkins University
12:00 p.m.	**PANEL: TOOLS AND TECHNOLOGIES FOR ENVIRONMENTAL EXPOSURES RESEARCH (10 min/panelist)**
	Microphysiological Systems and Bioinspired Robotics: Enabling Technologies for Environmental Exposures Kambez Benam, D.Phil., University of Pittsburgh **Integrating Multiscale Geospatial Environmental Data into Large Population Health Studies: Opportunities and Challenges** Chi-Ren Shyu, Ph.D., University of Missouri Institute of Data Science and Informatics **Integrative Chemical–Biological Profiling to Determine Primary Drivers of Wildfire Smoke–Induced Toxicity** Ilona Jaspers, Ph.D., University of North Carolina at Chapel Hill **Statistical and Machine Learning Approaches to Study Impacts of Environmental Exposures on Cystic Fibrosis and Respiratory Mortality** Rhonda D. Szczesniak, Ph.D., University of Cincinnati

12:40 p.m.	**Panel Discussion Q&A** Moderators: Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Jacqueline Marzec, M.S., NIEHS Taylor Poor, M.D., Ph.D., NIAID
1:10 p.m.	**BREAK**
1:40 p.m.	**PANEL: INTERVENTIONS TO MITIGATE CARDIOPULMONARY EFFECTS OF ENVIRONMENTAL EXPOSURES (10 min/panelist)**
	Nutritional Interventions to Mitigate the Risks of Inhalational Exposures on Respiratory Health Emily Brigham, M.D., M.H.S., University of British Columbia, Canada **Microbiome-Targeted Interventions to Prevent or Combat Air Pollution Consequences: Scientific Gaps and Opportunities** Yvonne J. Huang, M.D., University of Michigan, Ann Arbor **Effectiveness of Indoor Air Purifiers on Heart Failure Outcomes (PURI-HF Trial)** Rajesh Vedanthan, M.D., M.P.H., New York University Grossman School of Medicine **Outdoor Interventions for Lung Health** Mary B. Rice, M.D., M.P.H., Harvard Medical School **Indoor Interventions for Lung Health** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine **Strategies to Improve Indoor Air Quality** Brent Stephens, Ph.D., Illinois Institute of Technology
2:40 p.m.	**Panel Discussion** Moderators: Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Taylor Poor, M.D., Ph.D., NIAID Beena G. Sood, M.D., M.S., NHLBI
3:10 p.m.	**BREAK**

3:25 p.m.	**Recap Day 2** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard T.H. Chan School of Public Health/Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada Beena G. Sood, M.D., M.S., NHLBI Jacqueline Marzec, M.S., NIEHS
3:45 p.m.	**Workshop Summary** Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine Mary B. Rice, M.D., M.P.H., Harvard Medical School Emily Brigham, M.D., M.H.S., University of British Columbia, Canada
4:00 p.m.	**Adjourn Day 2**

Leadership

Gustavo Matute-Bello, M.D.
Acting Director, Division of Lung Diseases, National Heart, Lung, and Blood Institute (NHLBI)

Dr. Matute-Bello is Acting Director, Division of Lung Diseases, NHLBI. Dr. Matute-Bello received his M.D. from the Central University of Venezuela. He then completed an internal medicine internship and residency at Albert Einstein Medical Center in Philadelphia, PA, and a pulmonary and critical care fellowship at the University of Washington (UW) in Seattle. Prior to joining NHLBI in November 2022, Dr. Matute-Bello was professor of medicine at the University of Washington, investigator at the UW Center for Lung Biology, and staff physician at the Veterans Administration Puget Sound Healthcare System. Dr. Matute-Bello is the author or coauthor of more than 100 scientific publications and abstracts. He has served as a reviewer for multiple scientific journals.

Academic Co-chairs

Nadia N. Hansel, M.D., M.P.H.
William Osler Professor of Medicine
Director, Department of Medicine
Johns Hopkins University School of Medicine

Dr. Hansel is the Director of the Department of Medicine (DOM) at the Johns Hopkins University School of Medicine, physician-in-chief of the Johns Hopkins Hospital, and director of medicine for Johns Hopkins Medicine. A 1997 graduate from Harvard Medical School, Dr. Hansel completed her internal medical residency at the University of Pennsylvania before joining Johns Hopkins to complete a master's in public health at Johns Hopkins University in 2001. Simultaneously, she began a fellowship in the Division of Pulmonary and Critical Care Medicine that she completed in 2004 before joining the faculty at Hopkins. In 2014, she was named associate dean of research at Johns Hopkins Bayview and chair of the Bayview Scientific Advisory Board.

Dr. Hansel directed the Division of Pulmonary and Critical Care Medicine from 2019 until she became interim departmental director in 2022. During that time, she was elected to the American Society for Clinical Investigation and received an Annual Sponsorship Award from the DOM Task Force on Women's Academic Careers in Medicine. She also leads the Development Core of the Collaborative Centers in Children's Environmental Health Research and Translation, funded by the National Institute of Environmental Health Sciences. Dr. Hansel's areas of clinical expertise include chronic obstructive pulmonary disease and asthma. Her research focuses on understanding environmental determinants and sub-phenotypes of obstructive airway diseases.

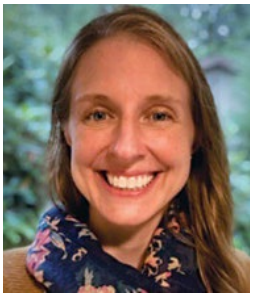
Mary B. Rice, M.D., M.P.H.
Mark and Catherine Winkler Associate Professor of Environmental Respiratory Health
Environmental Health
Director, Center for Climate, Health, and Global Environment (C-CHANGE)
Harvard T.H. Chan School of Public Health
Associate Professor of Medicine
Director, Beth Israel Deaconess Medical Center Institute for Lung Health
Harvard Medical School

Dr. Rice is the director of Harvard Chan C-CHANGE and the Mark and Catherine Winkler associate professor of environmental respiratory health at the Harvard T.H. Chan School of Public Health. She is a pulmonary and critical care physician and the director of the Beth Israel Deaconess Medical Center Institute for Lung Health, where she is an associate professor of medicine at Harvard Medical School and director of research for the Division of Pulmonary, Critical Care, and Sleep Medicine.

Dr. Rice's areas of investigation focus on the influence of environmental exposures on the respiratory health of children and adults, as well as the development of interventions to mitigate these health effects. She is the principal investigator of a National Institutes of Health (NIH)–funded clinical trial of home air purification for patients with chronic obstructive pulmonary disease, and she leads the environmental health research program of the American Lung Association Lung Health Cohort.

Dr. Rice chaired the American Thoracic Society Environmental Health Policy Committee from 2018 to 2021, and in 2024 she was elected chair of the Environmental, Occupational, and Population Health Assembly of the American Thoracic Society. In 2020, she received the Jo Rae Wright Award for Outstanding Science from the American Thoracic Society, a national award recognizing emerging leaders in science. In 2025, she received the Assembly on Environmental, Occupational, and Population Health Mid-Career Achievement Award from the American Thoracic Society. From October 2024 to January 2025, she served on the Clean Air Scientific Advisory Committee, an

independent scientific committee that advises the U.S. Environmental Protection Agency on the National Ambient Air Quality Standards.



Emily Brigham, M.D., M.H.S.
Associate Professor, Respiratory Division
University of British Columbia, Canada

Dr. Brigham is an associate professor in the Respiratory Division at the University of British Columbia and is a research scientist at Vancouver Coastal Health Research Institute as well as a practicing respirologist at Vancouver General Hospital. Dr. Brigham earned her professional degrees at the Johns Hopkins Schools of Medicine and Public Health, completing her residency in internal medicine and a fellowship in pulmonary and critical care medicine at the Johns Hopkins Hospital, where she was subsequently hired as faculty. She was recruited to her current position in 2021, to continue her research program focused on (1) the impact of diet and other metabolic factors on respiratory health in airways disease, (2) how these factors may augment or mitigate the symptomatic and inflammatory response to air pollution and other pro-inflammatory exposures, and (3) ways to translate these findings into action to improve respiratory health, particularly within susceptible and vulnerable populations.

Workshop Planning Committee Co-chairs

Beena G. Sood, M.D., M.S., Program Director
Neonatal and Pediatric Lung Disease/Critical Care Program
Lung Development and Pediatric Diseases Branch
Division of Lung Diseases, National Heart, Lung, and Blood Institute (NHLBI)

Dr. Sood is a program director in the Lung Development and Pediatric Diseases Branch in the Division of Lung Diseases of NHLBI. Her role at NHLBI is to support the Neonatal and Pediatric Lung Disease/Critical Care program. Her research interests include prenatal exposures and childhood outcomes, neonatal respiratory failure, pulmonary hypertension, chronic lung disease, inhaled drug delivery, and novel biomarkers of disease including infrared spectroscopy, epigenomics, and lipidomics.

Jacqueline Marzec, M.S., Health Scientist Administrator/Health Specialist
Exposure, Response, and Technology Branch
Division of Extramural Research and Training
National Institute of Environmental Health Sciences (NIEHS)

Ms. Marzec is a health specialist with the Exposure, Response, and Technology Branch within NIEHS at the National Institutes of Health (NIH). She provides evaluative support for the trans-NIH Chemical Countermeasures Research Program and the NIEHS Air Pollution program for the Division of Extramural Research and Training. Her prior work in the NIEHS Intramural Research Program focused on cardiopulmonary toxicants, environmental pollutants, and respiratory pathogens.

Srikanth Nadadur, Ph.D., Branch Chief
Exposure, Response, and Technology Branch
Division of Extramural Research and Training
National Institute of Environmental Health Sciences (NIEHS)

Dr. Nadadur is the branch chief for the Exposure, Response, and Technology Branch. He joined the NIEHS Division of Extramural Research and Training in 2007. As program director over the past 16 years, he provided scientific and programmatic oversight to research programs in air pollution, cardiopulmonary health, nanotechnology, environmental health, and safety. Dr. Nadadur also serves as program lead for developing countermeasures for pulmonary toxicants under the National Institutes of Health–wide Chemical Countermeasures Research Program over the past 12 years. He also leads the Inflammation Resolution Biology program and the Impact of Environmental Factors in Exposure-Induced Morbidities program.

Taylor Poor, M.D., Ph.D., Medical Officer
Allergy, Asthma and Airway Biology Branch
Division of Allergy, Immunology, and Transplantation
National Institute of Allergy and Infectious Diseases

Dr. Poor joined the Allergy, Asthma, and Airway Biology Branch in August 2024 as a medical officer. He completed medical school and the medical-scientist training program at the Feinberg School of Medicine at Northwestern University. Following graduate school, he remained at Northwestern University for internship and residency training in internal medicine at the McGraw Medical Center, followed by fellowship training in pulmonary and critical care medicine. Dr. Poor joined the faculty of the Division of Pulmonary and Critical Care Medicine in 2022, where his research focused on metabolic control of lung epithelial repair in models of lung injury, as well as pathophysiology of the host response pulmonary infection in critical illness.

Workshop Planning Committee Members

Academic Co-chairs

- Nadia N. Hansel, M.D., M.P.H., Harvard Medical School
- Mary B. Rice, M.D., M.P.H., Johns Hopkins University
- Emily Brigham, M.D., M.H.S., University of British Columbia, Canada

National Institutes of Health Committee Members

National Heart, Lung, and Blood Institute

- Beena G. Sood, M.D., M.S. (*Co-chair*)
- Marishka K. Brown, Ph.D.
- Regina Bures, Ph.D.
- Stephanie Davis, Ph.D.
- Marisol Espinoza-Pintucci, Ph.D.
- Michelle M. Freemer, M.D., M.P.H.
- Marrah Lachowicz-Scroggins, Ph.D., M.F.S., GCCP
- Qian “Joy” Liu, M.D.
- Qing Lu, Ph.D.
- Mary Masterson, Ph.D., M.S.
- Gustavo Matute-Bello, M.D.
- Lisa Postow, Ph.D.

National Institute of Environmental Health Sciences

- Jacqueline Marzec, M.S. (*Co-chair*)
- Srikanth Nadadur, Ph.D. (*Co-chair*)
- Ashlinn K. Quinn, Ph.D.

National Institute of Allergy and Infectious Diseases

- Taylor Poor, M.D., Ph.D. (*Co-chair*)
- Patrice M. Becker, M.D.
- Alkis Togias, M.D.

***Eunice Kennedy Shriver* National Institute of Child Health and Human Development**

- Cinnamon Dixon, D.O., M.P.H.

Speakers

January 26, 2026 (DAY 1)

Keynote Session

Hasan Bayram, M.D., Ph.D., Koç University School of Medicine, Istanbul, Türkiye

Dr. Bayram received his M.D. (1988) and completed his pulmonology residency (1999) in Turkey. He earned his Ph.D. in the field of asthma and air pollution at Queen Mary University of London, UK (1994–1998), and conducted post-doctoral research at the National Heart and Lung Institute (2002–2003), Imperial College London.

Dr. Bayram continues his work as a full-time professor of respiratory medicine and director of the Department of Pulmonary Medicine at the School of Medicine, Koç University, in Istanbul, Türkiye. He is the author of more than 150 full papers and book chapters.

Dr. Bayram is a fellow of the American Thoracic Society (ATS) and a member of the planning committee of the ATS Environmental, Occupational, and Population Health Assembly. He is also an active member and fellow of the European Respiratory Society and a member of the European Academy of Allergy and Clinical Immunology.

His main research areas include the respiratory health effects of air pollutants, particularly diesel exhaust particles. His ongoing research focuses on mechanisms underlying the pathogenesis of chronic obstructive pulmonary disease. Recent studies have examined the effects of SARS-CoV-2 on airway epithelial cells, pollutant–SARS-CoV-2 interactions, and mechanisms underlying respiratory effects of earthquakes following the February 6 earthquake in Türkiye (2023).

Title of Presentation: *Impact of Natural Disasters and Extreme Weather Events on Pulmonary Health*

Natural disasters and extreme weather events—including heatwaves, wildfires, hurricanes, floods, dust storms, earthquakes, and volcanic eruptions—significantly impact respiratory health, particularly among vulnerable populations such as individuals with chronic diseases, children, and the elderly.

This presentation will explain trends in natural disasters and the relationship between these events and respiratory mortality and morbidity, and the resulting respiratory burden.

Air pollutants such as particulate matter, ozone, hazardous gases and chemicals, and minerals originating from natural catastrophes and extreme weather events will be described. Further, the mechanisms underlying the biological effects of these irritants will be discussed, supported by data from in vivo and in vitro mechanistic studies.

Finally, general strategies for prevention, mitigation, and intervention will be summarized.

Panel 1: Cardiopulmonary Effects of Environmental Exposures

Rosalind Wright, M.D., M.P.H., Icahn School of Medicine at Mount Sinai

Dr. Wright is the Horace W. Goldsmith professor of life course health research in the Departments of Public Health and Environmental Medicine at the Icahn School of Medicine at Mount Sinai (ISMMS), a pulmonary physician and internationally recognized life course epidemiologist with transdisciplinary training in perinatal environmental programming of chronic disease risk. Dr. Wright is also the founding co-director of the Institute for Exposomic Research at ISMMS.

Dr. Wright has a primary interest in early life (prenatal and early childhood) predictors of developmental disorders including asthma and lung development, sleep, and neurobehavioral development. A particular focus of her research has been on the implementation of studies considering the role of social (e.g., psychosocial stress, trauma, other socioeconomic risk factors), nutritional, and physical (e.g., air pollution, chemical, allergens) environmental factors in explaining health patterns. Her group also has a growing interest in elucidating sex-specific programming effects of environmental toxins.

Her research program also explores underlying mechanisms through which chemical and non-chemical stressors program adverse health and development by incorporating biomarkers of physiological pathways (e.g., altered hypothalamic-pituitary-adrenal axis functioning, shifts in maturation of the immune system, disruption of the autonomic nervous system, telomeres, mitochondriomics, epigenetics, and extracellular vesicles).

Title of Presentation: *Intrauterine and Early Postnatal Environmental Exposures and Childhood Lung Function*

Outdoor air pollution may play an important role in early programming of lung growth and respiratory health across the lifespan and is potentially amenable to intervention. Optimal coordinated functioning of many complex processes and their networks of interaction are necessary for normal lung development and the maintenance of respiratory health across the life course. Starting in utero, environmental factors including ambient air pollutants may organize these systems toward trajectories of enhanced pediatric (e.g., asthma) as well as adult disease risk (e.g., chronic obstructive pulmonary disease). Early childhood lung function is an early marker of subsequent risk. This brief overview highlights growing epidemiological evidence for the programming effects of outdoor air pollution exposures during early development on lung function. A large body of epidemiologic data demonstrate that ambient air pollution exposure, especially fine particulate matter (PM with an aerodynamic diameter $\leq$2.5 µm; $PM_{2.5}$), affects childhood respiratory outcomes including lung growth and development. Emerging evidence demonstrates a role for other components such as nitrates (NO_3^-) or sulfate (SO_4^-), and secondary pollutants such as ground level ozone (O_3). Studies largely consider one pollutant or component at a time. Recent calls underscore the need to consider more complex pollution mixtures to more fully elucidate the impact of ambient pollution on disease programming. Moreover, programming effects of air pollutants may differ based on children's biological sex.

Coralynn Sack, M.D., M.P.H., University of Washington (UW)

Dr. Sack is an associate professor in the Departments of Medicine & Environmental and Occupational Health Sciences at UW. She is a physician-scientist with clinical and research expertise in environmental and occupational lung disease. Dr. Sack earned an M.D. from the University of Buffalo and an M.P.H. in epidemiology from UW. She is board-certified in internal medicine, pulmonology, critical care, and occupational medicine. Her research activities integrate translational experimental design and epidemiologic studies to characterize environmental exposures, explore disease mechanisms, and investigate health outcomes.

Title of Presentation: *Host–Environmental Interactions: Dysanapsis as a Susceptibility Factor*

Dysanapsis refers to a mismatch between airway tree caliber and lung parenchyma size. While initially inferred from spirometry in the 1970s by Malcom Green, Jere Mead, and colleagues, there has been renewed interest in understanding the biologic basis and pathophysiologic consequences of dysanapsis. Advanced imaging and ex tissue examination have demonstrated that interindividual variation in native airway tree structure is common, established by early adulthood, and extends from the trachea to the peripheral airways. Growing evidence also links dysanapsis to a broad spectrum of diseases and poor outcomes across the lifespan—including morbidity in bronchopulmonary dysplasia and asthma, accelerated lung function decline, chronic obstructive pulmonary disease incidence and progression, and all-cause mortality.

Gillian C. Goobie, M.D., Ph.D., FRCPC, University of British Columbia, Canada

Dr. Goobie completed internal medicine and respirology residencies in Calgary and Vancouver, Canada, respectively. Subsequently, she obtained her Ph.D. at the University of Pittsburgh, with a focus on the impacts of air pollution on clinical outcomes and the epigenome in patients with fibrotic interstitial lung disease (ILD). Currently, Dr. Goobie is a clinical assistant professor and attending respirologist at the University of British Columbia in Vancouver, Canada, where she cares for patients with ILD and continues her research into the environmental pathophysiology of these conditions. Her current research is supported by the Canadian Institutes of Health Research, Michael Smith Health Research BC, Genome BC, and most recently the Parker B. Francis Family Foundation.

Title of Presentation: *Environmental Influences on Fibrotic Interstitial Lung Disease Pathogenesis and Progression*

Patients with fibrotic interstitial lung disease (fILD) reflect a uniquely sensitive population within which the study of environmental influences on disease onset and progression is needed. Over the past decade, ambient air pollution has been identified as a major risk factor for fILD incidence, progression, and mortality, but the impact of other environmental factors has remained unclear. Other environmental factors, including wildfires, extreme heat, humidity, mold, and dust storms may also contribute to fILD risk, but much remains to be determined with these exposures. Through exposure interactions with genetics, epigenetics, and other molecular pathways, the environment poses a significant and potentially modifiable risk factor for fILD pathobiology.

Christopher Carlsten, M.D., M.P.H., University of British Columbia (UBC), Canada

Dr. Carlsten is a professor of medicine, Canada research chair in Occupational and Environmental Lung Disease and holds the Astra-Zeneca chair in Occupational and Environmental Lung Disease at UBC. He is the head of UBC Respiratory Medicine, director of the Air Pollution Exposure Laboratory as well as the Legacy for Airway Health. Dr. Carlsten's research focuses on the respiratory and immunological health effects of inhaled environmental and occupational exposures, using diesel exhaust, western red cedar, and phthalates as model inhalants.

Title of Presentation: *Bugs and Bad Air: Airway Interactions Between Pollution and Microbes*

The lung was long thought to be a sterile organ, but evidence has evolved clearly to the contrary. As humans increase their understanding of what organisms inhabit the lungs and what diverse functions these organisms serve, people must also appreciate how they interact with other lung exposures, such as air pollutants. This interaction can be direct or, more plausibly, indirect through changes in immunity. Further, the lung microbiome can serve as an effect modifier of the relationship between pollution and adverse health effects. This talk outlines emerging data informing these concepts and stimulates discussion and potential collaborations therein.

Meghan E. Rebuli, Ph.D., University of North Carolina at Chapel Hill

Dr. Rebuli is an assistant professor of pediatrics, director of the curriculum in toxicology and environmental medicine, a member of the Center for Environmental Medicine, Asthma and Lung Biology, and a vice chair of the Institutional Review Board at the University of North Carolina at Chapel Hill. She earned a B.S. and a Ph.D. from North Carolina State University, and she completed her postdoctoral training at the University of North Carolina at Chapel Hill. Her research focuses on investigating sex-specific effects of air pollutants and new and emerging tobacco products on respiratory health. Specifically, she is interested in how the interaction of sex and inhaled toxicants can alter respiratory health at the individual and population levels. Dr. Rebuli investigates these questions using prospective and observational clinical studies and translational cell culture models.

Title of Presentation: *Sex-Specific Effects of Air Pollutants on Pulmonary Health*

There is growing clinical and epidemiological evidence of sex differences in the onset and severity of chronic pulmonary disease, such as asthma, chronic obstructive pulmonary disease, and lung cancer. Many of these diseases are worsened or hypothesized to be linked to air pollutant exposures, which can also vary by sex due to differences in male and female anatomy and physiology, as well as exposure type, dose, and duration. Examples of sex differences in response to air pollutant exposure in the epidemiological literature include higher mortality and hospitalizations in women after ozone exposure and increased chronic obstructive pulmonary disease rates in women with household air pollution. In controlled exposure studies, increased inflammatory gene expression in males and suppressed host defense gene expression in females is found in response to viral infection after wood smoke exposure in humans and primary respiratory epithelial cells. Further, higher antibody titers indicative of a Type I immune response and presence of immune cells in bronchoalveolar lavage were present in female mice exposed to inhaled fungal pathogens common in moldy environments. Studies uncovering the mechanisms of observed response sex differences remains a research gap. Better understanding how and why males and females respond differently to air pollutant exposures can lead to developing improved treatments and prevention strategies against the adverse effects of pollutant exposures and chronic disease, ultimately improving public health.

Ulrike Gehring, Ph.D., Utrecht University, The Netherlands

Dr. Gehring is an associate professor at the Institute for Risk Assessment Sciences at Utrecht University, The Netherlands. The aim of her research is to understand the influence of environmental risk factors on health throughout life. A special focus of her work is investigating the long-term effects of ambient air pollution on children's respiratory health. As a co-principal investigator, Dr. Gehring leads the Dutch PIAMA (Prevention and Incidence of Asthma and Mite Allergy, piama.iras.uu.nl) birth cohort study. She is the current chair of the Environment and Health Committee of the European Respiratory Society (since 2024), a member of the Review Committee of the Health Effects Institute (since 2022), and has been an elected member of the Executive Council of the International Society of Environmental Epidemiology (2016–2018). She has been an associate editor of Environmental Health Perspectives since 2016.

Title of Presentation: *Health Effects of Air Pollution and Extreme Weather Events in Children with Asthma*

Extreme weather events—including heat waves, wildfires, desert dust storms, and flooding—have been increasing in frequency and intensity. They impact respiratory health, and children and individuals with preexisting conditions are particularly vulnerable. The presentation discusses epidemiological evidence of the health effects of extreme weather events in children with asthma, underlying mechanisms, and knowledge gaps.

Panel 2: Mechanisms of Inhaled Environmental Exposures and Cardiopulmonary Health

John R. Balmes, M.D., University of California, San Francisco/University of California, Berkeley

Dr. Balmes is professor of medicine emeritus at the University of California, San Francisco (UCSF) and professor of environmental health sciences emeritus in the School of Public Health at the University of California, Berkeley (UC Berkeley). He is a faculty member of the UCSF Division of Occupational, Environmental, and Climate Medicine and the Division of Pulmonary and Critical Care Medicine at the Zuckerberg San Francisco General Hospital. At UC Berkeley, he is one of the principal investigators of the Children's Health and Air Pollution Study in Fresno, CA. Dr. Balmes has been studying the effects of occupational and environmental agents on respiratory, cardiovascular, immunologic, and metabolic health for over 40 years. He was appointed physician member of the California Air Resources Board in 2008.

Title of Presentation: *Where There's Fire, There's Smoke*

In recent years, increased wildfire smoke has negated improvements in air quality. Wildfire smoke is a complex mixture of gases and solids, and its chemical composition depends on the material burned, the fire temperature, and duration of burning. Wildfires emit fine particulate matter (PM2.5) and harmful gases such as carbon monoxide, volatile organic compounds, and nitrogen oxides. Wildfires across the United States account for up to 25% of PM2.5 emissions annually. Wildfire smoke PM2.5 can contain more carbon and polar organic compounds that generate reactive oxygen species than non-wildfire PM2.5, making wildfire smoke PM2.5 up to 10 times more toxic than PM from other sources. When wildfires extend into the wildland-urban interface, combustion of synthetic materials generates toxic pollutants, such as hydrochloric acid, phosgene, and hydrogen cyanide. Exposure to wildfire smoke is associated with adverse respiratory outcomes, including exacerbations of asthma and chronic obstructive pulmonary disease, and increased risk of lower respiratory infections. Oxidative stress, localized and systemic inflammation, epithelial damage, and decreased immune defenses are potential biological explanations for these associations. Research into understanding the mechanisms by which wildfire smoke mediates adverse health effects can inform preventive strategies.

Kari C. Nadeau, M.D., Ph.D., Harvard T.H. Chan School of Public Health

Dr. Nadeau is the chair of the Department of Environmental Health at the Harvard T.H. Chan School of Public Health. She practices allergy, asthma, and immunology in children and adults. Dr. Nadeau has published more than 400 papers, many in the field of air pollution exposures, allergies, and asthma. For more than 30 years, she has devoted herself to understanding how environmental and epigenetic factors affect the risk of developing immune dysfunction. Her laboratory has been studying exposomics and solutions-facing research with policy-oriented outcomes. She works with the World Health Organization and United Nations on several projects in global health. Dr. Nadeau earned her M.D. and Ph.D. from Harvard Medical School in 1995, completing her doctoral work in biochemistry and immunology, followed by a pediatric residency, and fellowship in the Allergy, Asthma, and Immunology Program. She joined the Stanford faculty, where she was the Naddisy Professor of Medicine and Pediatrics until 2022, and then joined Harvard where she is now the John Rock Professor.

Title of Presentation: *Mechanisms of Climate and Air Pollution Exposures on the Immune System Leading to Allergic Disease and Asthma*

Epidemiological studies have shown that air pollution, wildfires, thunderstorms, flooding, heat waves, hurricanes, and increased pollen season length increase allergies and asthma. Research suggests damage to the epithelial

barrier and skewing toward a Th2 inflammatory pathway and IgE production as key mechanisms in allergy and asthma. Other mechanisms that have been implicated in allergies and asthma are oxidative stress and activation of inflammasome signaling.

To prepare for expected increases in asthma and allergies, additional research is needed to understand further the biological mechanisms mediating the environmental effects on allergic disease in order to establish preventative guidelines and develop targeted therapies. Research into better monitoring systems and alerts for air pollutants and pollen could result in the advent of testing to determine whether behavioral interventions and adaptations to decrease exposure to pollens and air pollutants (staying indoors, wearing face masks, using air filters) lead to improved health outcomes. Conducting a cost-benefit analysis on decreasing greenhouse gases and health outcomes can assist with policy decisions.

Ranu Surolia, Ph.D., The University of Alabama at Birmingham

Dr. Surolia is an associate professor of medicine in the Division of Pulmonary, Allergy, and Critical Care at the University of Alabama at Birmingham. Her research examines how environmental and occupational toxicants, including heavy metals and arsenic-based chemicals, contribute to chronic lung injury, chronic obstructive pulmonary disease (COPD), and impaired repair. Dr. Surolia leads National Institutes of Health–funded projects to define the molecular mechanisms of pollutant-driven lung disease and to develop new experimental models. Her work also investigates the role of arsenic-based toxicants in systemic inflammation and lung injury, as well as airborne hazard–related, deployment-associated respiratory diseases.

Title of Presentation: *Metals in the Air: Impaired Inflammation Resolution in COPD and Emphysema*

The talk will highlight cadmium as a key airborne toxicant that drives chronic lung disease. Cadmium, found in cigarette smoke, wildfire suppressants, and fossil fuel combustion, is increasingly recognized as a contributor to COPD. Our findings show that cadmium disrupts efferocytosis by upregulating the receptor MerTK while also promoting its cleavage by ADAM17, releasing soluble Mer. Acting as a decoy, soluble Mer hampers inflammation resolution, prolonging tissue damage and expediting emphysema development. These insights reveal a new mechanism of cadmium-induced lung injury and identify ADAM17 and soluble Mer as promising therapeutic targets.

Salik Hussain, D.V.M., Ph.D., School of Medicine, West Virginia University

Dr. Hussain is an associate professor in the Department of Physiology, Pharmacology and Toxicology at the West Virginia University School of Medicine. He received a European doctorate in toxicology from the University Paris Diderot, in Paris, France, and completed his postdoctoral training at the National Institute of Environmental Health Sciences (NIEHS). His laboratory studies the mechanistic basis of environmental and occupational toxicant-induced immune alterations, microbial dysbiosis, and epithelial-immune interactions. Dr. Hussain's ongoing work focuses on the impact of ozone, ultrafine particles, nanomaterials, cigarette smoke, and natural events such as fires and temperature extremes on the susceptibility to chronic pulmonary and systemic disorders including asthma, pulmonary fibrosis, obesity, cancer, and cardiovascular diseases. His current research work is funded through the Outstanding New Investigator Award from NIEHS. Dr. Hussain's work has won multiple awards, including the Young Investigator Award.

Title of Presentation: *Unraveling the Roles of Air Pollution–Induced Non-inflammasome NLR Signaling: Implications for Lung Health and Beyond*

NOD-like receptors that cannot form inflammasomes include NLRX1, NLRP12, and NLRC3. These NLRs negatively regulate inflammation primarily through canonical and non-canonical NF-kB signaling. Recent literature

implicates these in various cellular processes that include cancer, metabolic disorders, neurological disorders, and cardiovascular disorders. While their role has received substantial attention in infectious diseases, their contribution to the pathophysiology of chronic pulmonary diseases and environmental exposure–induced pulmonary responses is not well understood. We have elaborated the role of Nlrx1 in air pollution–induced lung inflammation and lung function changes using single pollutant (O_3) and mixed (carbon black + ozone) inhalation exposures. Environmental inhalation exposures are inherently mixed (gases and particles). The use of an ultrafine particle and gas mixed inhalation exposure system offers added relevance compared with individual particle and gas exposures by: (1) providing the surface for the chemical reaction between various components of air pollution; (2) providing a potential carrier system for transport of gaseous and other components of air pollution to the deeper lung parts; and (3) providing a system for studying interactions between different components of air pollution. Our recent work demonstrated a more-than-additive impact of ultrafine carbon black and O_3 co-exposure, resulting in significantly greater pulmonary inflammation and lung function decline through an oxidant-alarmin pathway. Our work demonstrates that Nlrx1 plays an essential pathophysiological role in pulmonary inflammation and lung function changes after air pollution exposure. Moreover, a small molecule-mediated Nlrx1 agonism is a viable strategy to reduce the inflammatory impacts of ozone as well as ultrafine carbon and ozone mixed inhalation exposures.

Sanjay Rajagopalan, M.D., Cardiovascular Research Institute, Case Western Reserve University

Dr. Rajagopalan is the chief of cardiovascular medicine and chief academic and scientific officer at the University Hospitals Harrington Heart & Vascular Institute. He is a professor of medicine and biomedical engineering and director of the Case Cardiovascular Research Institute at Case Western Reserve University's School of Medicine in Cleveland, OH. Dr. Rajagopalan is a graduate of the Sloan School of Management at the Massachusetts Institute of Technology, specializing in health analytics and sustainability science. He is a well-known expert on the impact of environmental pollution on cardiovascular health. He has led many innovative initiatives in health care centered around care delivery for high-risk patient populations, precision medicine initiatives, and next-generation approaches for the prevention of heart and metabolic disease. Dr. Rajagopalan is an elected member of the American Society for Clinical Investigation, Association of American Physicians, and Association of University Cardiologists, and he serves as president of the Association of Professors of Cardiology. He is a recipient of the 2021 American College of Cardiology's Distinguished Scientist Award (Translational Domain) as well as the 2025 American Heart Association's Distinguished Scientist Award.

Title of Presentation: *Circadian Disruption as a Mediator of Cardiometabolic Risk in Air Pollution*

Particulate matter ≤2.5μm ($PM_{2.5}$) air pollution is a leading environmental risk factor contributing disproportionately to the global burden of non-communicable disease. We compared the impact of chronic exposure to $PM_{2.5}$ alone or with light-at-night exposure (LL) on metabolism. $PM_{2.5}$ induced peripheral insulin resistance, circadian rhythm (CR) dysfunction, and metabolic and brown adipose tissue (BAT) dysfunction, akin to LL (with no additive interaction between $PM_{2.5}$ and LL). Transcriptomic analysis of liver and BAT revealed widespread but unique alterations in CR genes, with evidence for differentially accessible promoters and enhancers of CR genes in response to $PM_{2.5}$ by ATAC-seq. The histone deacetylases 2, 3, and 4 were downregulated with $PM_{2.5}$ exposure, with increased promoter occupancy by the histone acetyltransferase p300 as evidenced by ChIP-seq. These findings suggest a previously unrecognized role of $PM_{2.5}$ in promoting CR disruption and metabolic dysfunction through epigenetic regulation of circadian targets.

Jesús Araujo, M.D., Ph.D., M.Sc., Fielding School of Public Health, University of California, Los Angeles

Dr. Araujo was born in Caracas, Venezuela, where he earned his M.D. at the Central University of Venezuela, and M.Sc. in immunology at the Venezuelan Institute for Scientific Research. Subsequently, Dr. Araujo completed his residency in internal medicine at Beth Israel Medical Center, Albert Einstein College of Medicine in New York, his cardiology and echocardiography fellowships at UCLA Medical Center in Los Angeles, and he obtained a Ph.D. in molecular biology from the Molecular Biology Institute at UCLA. He is currently professor of medicine (cardiology) and environmental health sciences at the David Geffen School of Medicine and Fielding School of Public Health at UCLA. Dr. Araujo leads the Environmental Cardiology and Vascular Biology Laboratory at UCLA with a focus on (1) dissecting mechanisms of how exposure to air pollution promotes atherosclerosis and heart disease, (2) cardiovascular toxicity of tobacco products such as e-cigarettes and hookahs, and (3) vascular oxidative stress and gene-environment interactions of relevance in ischemic heart disease.

Title of Presentation: *Interplay Between the Lung, Macrophages, and Lipid Oxidation in the Cardiometabolic Toxicity Induced by Particulate Matter*

Air pollution is associated with significant adverse pulmonary and cardiometabolic health effects leading to increased cardiovascular morbidity and mortality. Epidemiological and animal studies indicate that particulate matter (PM) of different size ranges and sources promote atherosclerosis. We have reported that ambient ultrafine particles (UFP) produced by traffic emissions—with an aerodynamic diameter < 0.20 μm—induce pro-oxidative effects in the blood, alter plasma lipoproteins, and promote atherosclerosis to a larger degree than particles of bigger size. Additionally, we have demonstrated that inhalation exposures to diesel exhaust, rich in UFP, dysregulate lipid metabolism and induce hepatic steatosis due to mitochondrial dysfunction—processes that could mediate vascular inflammation and atherosclerotic lesion formation. However, the mechanisms by which inhaled PM lead to these oxidative, inflammatory, and metabolic effects in the systemic tissues are not known. This talk will present evidence about the interplay between the lung as port of entry for the PM, lipid oxidation, and alveolar macrophages as potential mediators of the systemic vascular toxicity induced by various types of PM.

Afternoon Sessions

Alison Lee, M.D., M.S., Icahn School of Medicine at Mount Sinai

Dr. Lee is an associate professor of medicine with tenure in the Division of Pulmonary, Critical Care, and Sleep Medicine in the Department of Medicine and the vice chair for research and faculty affairs in the Department of Global Health and Health Systems. Dr. Lee is a National Institutes of Health–funded physician-scientist with expertise in environmental health, with a focus on air pollution and heat exposures. Her research considers how environmental exposures during critical windows of exposure can influence chronic disease risk over the life course.

Title of Presentation: *Household Air Pollution, Multi-morbidity, and Cleaner Stove Solutions*

Approximately 40% of the world's population is exposed daily to household air pollution from the burning of solid fuels on inefficient stoves, resulting in large air pollution exposures over the life course.

In 2013, the Ghana Randomized Air Pollution and Health Study (GRAPHS) randomized pregnant women to cleaner fuel intervention stoves or control (traditional stove) in early pregnancy, and the intervention was supported through pregnancy and the child's first year of life. Maternal and child longitudinal follow-up with a focus on lung and cardiometabolic health is ongoing.

GRAPHS children born to mothers randomized to the liquefied petroleum gas stove intervention had lower exposures over the intervention period and better lung function and lower diastolic blood pressure at age 4, which is 3 years after the intervention ended.

Higher household air pollution exposure during critical windows including the prenatal and early childhood periods is associated with worse health, including lung health, cardiovascular health, and growth.

Meredith C. McCormack, M.D., M.H.S., Johns Hopkins University

Dr. McCormack is a professor of medicine and the director of the Division of Pulmonary and Critical Care at the Johns Hopkins University School of Medicine. She has clinical expertise in asthma and chronic obstructive pulmonary disease (COPD), as well as pulmonary physiology and pulmonary function testing. She served as the medical director of the Johns Hopkins University Pulmonary Function Laboratory for more than 15 years and is the immediate past chair of the American Thoracic Society Pulmonary Function Testing Standards Committee.

Dr. McCormack is a physician–scientist funded by the National Institutes of Health and formerly by the U.S. Environmental Protection Agency (EPA), with a research focus on the effects of environmental influences on respiratory morbidity—specifically weather, air pollution, diet, and obesity as they relate to COPD and asthma. She is the current director of the Bridging Research, Lung Health, and the Environment Center, which investigates environmental exposures and lung health across the lifespan, and the Johns Hopkins Asthma Precision Medicine Center of Excellence.

Title of Presentation: *When Heat Hurts: Cardiopulmonary Consequences of Extreme Heat*

This session will summarize the body of evidence defining the associations and putative pathways linking extreme and exacerbations of chronic cardiopulmonary diseases. Individual susceptibility factors and exposure profiles that may modify health risk will be explored, as will the interplay between air pollution and extreme heat exposure. Approaches to incorporating precision medicine frameworks to refine risk assessment and management will be reviewed in order to apply evidence-based strategies in clinical care to reduce cardiac and respiratory morbidity.

January 27, 2026 (DAY 2)

Community Perspectives

Stacie Reveles, B.A., Cystic Fibrosis Research Institute

Ms. Reveles received her B.A. in organizational leadership and serves on the staff of the Cystic Fibrosis Research Institute, a nonprofit serving the cystic fibrosis (CF) community nationwide and globally in the areas of research, education, support, and advocacy. As an advocacy and programs associate, Ms. Reveles advocates for legislation affecting rare disease on both state and federal levels, raising the patient voice, as well as increasing CF awareness. Ms. Reveles is a certified yoga instructor, and lives with her husband of over 25 years in California. She is the mother of three adult children; the youngest is living with CF.

Title of Presentation: *The Weight of the Air We Breathe*

Living with a rare disease like CF is challenging and weighs heavily on the family system. The constant threat of wildfires exacerbates the difficulties for families living with lung diseases. Smoke from wildfires is inescapable, and can change with the wind, making it impossible to predict or escape its effects. Neither medication, personal protective equipment, nor home protective measures can confidently mitigate the impact of smoke on everyday life. Mental and emotional exhaustion are constant, and protecting physical health comes at the cost of mental well-being. Decision-making becomes increasingly difficult, and families already living with lung diseases can become completely overwhelmed and directionless while trying to protect their loved ones.

Rosamund Adoo-Kissi-Debrah, Ella Roberta Family Foundation

Rosamund Adoo-Kissi-Debrah, CBE, FBSA, is a World Health Organization BreatheLife Champion and founder of the Ella Roberta Family Foundation. She is one of the most prominent advocates for clean air worldwide, campaigning for greater awareness about the devastating impact air pollution has on human health and the need for governments to clean up the air we breathe. She started campaigning as soon as she realized its role in the death of her 9-year-old daughter, Ella. Ms. Adoo-Kissi-Debrah spent years campaigning for a second coroner's inquest into Ella's death to determine whether it was linked to air pollution, which a coroner eventually did in a landmark decision in December 2020, making Ella the first person in the world to have air pollution listed as a cause of death on her death certificate.

Title of Presentation: *A Mother's Fight for Clean Air*

Ms. Adoo-Kissi-Debrah is one of the most prominent advocates for clean air worldwide, campaigning for greater awareness about the devastating impact air pollution has on human health and the need for governments to clean up the air we breathe.

Keynote Sessions

Anna Hansell, M.P.H., Ph.D., MRCP, FFPH, University of Leicester, United Kingdom

Dr. Hansell is professor of environmental epidemiology and inaugural director of the Centre for Environmental Health & Sustainability at the University of Leicester. She is director of the National Institute for Health and Social Care (NIHR) Health Protection Research Unit in Chemical Threats and Hazards, and she is the theme lead for the Environment Theme lead of the NIHR Leicester Biomedical Research Centre. Since 2021, she has chaired the UK government scientific advisory group, the Committee on the Medical Effects of Air Pollution.

Dr. Hansell holds honorary clinical consultant contracts with the UK Health Security Agency and University Hospitals of Leicester NHS Trust. Her initial career was in respiratory (hospital) medicine and public health, completing a Ph.D. in epidemiology in 2005. She has been working in environmental epidemiology for more than 25 years. Dr. Hansell's research interests include air pollution, environmental noise, and chemical hazards, with a particular interest in environmental impacts on respiratory disease.

Title of Presentation: *Genome-wide Gene-Air Pollution Interaction Analysis of Lung Function in 300,000 Individuals*

Using UK Biobank, a team combining environmental epidemiology and respiratory genetics expertise at the University of Leicester (UK) conducted the largest genome-wide gene-air pollution interaction study of lung function to date. The analyses identified seven new genome-wide interaction signals. These were up to 440 milliliter lower lung function for certain genotypes when exposed to mean levels of outdoor air pollution, which is approximately equivalent to 9 years of average normal loss of lung function in adults. However, only a small number of interaction signals were identified, results were not consistent across gene-air pollution metrics, there was no association with genetic risk scores, and results have yet to be replicated. Discussion includes the challenges conducting this type of study and preliminary results from follow-on work. Identifying factors that cause increased susceptibility to air pollution is important at both individual and population levels, and can help suggest potential mitigation opportunities.

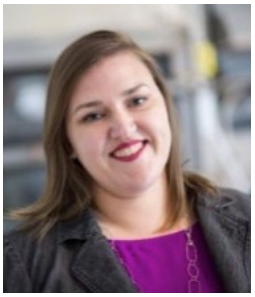
Valérie Siroux, Ph.D., Inserm, France

Dr. Siroux is an environmental and respiratory epidemiologist. She earned a Ph.D. in respiratory epidemiology from the University Paris XI, and completed a postdoctoral training in genetic epidemiology at the Arizona Respiratory Center, in Tucson, AZ. Dr. Siroux currently holds a senior researcher position at Inserm (French Institute of Health and Medical Research) in Grenoble, France.

Her research focuses on respiratory epidemiology, specifically on asthma and lung function. Asthma is the most common chronic disease among children, and 10% of the French population lives with asthma. Asthma is associated with an impaired quality of life and leads to considerable social and economic costs. Her research—based on several cohorts spanning the whole life course—is aimed at better understanding asthma and identifying its risks factors, mainly environmental risk factors (including ambient air pollution). In recent years, she developed exposome research projects, aiming to consider the joint effect of a wide range of exposures on respiratory health.

Title of Presentation: *Ambient Air Pollution and Early-Life Lung Function*

Increasingly, evidence indicates that early-life exposure to ambient air pollutants plays a role in children's lung function. However, the effects of air pollution on health are probably underestimated because of exposure measurement errors. This presentation discusses the oxidative potential of particulate matter (PM) and a novel PM-exposure metric to gain a better understanding of the effects of air pollution on health.



Kirsten Koehler, Ph.D., Johns Hopkins University

Dr. Koehler is a professor in the Department of Environmental Health and Engineering at the Johns Hopkins Bloomberg School of Public Health. She is the director of the master's program in occupational and environmental hygiene and co-director of the doctoral program in exposure sciences and environmental epidemiology. She completed a B.S. in atmospheric science at the University of California, Los Angeles. She then earned an M.S. and Ph.D. in atmospheric science and a postdoctoral fellowship in environmental health science at Colorado State University. She has expertise in exposure assessment with a focus on

particulate matter air pollution and more than 130 peer-reviewed publications. Her research goals are to improve exposure assessment methods to inform occupational and public health policy. Dr. Koehler's research involves improving spatiotemporal exposure assessment using lower-cost technologies and improving exposure assessment methods to investigate the influence of microenvironment on health.

Title of Presentation: *Low-Cost Environmental Air Pollution Sensors for Personal Exposure Assessment and Exposure Assessment in Epidemiologic Studies*

This presentation examines the applicability of lower-cost sensors for exposure assessment in epidemiology studies. Sensors for exposure to particulate matter will be the focus, but sensors for gas phase pollutants and temperature will also be discussed. The presentation provides examples from several recent research studies that highlight applications for measurement of ambient air pollution, indoor air pollution, personal exposure assessment, and measurements in lower-resource settings. Accuracy of the sensors and strengths and limitations of using lower-cost sensors for research and for community science will also be discussed.

Panel 1: Tools and Technologies for Environmental Exposures Research

Kambez Benam, D.Phil., University of Pittsburgh

Dr. Benam is an associate professor of medicine and bioengineering at the University of Pittsburgh, where he directs the Translational and Multidisciplinary Lung Microengineering Lab. His research centers on developing cutting-edge technologies, including Organs-on-Chips and biomimetic robotic systems, to model the human lung, immune, and vascular systems in vitro. These platforms are designed to advance our understanding of host-environment/pathogen interactions, accelerate therapeutic discovery, and provide new insights into complex respiratory, vascular, and immune conditions. Dr. Benam earned his D.Phil. from the University of Oxford and completed postdoctoral and technology development training at Harvard University's Wyss Institute for Biologically Inspired Engineering. He has received multiple awards for scientific innovation, including honors from the American Thoracic Society and the Society of Toxicology. His work has been widely featured in the media and is protected by multiple patents, several of which have been successfully licensed.

Title of Presentation: *Microphysiological Systems and Bioinspired Robotics: Enabling Technologies for Environmental Exposures*

Dr. Benam showcases how next-generation human-relevant platforms—Organs-on-Chips and bioinspired robotic systems—can transform the study of environmental exposures in pulmonary and cardiovascular health. This discussion features the Lung Small Airway-on-a-Chip, capable of recapitulating complex human responses to cigarette smoke and toxicants, and HUMITIPAA, a robotic platform that mimics disease-specific breathing profiles to analyze real-time aerosol exposure from electronic cigarettes. Together, these technologies offer unprecedented insight into host-environment interactions, support precision toxicology, and lay the groundwork for developing deployable countermeasures against environmental and inhaled threats.

Chi-Ren Shyu, Ph.D., University of Missouri Institute of Data Science and Informatics

Dr. Shyu is director of the University of Missouri Institute for Data Science and Informatics, professor of electrical engineering and computer science, and associate dean for graduate education and strategic initiatives in the College of Engineering. His interdisciplinary research integrates multiscale geospatial artificial intelligence (AI), environmental exposomics, genomics, and real-world data to support large-scale population health, cancer, and cardiovascular studies. His work advances explainable and actionable artificial intelligence (X2AI) methods to quantify environmental exposures—such as pollutants and

extreme weather—and link them to clinical, molecular, and spatial health outcomes. Dr. Shyu is an elected fellow of the American College of Medical Informatics.

Title of Presentation: *Integrating Multiscale Geospatial Environmental Data Into Large Population Health Studies: Opportunities and Challenges*

The lung serves as a primary gateway for environmental exposures, making geospatial context essential for understanding how place, time, and human mobility influence pulmonary and cardiovascular risk. Geospatial AI enables the integration of multiscale environmental exposures—including air pollution, wildfire smoke, heat, flooding, and other extreme weather conditions—with clinical, genomic, and real-world health data. The presentation will highlight key resources supporting this research, such as the GeoARK geospatial knowledgebase, satellite and remote sensing products from National Aeronautics and Space Administration and European Space Agency, and open-source spatial analytics and machine-learning tools that lower barriers for health researchers. These capabilities create new opportunities to uncover previously hidden relationships among exposomes, genomics, and health outcomes across large populations. The presentation will also address major challenges, including patient privacy, residential and activity history, linking home–work–school environments, and the need for secure, user-friendly, AI- and LLM-enabled exploratory tools that allow researchers to think spatially while adhering to FAIR principles and ethical data use.

Ilona Jaspers, Ph.D., University of North Carolina at Chapel Hill

After receiving her Ph.D. in environmental health sciences from New York University studying the effects of the air pollutant ozone on respiratory epithelial cells, Dr. Jaspers came to the University of North Carolina (UNC) at Chapel Hill for a postdoctoral training opportunity at the Center for Environmental Medicine, Asthma, and Lung Biology (CEMALB). Since starting her faculty position at UNC-Chapel Hill in 2001, Dr. Jaspers was continuously funded by the National Institutes of Health (NIH), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Defense. She rose through the ranks to become a professor in the Department of Pediatrics, with joint appointments in microbiology and immunology, and environmental sciences and engineering. She also held numerous leadership roles, most recently as the director of CEMALB, where she was the principal investigator on a cooperative agreement with the EPA entitled “Convergence Science in Environmental Health—COSINE)” and directed a training program in the School of Medicine, the “Curriculum in Toxicology and Environmental Medicine.” In January 2025, she transitioned to a new position at the National Institute of Environmental Health Sciences/National Heart, Lung, and Blood Institute, where she was a tenured senior investigator and the chief of a new NIH-wide Center examining the health effects caused by extreme weather conditions (heat, drought, etc.), natural disasters (floods, hurricane), and emerging environmental exposures (wildfires, airborne/waterborne pollutant). Due to a change in priorities of the current U.S. administration, these research efforts were dismantled. For over 25 years, Dr. Jaspers has used in vitro, in vivo, human clinical, computational, and epidemiological experimental approaches to study the respiratory health effects of inhaled toxicants, including ambient air pollutants, military burn pit smoke, wildfire smoke, tobacco products, and cannabidiol vaping products. Dr. Jaspers is particularly interested in the mechanisms by which inhaled toxicants can modify respiratory immune health and the potential adverse health consequences susceptible populations may suffer.

Title of Presentation: *Integrative Chemical-Biological Profiling to Determine Primary Drivers of Wildfire Smoke–Induced Toxicity*

Controlled in vitro and in vivo models using simulated wildfire emissions can help rank toxicity based on waste type and combustion temperature, while scenario-specific simulations (e.g., Canadian vs. Los Angeles wildfires) may reveal distinct toxicological profiles. Computational analyses suggest that chemical groups—particularly polycyclic aromatic hydrocarbons—play a central role in driving biological responses, raising the possibility of

linking these exposures to specific biomarkers. Integrating omic data with known disease signatures may uncover overlaps with established respiratory conditions, and further investigation could reveal wildfire-specific patterns of disease exacerbation.

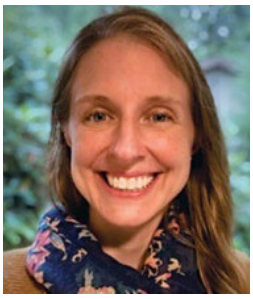
Rhonda D. Szczesniak, Ph.D., University of Cincinnati

Dr. Szczesniak has been working on pulmonary research for the last 18 years as a faculty member in the Division of Biostatistics and Epidemiology and Division of Pulmonary Medicine at Cincinnati Children's Hospital. Her research interests focus on developing methods for the analysis of medical monitoring data, particularly for rare lung disease. Dr. Szczesniak's research has been supported by the National Institutes of Health, the Cystic Fibrosis Foundation, and LAM (Lymphangioleiomyomatosis) Foundation. Some of the most notable discoveries made at her computational medicine lab include identifying pediatric phenotypes of rapid lung disease progression using the U.S. Cystic Fibrosis Patient Registry and her predictive modeling of lung disease informed by environmental exposures and community characteristics, which she and her team refer to as "geomarkers" of lung disease.

Title of Presentation: *Statistical and Machine Learning Approaches to Uncover Environmental Impacts on Cystic Fibrosis Lung Health*

Cystic fibrosis (CF) is a genetic disease, but non-genetic influences like environmental exposures and community characteristics can accelerate or modify its progression, particularly in lung function decline and even after initiating revolutionary therapies like Cystic fibrosis transmembrane conductance regulator (CFTR) modulators. This talk will highlight how statistical and machine learning approaches can improve prediction of disease trajectories by integrating previously identified clinical predictors with environmental risk factors, ultimately guiding more personalized strategies for care in CF and other lung diseases.

Panel 2: Interventions to Mitigate Cardiopulmonary Effects of Environmental Exposures



Emily Brigham, M.D., M.H.S., University of British Columbia, Canada

See "Academic Co-chair" for bio.

Title of Presentation: *Nutritional Interventions to Mitigate the Risks of Inhalational Exposures on Respiratory Health*

Respiratory health is directly affected by air quality, with effects on the lung determined by extrinsic and intrinsic factors. These factors include the ability to withstand and respond to the pro-inflammatory, pro-oxidant effects of air pollution exposures, influencing short- and long-term impacts such as symptoms, lung function decrements, and disease. Diet and nutrition have emerged as candidate, modifiable exposures influencing the respiratory response to air pollution, with mounting evidence. Proposed mechanisms of effect include antioxidant capacity (i.e., fruits and vegetables), interaction with the gut microbiome and anti-inflammatory properties (i.e., fiber), and inflammation-resolving abilities (i.e., omega-3 fatty acids in fish). The complexity of diet as an exposure provides both challenges and opportunities for discovery and intervention. Critical examination and prioritization of those most likely to benefit, alongside innovation in intervention delivery and measurement, are keys to advancing understanding.

Yvonne Huang, M.D., ATSF, FAAAAI, University of Michigan, Ann Arbor

Dr. Huang is internationally recognized for her research studying the role of host-microbiome interactions in chronic airway disease outcomes. Focusing on asthma and chronic obstructive pulmonary disease, her teams have uncovered novel links between the airway microbiome and airway disease phenotypes, including immune response patterns, treatment outcomes, and lung function trajectories. Dr. Huang directs a translational research program at the University of Michigan involving multidisciplinary collaborations. She completed her internal medicine residency at Yale and pulmonary/critical care fellowship at the University of California San Francisco. She has served on numerous working groups and panels for the National Institutes of Health, professional societies, and the National Academies of Sciences, Engineering, and Medicine (Committee on Advancing Understanding of the Implications of Environmental-Chemical Interactions with the Human Microbiomes). She is a fellow of the American Thoracic Society and the American Academy of Allergy, Asthma and Immunology.

Title of Presentation: *Microbiome-Targeted Interventions to Prevent or Combat Air Pollution Consequences: Scientific Gaps and Opportunities*

The presentation will summarize the state of current knowledge on air pollution effects on the microbiome and focus largely on scientific gaps and opportunities to advance understanding of this topic, particularly in the respiratory tract.

Rajesh Vedanthan, M.D., M.P.H., New York University Grossman School of Medicine

Dr. Vedanthan is the director of the Section for Global Health in the Institute for Excellence in Health Equity at the NYU Grossman School of Medicine. He is an associate professor with tenure in the Departments of Population Health and Medicine/Cardiology. He is a physician-scientist who is internationally recognized for his contributions to improving global cardiovascular health and health equity. His areas of interest include implementation science, global health delivery, global cardiology, environmental exposures, capacity building, and the intersection of health and development.

He is the principal investigator or co-investigator of multiple global health–related National Institutes of Health (NIH) grants, and he has been continuously supported by NIH grants for nearly 15 years. He is also the executive director of AMPATH Ghana, which, in partnership with the University for Development Studies and Tamale Teaching Hospital in Tamale, Ghana, aims to improve the health and well-being of people in communities in northern Ghana, educate tomorrow's medical experts worldwide, and jointly research breakthroughs that will inform improvements in population health and health equity around the world.

Title of Presentation: *Effectiveness of Indoor Air Purifiers on Heart Failure Outcomes (PURI-HF Trial)*

Dr. Vedanthan will summarize the global burden of household air pollution and its relationship to cardiovascular outcomes. He will briefly summarize different attempted approaches to reduce household air pollution that have had mixed results with respect to cardiovascular outcomes. He will then describe the PURI-HF trial, which aims to test whether air purifiers can improve cardiovascular outcomes for patients with heart failure with reduced ejection fraction in three cities in India.

Mary B. Rice, M.D., M.P.H., Harvard H.T. Chan School of Public Health/Harvard Medical School

See "Academic Co-chair" for bio.

Title of Presentation: *Outdoor Interventions for Lung Health*

This presentation will review implemented environmental and policy actions that have been associated with improvements in respiratory health. Dr. Rice will synthesize evidence from natural experiments and retrospective evaluations of interventions, including air quality regulations, industrial source closures, traffic congestion policies, wildfire management strategies, and urban design modifications. Using case studies such as coal-fired power plant retirements, low-emission and congestion-reduction zones, and prescribed burning programs, the talk reviews observed effects on asthma morbidity, chronic obstructive pulmonary disease exacerbations, lung function, and respiratory mortality. Collectively, these findings illustrate how upstream changes in outdoor environmental exposures can be evaluated as components of respiratory disease prevention, with implications for clinical care, public health practice, and policy development.

Nadia N. Hansel, M.D., M.P.H., Johns Hopkins School of Medicine

See "Academic Co-chair" for bio.

Title of Presentation: *Indoor Interventions for Lung Health*

This presentation will examine clinical trial evidence related to the home environment. It will explore how environmental interventions, including high-efficiency particulate air filtration, influence indoor air quality—particularly particulate matter and nitrogen dioxide levels. The session will also address the potential effects of these interventions on respiratory health, with an emphasis on chronic obstructive pulmonary disease and asthma. Finally, it will outline key gaps that remain in the current literature.

Brent Stephens, Ph.D., Illinois Institute of Technology

Dr. Stephens is the inaugural Arthur W. Hill endowed professor in sustainability and department chair in the Department of Civil, Architectural, and Environmental Engineering at Illinois Tech in Chicago, IL, where he co-directs the Built Environment Research Group (http://built-envi.com). His research interests and expertise involve the intersections of energy, air quality, and human health in the built environment. He is particularly interested in the fate and transport of indoor pollutants, building energy and environmental measurements and models, indoor air cleaning, and human exposure and health risk assessment. He recently served as a member of the National Academies of Sciences, Engineering, and Medicine (NASEM) Committee on Health Risks of Indoor Exposures to Fine Particulate Matter and Practical Mitigation Solutions (2021–Present). He was inducted into the ISIAQ Academy of Fellows in June 2024.

Title of Presentation: *Strategies to Improve Indoor Air Quality*

There are at least five well-understood principles for achieving good indoor air quality (IAQ): (1) minimize indoor emissions, (2) keep buildings dry, (3) ventilate well, (4) protect against outdoor pollution, and (5) utilize effective air cleaning. The impacts of such interventions on IAQ have been demonstrated in numerous investigations and continue to be studied, while the evidence base for cardio-respiratory and other health benefits of such strategies is still growing. A recent review of ongoing clinical trials involving indoor air cleaning with portable air cleaners (PACs) finds high variability in study populations, sample sizes, study durations, type of air cleaner used, and the level of detail involved in assessing the in-situ performance of PACs. With approximately 30 active air cleaner

intervention trials currently registered with ClinicalTrials.gov targeting approximately 6,000 participants, it is critical for studies to adopt strategies to assess the in-situ operation and performance of air cleaning interventions to be able to appropriately attribute observed effects to the interventions. A recent NASEM study referred to this as "building-aware epidemiology."