NATIONAL ACADEMIES Sciences Engineering Medicine

NUCLEAR AND RADIATION STUDIES BOARD

GILBERT W. BEEBE SYMPOSIUM on AI and ML Applications in Radiation Oncology, Medical Diagnostics, and Occupational and Public Safety

MARCH 13 – 14, 2025

THE NATIONAL ACADEMY OF SCIENCES BUILDING
FRED KAVLI AUDITORIUM
2101 CONSTITUTION AVENUE, NW
WASHINGTON, DC

ASK A QUESTION

Submit a question for a session or a presenter by scanning the QR code.

PROGRAM

The symposium will include a community discussion on algorithm development and pathways to success, a focus on future directions and opportunities in AI/ML methods and technology to advance the fields of the radiation health sciences, and discussions on the intentionality of data collection for algorithm development and training, as well as focused breakout sessions on current and emerging applications of AI and ML in the radiation health science fields. Sessions will consider such topics as: Broader AI Community Discussions, Future Directions and Opportunities for AI/ML Applications in the Radiation Health Sciences, Data for AI Readiness, AI in the Clinic – Applications in Radiation Oncology and Medical Diagnostics, AI Applications in Occupational and Public Health, AI Regulations and Ethics.

DAY 1 | THURSDAY, MARCH 13, 2025 (All times are US Eastern.)

Breakfast is available for purchase in the cafeteria (basement).

07:30 AM — **Optional | Early Morning Coffee**
Provided by the Academies for registered in-person attendees

08:00 AM — **Call to Order and Welcome**

Charles D. Ferguson, National Academies of Sciences, Engineering, and Medicine (NASEM)

Session One | Broader AI Community Discussions

This session aims to engage thought leaders in the broader AI community to share insights from AI developers, users, and government regulators on balancing the benefits of rapid AI innovation and the risks. Talks will address key Responsible AI principles in AI model development, human decision-making in AI, ethical considerations, and acceptable uncertainty levels for model outputs.

Session Introduction and Overview

Co-Moderated by Leo Chiang (NAE), Co-Chair, The Dow Chemical Company
Co-Moderated by Shaheen Dewji**,** Co-Chair, Georgia Institute of Technology

08:05 AM	Transformational AI Opportunities in Healthcare David C. Rhew, Microsoft
08:35 AM	Promoting a Safe and Effective Environment for Clinical AI Mike Tilkin, American College of Radiology
09:05 AM	**Session One | Panel Discussion**
09:45 AM	**BREAK (10 minutes)**

Session Two | Future Directions and Opportunities

This session will explore AI's primary focus areas within each subfield, covering current practices, emerging developments, and challenges to advancing applications. Presenters will discuss both model development and strategic pathways for implementing AI across radiation therapy, diagnostics, occupational health, and environmental safety. The session will emphasize human oversight, ethical considerations, and responsible AI integration to support effective, reliable decision-making in these diverse fields.

Session Two A | Future Directions and Opportunities

09:55 AM	**Session Introduction and Overview | Radiation Therapy/Oncology** **Co-Moderated by** Anyi Li**,** Planning Committee, Memorial Sloan Kettering Cancer Center **Co-Moderated by** Ceferino Obcemea, Planning Committee, National Cancer Institute
10:00 AM	AI Agents for Adaptive Radiotherapy Steve Jiang, University of Texas Southwestern
10:15 AM	Multi-omics Integration and Pattern Discovery in Patient Data Using Spatially Semantic Topographic Maps Lei Xing, Stanford University
10:30 AM	**Session Two A | Panel Discussion**

Session Two B | Future Directions and Opportunities

11:10 AM	**Session Introduction and Overview | Medical Diagnostics** **Moderated by Caroline Chung,** Planning Committee, MD Anderson Cancer Center
11:15 AM	Quantitative MR, Promising Data as a Replacement of CT Cameron Piron, Synaptive Medical
11:30 AM	AI and Quantitative Imaging Jayashree Kalpathy-Cramer, University of Colorado-Anschutz Medical Campus
11:45 PM	**Session Two B | Panel Discussion**
12:25 PM	**LUNCH (1 hour)** **Lunch is available for purchase in the cafeteria (basement). Additional tables are available upstairs in the West Court.**

Session Two C | Future Directions and Opportunities

01:25 PM **Session Introduction and Overview | AI/ML Innovations in Radiation Occupational Health**

Moderated by Sylvain Costes, Planning Committee, NASA

01:30 PM **Computational Approaches to Integrating Radiation Exposure Across the Lifecourse: Risks, Insights, and Innovations**
Heidi Hanson, Oak Ridge National Laboratory

01:45 PM **Patient-centric Synthetic Data Generation, No Reason to Risk Re-identification in Biomedical Data Analysis: The Anonymous Synthetic Data Era**
Pierre-Antoine Gourraud, Nantes Université, University Medical Center (CHU de Nantes), France

02:00 PM **Session Two C | Panel Discussion**

02:40 PM **BREAK (10 minutes)**

Session Three | Data for AI Readiness

This session will explore the significance of intentional data collection for trustworthy AI model results with a focus on medical imaging as an example. Key topics include data quality and quantity requirements, data collection planning, and data management strategies. Discussion will focus on tackling major gaps, bias, and ethical considerations in radiation health sciences data while suggesting innovative solutions.

02:50 PM **Session Introduction and Overview**
Co-Moderated by Leo Chiang
Co-Moderated by Anyi Li

02:55 PM **Data for AI: The Critical Role of Metadata and Context**
Caroline Chung, The University of Texas MD Anderson Cancer Center

03:10 PM **Requisites and Challenges in Quantitative Imaging**

Daniel C. Sullivan, Duke University Medical Center

03:25 PM **Centralized Imaging Collaborations for AI Readiness**
Paul Kinahan, University of Washington

03:10 PM **Data Management Tools and Strategy for Responsible Imaging AI**
Dan Marcus, Washington University School of Medicine in St. Louis

03:25 PM **Session Three | Panel Discussion**

04:15 PM **BREAK (10 minutes)**

Session Four | Community Discussion and End of Day Notes

04:25 PM **Radiation Therapy Wrap-up**
Report from Anyi Li

04:35 PM	**Medical Diagnostics Wrap-up** **Report from Caroline Chung**
04:45 PM	**Exposure Assessment Wrap-up** **Report from Sylvain Costes**
04:55 PM	**End of Day, Closing Remarks and Summary on Common Themes** **Shaheen Dewji**
05:10 PM	**Adjourn | End of Day 1 of Symposium**

Day 2 will provide a platform for invited speakers and participants to present and discuss advancements in AI and ML across diverse areas of radiation science, including health, occupational safety, environmental monitoring, and regulatory frameworks. Moderated panel sessions will build on insights from Day 1's "Future Directions and Opportunities" session, advancing discussions on the application, ethical considerations, and governance of AI across multiple radiation-related fields. This day's agenda will support a comprehensive exploration of AI's role in enhancing radiation safety, data integration, and regulatory processes, fostering collaboration among experts from varied domains within radiation science.

Day 2 is split into parallel sessions:

- **Morning sessions from 8:00 AM – 11:00 AM featuring topics on**
  - **Session 5A: Digital Twins (Fred Kalvi Auditorium) and**
  - **Session 5B: Multimodal Modeling (NAS 120).**
- **Afternoon sessions from 12:00 PM – 2:40 PM featuring topics on**
  - **Session 6A: Ethics and Bias (Fred Kalvi Auditorium) and**
  - **Session 6B: Uncertainty Quantification and Trustworthiness (NAS 120).**

Note: Opening remarks will be viewable in both the Auditorium and NAS 120. Audience members are encouraged to go directly to the room for the session they would like to attend.

DAY 2 | FRIDAY, MARCH 14, 2025 (All times are US Eastern.)

	Breakfast is available for purchase in the cafeteria (basement).
07:30 AM	**Optional | Early Morning Coffee** Provided by the Academies for registered in-person attendees
08:00 AM	**Welcome and Overview for Day 2** **Leo Chiang**, Co-Chair **Shaheen Dewji**, Co-Chair
	Session Five | Breakout Sessions Five A and Five B
Breakout Session Five A | Location – Fred Kavli Auditorium	
08:05 AM	**Session Five A | Digital Twins** **Session Introduction and Overview** **Co-Moderated by Caroline Chung** **Co-Moderated by Sylvain Costes**
08:15 AM	Digital Twins and AI for Precision Medicine Jun Deng, Yale University
08:40 AM	Multiscale Digital Twins for Personalized Radiopharmaceutical Therapy Greeshma Agasthya, Georgia Institute of Technology
09:05 AM	Cardiac Digital Twins: From the Academy to the Clinic Charles A. Taylor, University of Texas at Austin
09:30 AM	Digital Twins for Disease Modeling and Drug Development: Applications for Smarter, Faster Clinical Trials Jon Walsh, Unlearn

09:55 AM	**Session Five A | Panel Discussion**
11:00 AM	**LUNCH (1 hour)** **Lunch is available for purchase in the cafeteria (basement). Additional tables are available upstairs in the West Court.** **Reconvene after lunch for either Breakout Session Six A or Six B.**

Breakout Session Five B | Location – NAS 120

08:05 AM	**Session Five B | AI/ML Applications of Multimodal Modeling** **Session Introduction and Overview** **Co-Moderated by Anyi Li** **Co-Moderated by Ceferino Obcemea**
08:15 AM	**Rapidly Exploring Use Cases for Multimodal AI in Radiology** **Nur Yildirim**, University of Virginia
08:40 AM	**AI and Multi-modal Modeling in Lung Cancer** **Jia Wu**, MD Anderson Cancer Center
09:05 AM	**Integrating Mechanistic and Machine Learning Models to Assess Causal Effects of Radiotherapy on Patient Outcomes** **Igor Shuryak**, Columbia University Irving Medical Center (CUIMC)
09:30 AM	**The Promise and Challenges of Deep Learning in Radiation Risk Assessments** **Zhenqiu Liu**, Radiation Effects Research Foundation (RERF), Japan
09:55 AM	**Session Five B | Panel Discussion**
11:00 AM	**LUNCH (1 hour)** **Lunch is available for purchase in the cafeteria (basement). Additional tables are available upstairs in the West Court.** **Reconvene after lunch for either Breakout Session Six A or Six B.**

Session Six | Breakout Sessions Six A and Six B

Breakout Session Six A | Location – Fred Kavli Auditorium

12:00 PM	**Session Six A | Ethics and Bias** **Session Introduction and Overview** **Co-Moderated by Leo Chiang** **Co-Moderated by Sylvain Costes**
12:00 PM	**Artificial Intelligence Preparedness – A Regulatory Perspective** **Matt Dennis**, U.S. Nuclear Regulatory Commission
12:25 PM	**Issues in the Use of AI for Breast Cancer Screening** **Etta Pisano**f (NAM), American College of Radiology

12:50 PM	Addressing Bias in AI-Driven Medical Imaging: Pitfalls and Best Practices Amber Simpson, Queen's University, Canada
01:15 PM	Shortcuts Causing Bias in Medical Imaging Judy Wawira Gichoya, Emory University School of Medicine
01:40 PM	**Session Six A | Panel Discussion**
02:40 PM	**BREAK (20 minutes)**
	Reconvene in the Kavli Auditorium for Summary of Symposium and Highlight Discussions.

Breakout Session Six B | Location – NAS 120

12:00 PM	**Session Six B | Uncertainty Quantification and Trustworthiness** **Session Introduction and Overview** **Co-Moderated by Shaheen Dewji** **Co-Moderated by Ceferino Obcemea**
12:00 PM	Machine Learning and Low-Field MRI: Unlocking a New Class of Portable Scanners Matthew Rosen, Harvard Medical School
12:25 PM	Enhancing Trustworthiness: A Case Study on Blood Pressure Modeling with Physics-Informed Neural Networks Roozbeh Jafari, Massachusetts Institute of Technology Lincoln Laboratory
12:50 PM	Assessing Uncertainty in Indoor Radon Exposure Estimates: Implications for Radiation Epidemiology **Heidi Hanson**, Oak Ridge National Laboratory
01:15 PM	AI Enabled Healthcare Supply Chain Resilience and Risk Management Jie Yu, Johnson & Johnson
01:40 PM	**Session Six B | Panel Discussion**
02:40 PM	**BREAK (20 minutes)**
	Reconvene in the Kavli Auditorium for Summary of Symposium and Highlight Discussions.

	Reconvene location after break – Kavli Auditorium
03:00 PM	**Summary of Symposium and Highlight Discussions** **Leo Chiang**, Co-Chair **Shaheen Dewji**, Co-Chair Daniel Mulrow, NASEM Symposium Director
03:15 PM	**Adjourn workshop | End of Day 2 workshop**

ABSTRACTS

Multiscale Digital Twins for Personalized Radiopharmaceutical Therapy

Greeshma Agasthya
Georgia Institute of Technology, Atlanta, Georgia

Radiopharmaceutical therapy (RPT) has gained prominence over the past decade as a targeted radiation therapy approach that selectively delivers radiation to tumors while sparing normal tissues. Despite its potential, several challenges hinder its widespread clinical adoption. Current FDA-approved RPT protocols are primarily limited to late-stage cancers, and dosing strategies remain largely non-patient-specific, limiting therapeutic efficacy and safety. In this talk, I will explore the role of multiscale digital twins in addressing these challenges. Digital twins that integrate patient-specific data across multiple scales—from 3D chromosome conformation to whole-body kinetics—offer a promising approach to personalize RPT dosing, optimize treatment strategies, and predict outcomes. By capturing individual patient characteristics, these models enable improved dosimetry, and optimization of therapy with a prospective view of possible outcomes. Furthermore, digital twins based virtual clinical trials can accelerate the translation of novel radiopharmaceuticals by simulating treatment responses before clinical trials, thereby reducing developmental costs and time. An essential aspect of digital twin implementation is verification, validation, and uncertainty quantification (VVUQ), ensuring the reliability and clinical applicability of these models. I will discuss strategies for rigorous VVUQ and how it can enhance confidence in digital twin-based decision support. Ultimately, multiscale digital twins represent a transformative approach to advancing RPT, offering a pathway to truly personalized radiation therapy and broader clinical adoption.

Data for AI: The Critical Role of Metadata and Context

Caroline Chung, MD, MSc., FRCPC, CIP
The University of Texas MD Anderson Cancer Center, Houston, Texas

The success of artificial intelligence (AI) systems is intrinsically linked to the quality and contextual relevance of the data utilized for training, validation and utilization. Metadata—data about data—enriches datasets by providing structure, meaning, traceability and informing context, to facilitate building robust AI models and understanding why when AI models do not perform well. Metadata about the models can further facilitate explainability and understanding of the models, including the appropriate fit for purpose uses of each model. This session will provide an overview of the key practices for preparing data to optimize AI development and performance, including the people, processes and considerations of technology. In addition, challenges and potential approaches for integrating contextual data into AI systems will be discussed, emphasizing the need for robust data governance and ethical considerations. By leveraging data in context, AI can achieve higher levels of precision, fairness, and applicability across diverse domains, ultimately driving more meaningful and impactful innovations.

Digital Twins and AI for Precision Medicine

Jun Deng, PhD
Yale University, New Haven, Connecticut

Recently the National Academies of Sciences, Engineering, and Medicine (NASEM) have spearheaded the efforts in identifying the needs and opportunities to advance digital twins in various applications across science, engineering, and medicine. In healthcare, a human digital twin is used to monitor a person's health conditions, evaluate potential preventive or therapeutic plans, design personalized treatment and interventions, prevent potential adverse effects, and facilitate virtual clinical trials. In radiation oncology, cancer patient digital twins use mechanistic modeling, in silico simulation, high-performance computing, and biotechnologies to build individual representations that dynamically reflect molecular, physiological, and health status of each patient across different treatments and time. In this talk, we will first introduce basic concepts and principles of digital twins, as well as various applications of digital twins in health. Then, we will demonstrate some research efforts in implementing digital twins for personalized radiotherapy. Finally, we will discuss the opportunities, challenges, and outlook of AI and digital twins for precision medicine.

Artificial Intelligence Preparedness – A Regulatory Perspective

Matt Dennis, MS
U.S. Nuclear Regulatory Commission, Washington, District of Columbia

The rapid evolution of artificial intelligence (AI) presents opportunities and challenges for regulatory bodies. This presentation explores the U.S. Nuclear Regulatory Commission's (NRC) readiness for AI deployment. It provides an overview of the AI landscape, NRC activities, and regulatory gap analysis. Key considerations for developing AI systems in nuclear applications are covered, along with implications for agency use. The presentation details the NRC's strategic plan to prepare staff for AI reviews, internal research initiatives, and engagement with external stakeholders. It also underscores responsible AI use in radiation protection and the importance of strengthening AI partnerships. The NRC aims to ensure the safe and secure deployment of AI within the nuclear industry, promoting continuous engagement and proactive governance.

Shortcuts causing Bias in Medical Imaging

Judy Gichoya, PhD
Emory University School of Medicine, Atlanta, Georgia

AI systems learn shortcuts instead of meaningful patterns in medical imaging, in turn perpetuating biases when deployed in healthcare. We'll explore how these models sometimes cheat by learning spurious correlations - like image timestamps or hospital markers - rather than actual medical features. Through real-world examples, we'll uncover how these shortcuts disproportionately affect underserved populations and can lead to misleading diagnoses.

Patient-centric Synthetic Data Generation, No Reason to Risk Re-identification in Biomedical Data Analysis: The Anonymous Synthetic Data Era

Pierre-Antoine Gourraud, PhD
Nantes Université, University Medical Center (CHU de Nantes), France

Synthetic data generation methods promote collective intelligence and enable sharing codes that apply seamlessly to both original and synthetic data. The use of synthetic data allows unleashing personal data potential to improve future healthcare systems and beyond while ensuring individual privacy. Using a local private model, the Avatar method respects GDPR constraints by enabling data sharing without compromising privacy. Personal data should be restricted to personal use. Not using synthetic data when possible, undermines the trust required to build an open-knowledge society.

Computational Approaches to Integrating Radiation Exposure Across the Lifecourse: Risks, Insights, and Innovations

Heidi Hanson, PhD
Oak Ridge National Laboratory, Tennessee

Radiation exposure occurs across multiple domains; occupational, medical, and residential. Traditional exposure assessments often treat these sources in isolation, limiting our understanding of their combined effects. Computational approaches, including advanced data integration, machine learning, agent-based modeling, and AI offer new opportunities to study radiation exposure across the life course. Leveraging heterogenous datasets, diverse computational methods, and interdisciplinary collaborations will lead to a more holistic view of radiation exposure and human health.

Assessing Uncertainty in Indoor Radon Exposure Estimates: Implications for Radiation Epidemiology

Heidi Hanson, PhD
Oak Ridge National Laboratory, Tennessee

Indoor radon exposure is the second leading cause of lung cancer in the United States and has been linked to childhood leukemias, cardiovascular disease, and cognitive health. Large variability radon levels within small geographic regions can introduce uncertainty in exposure assessment. Verification, validation, and uncertainty quantification of exposures estimates are essential for accurately determining the relationship between exposure and disease. Dr. Hanson will critically examine sources of bias and uncertainty in commonly used exposure estimates. She will then describe the use of multiple approaches to uncertainty quantification, such as volatility analyses and quantile regression forests, that can be used to better understand the level of confidence in exposure estimates. She will conclude by proposing future research directions for radiation epidemiology.

Enhancing Trustworthiness: A Case Study on Blood Pressure Modeling with Physics-Informed Neural Networks

Roozbeh Jafari, PhD
Massachusetts Institute of Technology Lincoln Laboratory, Lexington, Massachusetts

Digital Twins represent a powerful approach in precision healthcare, providing real-time, personalized physiological insights critical for effective clinical interventions. In this presentation, we explore the integration of Scientific Machine Learning (SciML) and Physics-Informed Neural Networks (PINNs) to enhance trustworthiness, interpretability, and predictive accuracy of Digital Twins, particularly in the context of cuffless blood pressure (BP) monitoring. Through a case study employing Windkessel-PINNs, we demonstrate accurate, beat-to-beat blood pressure waveform estimation by dynamically adapting model parameters. Results illustrate improved accuracy with increasing model complexity and emphasize the importance of uncertainty quantification for reliable clinical decision support. This approach paves the way for more robust, physically consistent, and trustworthy Digital Twin implementations, ultimately enhancing patient outcomes and medical decision-making.

AI Agents for Adaptive Radiotherapy

Steve Jiang, PhD
University of Texas Southwestern, Dallas, Texas

The integration of artificial intelligence (AI) into adaptive radiotherapy (ART) is revolutionizing personalized oncology. Traditional radiotherapy, defined by fixed treatment parameters such as the number of fractions, fractional dose, and time intervals between treatments, adheres to a "one size fits all" approach. ART, however, introduces a patient-specific methodology that leverages real-time data—including anatomical imaging, functional imaging, and biological markers—to dynamically adjust treatment plans, optimizing tumor control and minimizing toxicity. ART is moving from anatomy-based to response-based. Anatomy-based ART focuses on adapting to anatomical changes, while response-based ART incorporates tumor and tissue responses, enabling true adaptation. Despite its transformative potential, ART presents challenges, including increased workload, complexity in workflows and technology, decision-making demands, error risks, and resource requirements, all of which necessitate advanced AI solutions. Multi-agent AI systems hold promise for addressing these challenges by streamlining clinical workflows, enhancing decision-making, and reducing errors. This talk highlights the transformative potential of agentic AI to revolutionize radiotherapy by delivering tailored, efficient, and effective cancer treatment solutions.

AI and Quantitative Imaging

Jayashree Kalpathy-Cramer, PhD
University of Colorado-Anschutz Medical Campus, Aurora

AI/ML are key to making medical imaging more quantitative. We have seen tremendous progress in the literature and in the field of AI broadly in terms of quantitative imaging from better tools for image segmentation and registration, to assessing treatment response. Despite these successes, few of these algorithms are being used in the clinic routinely. We will briefly discuss some of the challenges that are being faced in the deployment of AI, review a framework that can be used throughout the lifecycle and end with considerations for AI developers and end-users.

Centralized Imaging Collaborations for AI Readiness

Paul Kinahan, PhD
University of Washington, Seattle

Over 75% of the now over 1000 FDA authorized Artificial Intelligence and Machine Learning (AI/ML)-Enabled Medical Devices are for medical imaging or radiology. This is due to the demonstrated ability of AI to analyze medical images and the established digital workflows and universal DICOM standards for image storage. However, a large amount of imaging data is necessary to train, validate, and AI or ML algorithms and in general there is a lack of sufficiently large, curated, and representative training data that include ground truth data.

Currently, the vast majority of medical image data are stored in isolated PACS systems, which work well for the local clinical needs. These are rarely shared externally due to a combination of a lack of motivation, a lack of resources, and privacy concerns. As a result most research groups and industry have limited data access based on small sample sizes from limited geographic areas. In addition, the available data is often annotated or categorized using local standards. When data are shared or pooled for AI readiness, appropriate data management is essential, such as the FAIR (findability, accessibility, interoperability, and reusability) principles.

An increasing number of data sets has been made open source to address the problem of providing medical images for AI algorithm development. These vary widely in the types of image (i.e. modalities) the body regions imaged, the disease type and status, and associated meta-data such as clinical information or annotations. Importantly, there is also a wide variation in the level of curation of the image data sets ranging from rich sets of information, to no information or even inaccurate information. When PHI is removed from images, this can be done in a variable manner. There have also been reported cases of open-source image collections containing repeated sub-collections. These variations, if not known or accounted for, can confound AI algorithm development and performance.

In summary, an important aspect of centralized imaging collections constructed for for AI readiness is curation, that is, providing information about the data. This does mean that the images and associated meta-data are necessarily 'high-quality', but rather that we can say something about the quality, whether it has rigorous quality control, as may occur in some clinical trials, or if it is standard-of-care imaging, or even that we don't know anything.

Curated imaging collections, whether centralized or federated, are valuable resources for AI readiness, but require resources to create and maintain. Thus in addition to curation the sustainability is also an important characteristic of open-source collections of medical images.

Understanding Radiation Risk Through Deep Learning: Promise and Challenges

Zhenqiu Liu, PhD
Department of Statistics, Radiation Effects Research Foundation, Hiroshima, Japan

Accurately assessing radiation risks at low doses is essential for public health protection. While the risks of high-dose irradiation are well-documented, risk estimates for low doses (<100 mGy) remain controversial. The linear-no-threshold (LNT) model, widely adopted by government agencies, relies on extrapolation from high-dose data. However, no statistically significant radiation effects have been detected in A-bomb survivors exposed to less than 100 mGy in the Life Span Study (LSS) cohort. In this pilot study, we propose a deep neural network (DNN) model for radiation risk assessment using LSS data. Our findings demonstrate that DNNs provide greater flexibility by avoiding strong model assumptions, learning excess relative risk (ERR) directly from data, and achieving improved ERR estimation compared to traditional parametric models. We also compare DNN-based risk estimates with standard parametric approaches, explore the challenges of applying DNNs to radiation risk prediction, and discuss potential research directions to address these challenges.

Radiation risks at low doses are highly heterogeneous. We show that insights from DNNs can help identify radiation-sensitive and radiation-resistant subgroups, improving low-dose radiation risk assessment and enabling personalized radiation risk estimation.

Data Management Tools and Strategy for Responsible Imaging AI

Daniel Marcus, PhD
Washington University School of Medicine in St. Louis, Missouri

The rapid advancement of artificial intelligence (AI) in medical imaging presents both opportunities and challenges. While AI models demonstrate impressive diagnostic capabilities, their clinical readiness remains uncertain due to issues related to data bias, model generalizability, and regulatory acceptance. This presentation explores the role of imaging informatics in ensuring responsible AI deployment by addressing key challenges in data management, curation, and monitoring. XNAT, an open-source platform, supports scalable, reproducible, and transparent AI development. By facilitating data harmonization, quality assessment, federated learning, and AI-assisted annotation, XNAT enables efficient and responsible management of the full lifecycle of imaging AI models—from training and validation to deployment and continuous monitoring. The Feature Stack, a structured approach to data processing, is introduced to illustrate the progression from raw imaging data to clinically meaningful AI-generated phenotypes, emphasizing the importance of systematic quality control at each stage. Additionally, strategies for overcoming algorithmic bias, ensuring real-world performance validation, and maintaining AI models over time through adaptive learning and rigorous oversight are examined. This presentation highlights how scalable informatics tools can bridge the gap between research and clinical application, fostering responsible AI integration in medical imaging.

Quantitative MR, Promising Data as a Replacement of CT

Cameron Piron, MS
Synaptive Medical, Toronto, Ontario, Canada

Although MRI has been in clinical use since 1980’s, design approaches to improve performance of the modality have primarily focused on increasing magnetic field power. This path has reached a diminishing return as higher field imaging comes with significant increases in cost, complexity and operational challenges including staffing, patient compliance, access and device compatibility. In recent years there have been many advances in low and mid field MRI systems yielding accelerating performance returns.

We will explore the increased benefits and role mid-field MRI can bring to clinical care today. Of particular interest are the use of AI/ML approaches to enhance imaging quality and speed. Combination of hardware improvements at mid-field and AI/ML enhancements now rival high-field MRI performance. With this comes a potential large scale shift of case volumes from CT to MRI as acquisition time, ease of use and overall costs start to converge. This can lead to a significant reduction in radiation dose to compromised patients and caregivers in acute imaging situations.

Issues in the Use of AI for Breast Cancer Screening

Etta Pisano, MD, FACR
American College of Radiology, Reston, Virginia

There are many products currently authorized for sale in the US in breast cancer imaging. The limitations to the evidence supporting them will be discussed and the gaps in the evidence explained. Finally, a mechanism for the clinical community to gain confidence in the use of AI in the post-market environment will be described.

Transformational AI Opportunities in Healthcare

David C. Rhew, MD
Microsoft, New York, New York

This presentation focuses on the transformative potential of health AI, emphasizing key strategies to drive innovation and adoption. It will explore how leveraging AI can unlock new opportunities to enhance people's lives, while also ensuring the responsible development and ethical use of these technologies to mitigate potential risks. Additionally, I will address the importance of democratizing access to AI technologies and resources, fostering broader opportunities for diverse communities. Additionally, it will highlight the need to cultivate AI-empowered workforces and organizational cultures that are equipped to safely and effectively harness the power of AI in the healthcare sector.

Machine Learning and Low-Field MRI: Unlocking a New Class of Portable Scanners

Matthew S. Rosen, PhD
Massachusetts General Hospital, Charlestown; Harvard Medical School, Boston; Harvard University, Cambridge, Massachusetts

A promising approach to portable MRI is operation at low magnetic fields, where cost-effective electromagnets and simple permanent magnet arrays become practical. However, MRI in the low- (<0.1 T) and ultra-low-field (<0.01 T) regimes is inherently challenging due to intrinsically low Boltzmann polarization, leading to low signal-to-noise ratio (SNR). Despite these limitations, we have developed signal acquisition and processing techniques that enhance SNR and image quality in scanners operating as low as 6.5 mT (0.0065 T).

Machine learning (ML) has emerged as a critical enabler of low-field MRI, leveraging low-cost embedded GPUs for real-time data processing. We will present ML-based approaches for reducing noise, increasing attainable information per unit time, and solving highly undersampled, low-SNR inverse problems. Specifically, we will discuss our deep learning domain transformation method, AUTOMAP, and its role in improving image reconstruction. We will also explore ML-driven strategies for optimal experimental design, with applications in both MRI and NMR spectroscopy, demonstrating cases where AI-enhanced low-field methods rival or surpass high-field performance in specific tasks.

In clinical applications, we will showcase the use of super-resolution techniques to improve segmentation in bedside neuroimaging at 64 mT. A key focus of our discussion will be uncertainty quantification and trustworthiness in AI-driven MRI, including methods to parameterize reconstruction accuracy, assess model generalizability, and identify failure cases. We will highlight both the promise and the limitations of ML in portable MRI, addressing challenges in robustness, interpretability, and clinical deployment.

Integrating Mechanistic Modeling with Machine Learning to Evaluate Radiotherapy and Chemotherapy Outcomes in Head and Neck Cancer

Igor Shuryak, MD, PhD
Columbia University Irving Medical Center, New York, New York

Integrating mechanistic and machine learning (ML) models in radiation biology and oncology offers significant potential for improving treatment predictions. While traditional mathematical models like the Linear-Quadratic (LQ) model are based on diverse data sources, they cannot incorporate multiple features like patient demographics and omics data. ML methods can integrate these features but often function as "black boxes," making it difficult to incorporate established biological mechanisms into their predictions. Combining both approaches can create more accurate and interpretable models.

Building on our previously developed mechanistic Dose-Dependent (DD) tumor repopulation model for head and neck squamous cell carcinoma (HNSCC), we present a novel hybrid approach that combines mechanistic models with ML to assess radiotherapy and chemotherapy impacts on overall survival. We analyzed the RADCURE dataset of 2,651 HNSCC patients using a combination of mechanistic modeling (Biologically Effective Dose calculations using DD and older Dose-Independent DI models) and ML methods (competing risks Random Survival Forest for prediction and Causal Survival Forest for causal analysis). While our findings align with meta-analyses, the estimated chemotherapy effects are larger, possibly due to several factors: younger/healthier patients receiving chemotherapy more frequently, population differences, incomplete fulfillment of causal modeling assumptions, and evolving treatment protocols. This study demonstrates an example of how combining mechanistic models with ML can enhance biological interpretability and provide detailed predictions and causal effect estimates in cancer treatment. Our framework advances the field, enabling better understanding of treatment effects from non-randomized clinical data, potentially complementing randomized clinical trials, generating new hypotheses, and supporting personalized medicine.

Addressing Bias in AI-Driven Medical Imaging: Pitfalls and Best Practices

Amber Simpson, PhD
Queen’s University, Kingston, Ontario, Canada

Rapid advancements in artificial intelligence (AI) for medical imaging have led to a surge in publications showcasing models with potential clinical impact. However, the translation of these models into practice is hindered by biases introduced during study design, analysis, or reporting. In this work, we identify common statistical biases and sources of variability in AI research, with a focus on study design and analytical pitfalls. Drawing from statistical, radiologic, and machine learning literature, we highlight strategies to mitigate these biases, ensuring more reliable and generalizable AI-driven medical imaging applications.

Requisites and Challenges in Quantitative Imaging

Daniel Sullivan, MD
Duke University Medical Center, Durham, North Carolina

There is little standardization in clinical image (CT, MR, PET, or ultrasound) acquisition and interpretation. This leads to considerable variation in results across different patients or in the same patient at different time points. However, all clinical imaging modalities are now digital, which affords us the opportunity to extract objective, quantitative results from clinical imaging scans. AI algorithms for evaluating clinical images can mitigate the variability that inevitably ensues from subjective interpretations.

The pixel or voxel values in clinical scans contain biological information. But for these values to have high degrees of accuracy and precision, the technical and biological sources of potential error or variability in the voxel values must be understood and minimized by adhering to rigorous image acquisition specifications. Groups such as the Quantitative Imaging Biomarkers Alliance (QIBA) have developed metrological consensus and technical methodology to address this issue. Guidance documents for standardization of image acquisition for various clinical applications have been developed. The objective, quantitative, reproducible information derived by using these standards can be incorporated into decision support algorithms.

For these approaches to be successfully implemented in healthcare, several impediments must be overcome. Radiologists must accept more standardization in imaging acquisition protocols and use of structured reporting systems. Image data use issues (e.g., ownership, curation, correlation with clinical data) must be resolved. Substantial funding is needed to arrive at clinical validation and regulatory approval. Ideally there should be a national quality assurance program for quantitative imaging, similar to the Center for Disease Control's Clinical Standardization Programs or the CMS-administered accreditation program mandated by the Clinical Laboratory Improvement Amendment (CLIA) which ensures quality standards for all laboratories.

Cardiac Digital Twins: From the Academy to the Clinic

Charles A. Taylor, PhD
University of Texas at Austin

Patient-specific computational models of the cardiovascular system have generated significant interest since they were first introduced more than 25 years ago. Such models enable a new approach in medicine whereby predictive computational models can be used to evaluate and select alternate treatment strategies. Since they were first introduced in 2010, patient-specific models of *coronary* artery blood flow constructed from coronary CT angiography (cCTA) images leveraging deep learning A.I. methods and using computational fluid dynamics have transformed the diagnosis of heart disease. Such noninvasive, digital twin models of the coronary arteries have provided safer, less expensive and more efficient procedures as compared to the standard of care that often involves nuclear imaging and invasive diagnostic cardiac catheterizations. Such image-based computations require an accurate segmentation of the coronary artery lumen from cCTA images and employ biologic principles relating form (anatomy) to function (physiology). HeartFlow developed a non-invasive test, FFR_{CT}, based on computing flow and pressure in the coronary arteries. FFR_{CT} has been validated against invasive pressure measurements in more than 1000 patients and demonstrated to improve care in over 100 clinical studies enrolling more than 100,000 patients. At present, FFR_{CT} has been used for routine clinical decision making in more than 1500 hospitals that have served over 400,000 patients in the United States, Europe, and Japan. In the United States, the American College of Cardiology and the American Heart Association guidelines include FFR_{CT} in the recommended diagnostic pathway for heart disease. Medicare and most U.S. private insurance companies reimburse physicians for using FFR_{CT}. Future opportunities for research in developing and applying computational methods for diagnosing and treating cardiovascular diseases will be presented.

Promoting a Safe and Effective Environment for Clinical AI

Mike Tilkin, MS
American College of Radiology, Reston, Virginia

The rapid evolution of AI in radiology has generated excitement, concerns, and myriad questions regarding how best to navigate the journey to safe and effective use in clinical care. For the past seven years, the ACR Data Science Institute has been engaging researchers, vendors, regulators, and providers on issues that span the AI life cycle. This session will review challenges within the current AI environment and recent efforts to ensure implementation best practices, provide continuous monitoring, and promote an active dialogue on issues critical to AI adoption.

Digital Twins for Disease Modeling and Drug Development: Applications for Smarter, Faster Clinical Trials

Jonathan Walsh, PhD
Unlearn, San Francisco, California

I will describe the use of machine learning models capable of creating digital twins: computational models of individual patients, comprehensively forecasting their future health. They can be used across drug development to optimize trial design, boost trial power, prospectively simulate outcomes, and model treatment response in individuals or subgroups. I will review the machine learning problem, define particular applications, and provide examples. Highlighted topics include data, regulatory policy, and future work.

AI and Multi-modal Modeling in Lung Cancer

Jia Wu, PhD
MD Anderson Cancer Center, Houston, Texas

In this talk, I will discuss the role of multi-modal AI modeling in patient selection and stratification, focusing on its application in optimizing cancer treatment strategies. I will begin by highlighting our clinical-radiomics model for selecting patients treated with Stereotactic Ablative Radiotherapy (SABR) who may benefit from the addition of immunotherapy. Additionally, I will present findings from a multi-center study where a clinicogenomic model was developed to stratify patients receiving immune checkpoint inhibitors, helping guide treatment decisions between IO monotherapy (IO-mono) and combination therapy with chemotherapy (IO+chemo). Beyond patient selection, I will introduce emerging AI-driven tools designed for radiographic analysis, including deep learning models, habitat imaging for tumor characterization, and synthetic PET modeling. These imaging methodologies, when integrated with blood-based biomarkers, offer a powerful approach to recurrence prediction and personalized treatment planning. Finally, I will expand on how AI is transforming the analysis of digital pathology and spatial biology datasets, integrating these insights with other data modalities to address clinical gaps and improve patient outcomes. This talk will showcase the potential of AI-driven multi-modal modeling in advancing precision oncology, demonstrating how these approaches enable more effective and individualized treatment and prevention strategies.

Multi-omics Integration and Pattern Discovery in Patient Data Using Spatially Semantic Topographic Maps

Lei Xing, PhD
Stanford University, California

AI, driven by deep learning, has garnered significant attention in recent years and is increasingly being adopted for various applications in medical imaging and multi-omics data analysis in biomedicine. The remarkable success of AI and deep learning can be attributed to their unique ability to extract essential features from big data and make accurate inferences. This talk aims to update the audience on the latest advancements in the field of omics data analysis, including foundation models and large language models. It will also address the pitfalls of current data-driven approaches, summarize recent developments in interpretable AI, and offer perspectives on the applications of AI in multi-omics data analysis and precision oncology.

Rapidly Exploring Use Cases for Multimodal AI in Radiology

Nur Yildirim, PhD
University of Virginia, Charlottesville

Advances in artificial intelligence (AI) enable unprecedented technical capabilities, yet integrating these advances into real-world healthcare applications remains an open challenge. My research focuses on closing this gap by helping interdisciplinary teams envision low-risk, high-value AI use cases. I will present a case study in radiology imaging that demonstrates how teams can rapidly envision and prototype many use cases for multimodal AI to reduce the risk of developing technologies that clinicians will not use. I will discuss opportunities and challenges for future research to enable human-centered AI innovation in healthcare.

AI Enabled Healthcare Supply Chain Resilience and Risk Management

Jie Yu, PhD
Johnson & Johnson, Houston, Texas

In global healthcare sector, supply chain resilience and risk management are critical to ensure the reliable manufacturing and delivery of essential pharmaceutical products, medical equipment, and medications, when supply chain disruptions occur including geopolitical, economic, environmental, and public health uncertainties. Over 70% of healthcare organizations have experienced business impact and losses due to supply chain disruptions.

In this work, we have developed the cutting-edge AI model based digital twin platform to not only quantify different types of healthcare supply chain risks, but also simulate and predict various scenarios of risk propagations and impacts along the supply chain network from raw materials throughout intermediates until the finished products. The risk metrics including time to recover, time to survive, and residual risk exposure are proposed to quantify the value at risk associated with sales and inventory impacts at supply chain network nodes. The predictive scenario modelling capability can ultimately analyze and generate the optimal risk mitigation actions.

The developed supply chain resilience platform has been deployed to broad range of value streams of pharmaceutical and medical device products to enable automated while predictive risk assessment and mitigations. The benefits include stable healthcare products to market and revenue loss avoidance under different disruptive supply chain events.

BIOGRAPHIES

Planning Committee

Leo Chiang *(Planning Committee Co-Chair)* is a Senior R&D Digital Fellow at Dow Core R&D. He has a broad research interest in emerging AI and data science approaches and his ambition is to guide the industry to achieve AI at scale. Chiang is a trustee of Computer Aids for Chemical Engineering (CACHE), the industry co-chair for the 2025 Dynamics and Control of Process Systems (DYCOPS) conference, and the program chair for the 2026 Foundations of Process/Product Analytics and Machine learning (FOPAM) meeting. He is a Fellow of the American Institute of Chemical Engineers (AIChE) and has received many recognitions including the 2016 Herbert Epstein Award, 2016 Computing Practice Award, and American Automatic Control Council 2020 Control Engineering Practice Award. He was elected to the National Academy of Engineering (NAE) in 2023. Chiang received a B.S. in chemical engineering from the University of Wisconsin-Madison and an M.S. and Ph.D. in chemical engineering from the University of Illinois Urbana-Champaign. He currently serves as a member of the National Academies' Board on Chemical Sciences and Technology (BCST).

Shaheen A. Dewji *(Planning Committee Co-Chair)* is an Assistant Professor in the Nuclear and Radiological Engineering and Medical Physics Programs in the George W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. Prior to her current position, she was a faculty member in the Department of Nuclear Engineering at Texas A&M University and a Faculty Fellow of the Center for Nuclear Security Science and Policy Initiatives. In her preceding role at Oak Ridge National Laboratory, Dewji was Radiological Scientist in the Center for Radiation Protection Knowledge. Her recent research has included assessment of patient release criteria for nuclear medicine patients, as well as development of dose coefficients associated with the external exposure and internal uptake of radionuclides due to environmental or nuclear security exposures. She was recently appointed to serve on the National Council on Radiation Protection and Measurements (NCRP) PAC-6 and the International Commission on Radiological Protection (ICRP) Task Group 127 and Working Party on AI and Radiation Protection, both under Committee 4. Dewji received a B.S. in physics from the University of British Columbia and an M.S. and Ph.D. in nuclear and radiological engineering from the Georgia Institute of Technology. She is an alumna of the Sam Nunn Security Program. She currently serves as a member of the National Academies' Nuclear and Radiation Studies Board (NRSB).

Caroline Chung *(Planning Committee Member)* is vice president and Chief Data and Analytics Officer, Co-director of the Institute for Data Science in Oncology and a tenured professor in Radiation Oncology and Diagnostic Imaging at the University of Texas MD Anderson Cancer Center. Her clinical practice is focused on central nervous system malignancies and her computational imaging lab has a research focus on quantitative imaging and computational modeling to detect and characterize tumors and toxicities of treatment to enable personalized cancer treatment. She is actively involved in multidisciplinary efforts to improve the generation and utilization of quantitative imaging for clinical impact, including Co-Chair of the Quantitative Medical Imaging Coalition (QMIC) and Co-Chair of the Quantitative Imaging for Assessment of Response in Oncology Committee of the International Commission on Radiation Units and Measurements (ICRU). She is also actively involved in efforts to ensure responsible implementation of technology, including AI, in healthcare with roles including Co-Chair of the American Society of

Clinical Oncology (ASCO) AI Community of Practice as well as member of the new NIH Advisory Committee to the Director (ACD) Working Group (WG) on Artificial Intelligence (AI) and National Academies of Sciences, Engineering, and Medicine (NASEM)-appointed committee addressing Foundational Research Gaps and Future Directions for Digital Twins. Beyond her clinical, research, and administrative roles, Dr. Chung enjoys serving as an active educator and mentor with a passion to support the growth of diversity, equity and inclusion in STEM, including her role as Chair of Women in Cancer Chung received an M.Sc. in medical science from the University of Toronto and an M.D. from the University of British Columbia. She is a Fellow of the Royal College of Physicians and Surgeons of Canada.

Sylvain V. Costes *(Planning Committee Member)* was the Data Officer for the Biological and Physical Sciences Division at NASA Headquarters, under the Science Mission Directorate. He previously served for nearly eight years as the Project Manager for NASA's Open Science Data Repository (OSDR.nasa.gov), overseeing the development and management of genetic, epigenetic, proteomic, and physiological data integration. Costes is an expert in radiation biology, co-leading the Radiation Biophysics Laboratory at NASA. He also co-leads the AI for Life in Space (AI4LS) group, leveraging AI and machine learning methodologies to interpret complex space biology datasets. He has received numerous honors, including the NASA Exceptional Scientific Achievement Medal and the NASA Human Research Program Significant Contributor Award. Costes received a Ph.D. in nuclear engineering, specializing in radiation biology and computational modeling, from the University of California, Berkeley.

Anyi Li *(Planning Committee Member)* is the Associate Attending Physicist and Chief of Computer Service at the Department of Medical Physics at Memorial Sloan Kettering Cancer Center where he leads a team comprising mathematicians, physicists, engineers, and data scientists. Together, they collaborate with the Division of Clinical Physics and the Department of Radiation Oncology to harness artificial intelligence, operational research algorithms, and big data. Their objective is to optimize radiation therapy plans, enhance the efficiency of the radiation treatment process from start to finish, develop a data platform for clinical decision support, and improve patient safety by managing accumulated radiation doses. They utilize the latest language models to analyze clinical event timelines and construct workflow knowledge graphs, which improve the radiation therapy workflow and provide valuable insights to the clinical team. With a background as a theoretical nuclear physicist and research scientist tackling NP-hard (nondeterministic polynomial time) problems, Li transitioned into big data engineering and AI, bringing experience from positions at Yahoo and IBM Watson Health. He received a Ph.D. in theoretical nuclear physics from the University of Kentucky.

Ceferino Obcemea *(Planning Committee Member)* is the Program Director in Medical Physics at the National Cancer Institute (NCI). He oversees a portfolio of grants that includes all aspects of clinical physics in radiation oncology, novel medical devices, new treatment modalities such as ion beam therapy, on-line imaging techniques, AI applications in radiotherapy, big data analytics, and machine learning. He also serves as the NCI medical physics liaison to various clinical trial groups comprising the National Clinical Trials Network, the trans-NCI AI/Machine Learning working group as well as a member of the National Institutes of Health Quantum Information science working group. Prior to NCI, he had many years of experience as chief physicist at Memorial Sloan Kettering Cancer Center, Beth Israel Medical Center, and Georgetown University. He received various research fellowships from the Swedish Institute (Stockholm), Niels Bohr Institute (Copenhagen), International Center for Theoretical Physics, ICTP (Trieste) and the

Quantum Theory Project (QTP) at the University of Florida, Gainesville among others. Dr. Obcemea received a Ph.D. in physics from Uppsala University, Sweden and completed his clinical training at Harvard Medical School. He is board-certified by the American Board of Radiology.

Moderators and Participants

Greeshma Agasthya is an assistant professor in Nuclear and Radiological Engineering and Medical Physics Program at the George W. Woodruff School of Mechanical Engineering at Georgia Institute of Technology, where she established the Computational Medical Physics (CoMP) laboratory (2024). Dr. Agasthya received her B.E. in Medical Electronics from Visveswaraya Technological University, India (2005), and MS (2011) and Ph.D (2013) in Biomedical Engineering at Duke University, USA. She completed her postdoctoral training at the Emory Winship Cancer Institute. The Computational Medical Physics Laboratory, led by Dr. Agasthya, focuses on integrating advanced computational methods, medical physics, and biomedical engineering to personalize medical imaging, radiation therapy, and theranostics. Her research interests are: (1) developing multiscale digital twins for personalized radiation dosimetry and outcomes prediction, (2) modeling and simulations to assess novel radiation protocols for cancer diagnosis to cancer treatment, and (3) developing AI frameworks to model patient trajectories in oncology.

Dr. **Jun Deng** is a Professor and Director of Physics Research at the Department of Therapeutic Radiology; a professor at the Department of Biomedical Informatics and Data Science of Yale University School of Medicine; the Principal Investigator of Yale Smart Medicine Lab; and the leading member of the Digital Twins for Health (DT4H) Consortium. Dr. Deng received his PhD from University of Virginia and finished his postdoctoral fellowship at Stanford University. With funding from NIBIB, NSF, NCI, DOE, and YCC, Dr Deng's research has been focused on artificial intelligence, machine learning, and medical imaging for real-time clinical decision support, digital twins of cancer patients, early cancer detection, as well as AI-empowered mobile health. Dr. Deng is an elected fellow of IOP, AAPM, ASTRO, and has been recently selected as one of Key Thought Leaders of the NCI Cancer AI Accelerator Program, one of the Experts for the NIH AIM-AHEAD PAIR Program, and one of the Mentors for the NIH AIM-AHEAD Research Fellows Program.

Matt Dennis is a Data Scientist at the U.S. Nuclear Regulatory Commission (NRC) in the Office of Nuclear Regulatory Research, Division of Systems Analysis and leads the agency's efforts in developing and implementing the NRC Artificial Intelligence Strategic Plan. Additionally, Matt supports the development and maintenance of the MACCS consequence analysis suite of codes and conducts severe accident consequence analyses. Prior to joining the NRC, Matt held positions at Northrop Grumman and Sandia National Laboratories. As a Senior Reliability Engineer with the Reliability Analysis Laboratory at Northrop Grumman's Mission Systems Baltimore, he supported sustainment efforts for Global Hawk, Triton and Phoenix unmanned aircraft systems. As a Senior Member of the Technical Staff in the Risk and Reliability Analysis department at Sandia National Laboratories, Matt led research and development projects supporting risk assessment and consequence analysis for new and operating nuclear reactors, as well as nuclear waste transportation. He has a B.S. and M.S. in Nuclear Engineering from the Missouri University of Science and Technology.

Dr. **Judy W. Gichoya** is an associate professor at Emory university in Interventional Radiology and Informatics leading the HITI (Healthcare AI Innovation and Translational Informatics) lab . Her work is centered around using data science to study health equity. Her group works in 4 areas - building diverse datasets for machine learning (for example the Emory Breast dataset); evaluating AI for bias and fairness; validating AI in the real world setting and training the next generation of data scientists (both clinical and technical students) through hive learning and village mentoring. She serves as the program director for radiology:AI trainee editorial board and the medical students machine learning elective. She has mentored over 60 students across the world (now successful faculty, post doc, PHD and industry employees) from several institutions around the world. She has received several awards including the most influential radiology researcher in 2022 and is a 2023 Emerging Scholar in the National Academy of Medicine.

Pierre-Antoine Gourraud is a university professor and hospital practitioner at the Faculty of Medicine of the University of Nantes (France). He is an Ecole Normale Supérieure de Lyon’s (France) alumni in the Biology Department. After a master's degree in public health from the University of Paris XI in 2002, he obtained a PhD in immunogenetic epidemiology and public health from the University of Toulouse-III in 2005. He lived in San Francisco from 2009 to 2016. He arrived as a post-doctoral researcher in the Department of Neurology at the University of California (UCSF, USA) and left as an associate professor in 2018. In 2006, PA Gourraud received an undergraduate degree with a specialization in philosophy at the Catholic University of Toulouse, which he then used to contribute to the study of bioethical issues in genetics. He did this under the dual influence of two of his mentors, Dr. Anne Cambon-Thomsen, former member of the French National Bioethics Committee and Professor Stephen L. Hauser, member of the Presidential Commission for the Study of Bioethical Issues in the USA. In 2008, he founded Methodomics, a French company dedicated to statistical analysis and algorithm development in biology. During the covid-19 crisis, he distinguished himself by taking the lead, for the Defense Innovation Agency, on the MakAir project, the first ventilation device designed in 3D printing, and the only project in the world to have been tested on humans in duly authorized clinical trials. MakAir has been deployed abroad, especially in Madagascar. This mobilization, also illustrated by the design of the Argos platform for regional monitoring of the pandemic, have made him one of the youngest civilians admitted to the rank of Knight in the Order of the Legion of Honor, at only 41 years old. Like his lectures, his teaching is widely disseminated on the web through a MOOC in Cell Biology and a medical English website "Road 66 to medical English". Author (h-index of 57) of about 200 publications with more than 12,000 citations, his research activities are at the crossroads of immunology, genetics and health data processing. Close to the entrepreneurial world, he has been working with several companies and international groups in the health and biotechnology fields, providing them with the benefit of his expertise.

Heidi Hanson, PhD, is a Senior Scientist and Group Lead of Biostatistics and Biomedical Informatics at Oak Ridge National Laboratory. She is a demographer and life course epidemiologist, with expertise in analysis of population health data. She leads the joint NCI-DOE Modeling Outcomes using Surveillance data and Scalable AI for Cancer (MOSSAIC) and the "Data-Driven Population Health Surveillance at Scale for Pandemic Readiness" project EHRLICH. Her previous projects have taken advantage of large health databases such as the NCI’s Surveillance, Epidemiology, and End-Results (SEER) data, Utah Population Database (UPDB), Demographic Health Survey (DHS), Centers for Medicare and Medicaid Services (CMS), and the National Health and Nutrition Examination Survey (NHANES).

Dr. **Roozbeh Jafari** is a principal staff member in the Biotechnology and Human Systems Division at MIT Lincoln Laboratory with a joint research appointment on MIT campus. He is also an adjunct professor in Electrical and Computer Engineering and in the School of Engineering Medicine at Texas A&M University. Jafari's goal is to establish impactful and highly collaborative programs to promote the health and wellness of interest to our national security and our communities. His aspiration is to serve as a catalyst between Lincoln Laboratory, MIT campus, and other academic entities across the nation for such programs. He joined MIT from Texas A&M where he was the Tim and Amy Leach Professor in Electrical and Computer Engineering and in the School of Engineering Medicine. Jafari received his PhD in computer science from the University of California, Los Angeles, and completed a postdoctoral fellowship at the University of California, Berkeley. His research interests lie in the areas of wearable computer design, sensors, systems, and AI for digital health paradigms and, most recently, digital twin for precision health..

Dr. **Steve Jiang** received his Ph.D. in Medical Physics from Medical College of Ohio in 1998. After completing his postdoctoral training at Stanford University, he joined Massachusetts General Hospital and Harvard Medical School in 2000 as an Assistant Professor of Radiation Oncology. In 2007, Dr. Jiang was recruited to University of California San Diego (UCSD) as a tenured Associate Professor to build Center for Advanced Radiotherapy Technologies, for which he was the founding and executive director. He was then promoted to Full Professor with tenure in 2011. At UCSD, Dr. Jiang pioneered in utilizing GPU for healthcare supercomputing, with his team developing over 40 toolkits to speed up medical imaging and cancer radiotherapy tasks. In October 2013, Dr. Jiang joined University of Texas Southwestern Medical Center as a tenured Full Professor, Barbara Crittenden Professor in Cancer Research, Vice Chair for Digital Health and AI of Radiation Oncology Department, and Director of Medical Physics and Engineering Division. Dr. Jiang is a Fellow of Institute of Physics, American Association of Physicists in Medicine, and American Institute of Medical and Biological Engineering. Dr. Jiang's research in various areas of cancer radiotherapy has been funded by federal, state, charitable, and industrial grants for over 20 million dollars, resulting in over 200 peer-reviewed journal papers with an H-index of 92. His current research interest is on the development and deployment of artificial intelligence technologies to solve medical problems. He is the founding director of Medical Artificial Intelligence and Automation Laboratory at UT Southwestern. He has supervised over 30 postdoctoral fellows and 15 Ph.D. students.

Jayashree Kalpathy-Cramer is the endowed chair in Ophthalmic data sciences and the founding chief of the Division of Artificial Medical Intelligence in the Department of Ophthalmology at the University of Colorado (CU) School of Medicine. She is also the Director for Health Informatics at the Colorado Clinical and Translational Sciences Institute. She leads the development and translation of novel artificial intelligence (AI) methods into effective patient care practices at the Sue Anschutz-Rodgers Eye Center. Previously, she was an associate Professor of Radiology at Harvard Medical School and led imaging AI activities as the Scientific Director at the MGH/WBH Center for Clinical Data Science. Her research interests span the spectrum from novel algorithm development to clinical translation. She is actively involved in AI efforts locally and nationally as a Senior Scientist at the American College of Radiology's Data Science Institute, is on the Artificial Intelligence Committee at the American Academy of Ophthalmology, is a member of the Council of Distinguished Investigators at the Academy for Radiology and Biomedical Imaging Research and is a Deputy Editor for Radiology-AI journal. Dr. Kalpathy-Cramer spent almost a decade in the semiconductor industry before a pivot to academia and healthcare. She has been funded by the NIH, NSF and the

EU and has co-authored over 250 peer-reviewed publications, has written over a dozen book chapters and is a co-inventor on 15 patents.

Paul E. Kinahan, PhD, is a Professor of Radiology and Bioengineering and the Vice-Chair of Radiology Research at the University of Washington in Seattle. He is the Head of the Imaging Research Laboratory and Clinical Director of PET/CT Imaging Physics. His research includes optimizing the physics of PET and CT imaging, the use of image reconstruction methods, objective assessment of image quality, and the use of quantitative analysis in imaging-based clinical trials. He was a member of the team that developed the first PET/CT scanner, and was a founding member and Chair of the NCI Quantitative Imaging Network and the Quantitative Imaging Biomarkers Alliance. He is a co-PI of the Medical Imaging and Data Resource Center (MIDRC.org), a multi-society initiative for the collection and dissemination of medical imaging and associated data. Most recently he is the co-chair of the RSNA Quantitative Imaging Committee, which has the goal of increasing the use of quantitative imaging biomarkers in clinical practice.

Zhenqiu Liu, PhD, is a senior scientist at Radiation Effects Research Foundation (RERF) with extensive expertise in bioinformatics, computational medicine, and data science. A prolific researcher with over 150 publications, his current work focuses on advancing machine learning and AI methods for low-dose radiation risk assessment. By integrating epidemiological, genomic, and clinical data, his research addresses critical challenges in understanding radiation effects.

Dr. **Daniel Marcus** is a professor of radiology at Washington University School of Medicine and director of the Computational Imaging Research Center, an interdisciplinary team of engineers, scientists, software developers, and informaticists all contributing towards the common goal of enabling imaging in biomedical research. The center develops XNAT, the world's most widely used imaging informatics platform, and contributes to the international biomedical informatics infrastructure through a portfolio of NIH-funded projects. Dr. Marcus directs imaging informatics operations for a number of large-scale research programs, including the Human Connectome Project, the Connectome Coordination Facility, the Dominantly Inherited Alzheimer Network, and the Neuroimaging Informatics and Analysis Center.

Cameron Piron, MS, currently serves as President and Co-founder of Synaptive Medical and sits on the Board of Directors as a chair. He is an industry-recognized leader and innovator in image-guided surgery. Prior to co-founding Synaptive Medical, Cameron was President and Co-Founder of Sentinelle Medical, a medical device company that developed and manufactured advanced MRI-based breast imaging technologies.

Dr. **Etta Pisano** joined ARPA-H as Portfolio Lead overseeing the Advancing Clinical Trials Readiness (ACTR) initiative in March 2024. She also currently serves as the Chief Research Officer at the American College of Radiology and as the Principal Investigator for the NCI-funded ECOG-ACRIN-sponsored Tomosynthesis Mammographic Imaging Screening Trial (TMIST) which is comparing digital mammography to tomosynthesis for breast cancer screening and has recruited 108,600 women at 133 centers in the US, Canada, Argentina, Peru, Italy, Spain, Thailand, Taiwan and S Korea since it opened in July 2017. She has adjunct faculty appointments in radiology at the University of Pennsylvania and the University of North Carolina at Chapel Hill. After completing her undergraduate degree in Philosophy at Dartmouth College, Dr. Pisano received her MD from Duke University School of Medicine. She did her radiology residency at Beth Israel Hospital at Harvard Medical School. She next served on the faculty at the University of North Carolina Medical School where she was founding Chief of Breast Imaging for 16 years before becoming Vice Dean for Academic Affairs, overseeing the research and education missions of the medical school. While at UNC, she also served as the first Principal Investigator for the CTSA grant from the National Center for Advancing Translational Sciences and the founding Director of the Biomedical Research Imaging Center. After serving as Dean of the College of Medicine and Vice President for Medical Affairs at the Medical University of South Carolina, she joined the faculty of Harvard Medical School serving as Professor in Residence at Beth Israel-Deaconess Health System from 2015-2021. Her career has focused on breast imaging with a special focus on the development and testing of new technologies, most recently studying the application of Artificial Intelligence and Machine Learning to breast cancer screening. Dr. Pisano is a member of the National Academy of Medicine (NAM) and has received gold medals from the Radiological Society of North America, the American Roentgen Ray Society and the Association of University Radiologists. She is a Fellow of the American College of Radiology, the Society of Breast Imaging and the American Association of Women Radiologists, and is a member of the International Society of Strategic Studies in Radiology. She also has been recognized by the National Women's History Museum for her accomplishments and has received the Marie Curie Award from the Association of Women Radiologists.

David C. Rhew, M.D., is Microsoft's Global Chief Medical Officer and VP of Healthcare. He has served as Microsoft's International Coordinator for the Pandemic Response, working with WHO to develop their World Health Data Hub, CDC to standup their vaccine data lake, and U.S. states to roll-out COVID-19 vaccines. He is Adjunct Professor at Stanford University; holds six U.S. technology patents that enable authoring, mapping, and integration of clinical decision support into electronic health records; and has been recognized as one of the 50 most influential clinician executives by Modern Healthcare. Dr. Rhew received his Bachelors of Science degrees in computer science and cellular molecular biology from University of Michigan. He received his MD degree from Northwestern University and completed internal medicine residency at Cedars-Sinai Medical Center. He completed fellowships in health services research at Cedars-Sinai and infectious diseases at UCLA. He has served as CMO for Samsung and Zynx Health and sat on National Quality Forum's Executive CSAC Board. He is Chair-emeritus for Consumer Technology Association's Health Technology Board and currently serves on AdvaMed's Digital Health Board; the Governing Committee for NESTcc, the medical device advisory group for FDA, CMS, and NIH; and the Board of Directors for Cedars-Sinai Medical Center.

Dr. **Matt Rosen** is a physicist, tool-builder and inventor whose research bridges the spectrum from fundamental physics to applied bioimaging work in the field of MRI. The Rosen Lab focuses on new methods and tools to enable unconventional approaches to MRI scanner construction. In addition, Dr. Rosen Co-directs the Center for Machine Learning at the Martinos Center. Dr. Rosen is a Fellow of the American Physical Society, a Fellow of the International Society of Magnetic Resonance in Medicine and was named Distinguished Investigator by the Academy for Radiology and Biomedical Imaging Research in 2023. He is the Kiyomi and Ed Baird MGH Research Scholar, and an Associate Professor of Radiology at Harvard Medical School. He is the Founder of five companies including Hyperfine, which has developed the world's first portable MRI scanner which can be used at the patient bedside by virtue of its operation at low magnetic field. He has served on the scientific advisory boards of nine companies since 2014. He is the Startup Innovation Expert for MGB Enterprise Radiology (ERIE).

Dr. **Igor Shuryak** is an Associate Professor of Radiation Oncology at the Center for Radiological Research, Columbia University. He holds a BA in Biology and Environmental Sciences from Columbia College, an MD from SUNY Downstate Medical Center, and a PhD in Environmental Health Sciences from Columbia University. Dr. Shuryak's research focuses on quantitatively modeling radiation effects, including radiation carcinogenesis, cancer treatment, space radiation effects, and radioresistance. His interdisciplinary background combines proficiency in computational research using mechanistic modeling and machine learning with expertise in biology, medicine, and cancer epidemiology. Dr. Shuryak has received several awards, including the Radiation Research Editor's Award and the Jack Fowler Award from the Radiation Research Society. His current area of interest involves integrating causal machine learning with mechanistic modeling techniques to better understand radiation effects and improve radiotherapy outcomes.

Dr. **Amber Simpson**, Canada Research Chair in Biomedical Computing and Informatics, seeks to transform how clinicians treat patients with cancer using a data-driven approach. By defining relevant biomarkers to guide targeted treatments, and ultimately improve human health, she will move the field from the "treat everyone to help a few" paradigm towards precision medicine. Simpson leverages state-of-the-art machine learning technologies for biomedical data integration and exploration. Specifically, to develop, validate, and translate to clinical practice two important field innovations. The first will develop benchmarking and novel machine learning-based predictive and prognostic imaging biomarkers to better select patients for optimal treatment. The second innovation will be to integrate computation modelling of multi-scale, multi-resolution biomedical data to elucidate new phenotypes, such as appearance, development, and behaviour, of cancer tumors.

Dr. **Daniel Sullivan** is Professor Emeritus, Department of Radiology at Duke University Medical Center. He completed radiology residency and nuclear medicine fellowship in 1977 at Yale-New Haven. Dr. Sullivan held faculty appointments at Yale University Medical Center, Duke University Medical Center, and University of Pennsylvania Medical Center, before joining the National Cancer Institute at NIH in 1997. From 1997 to 2007 Dr. Sullivan was Associate Director in the Division of Cancer Treatment and Diagnosis of the National Cancer Institute (NCI), and Head of the Cancer Imaging Program (CIP) at NCI. He is Founder and Chair Emeritus of the Quantitative Imaging Biomarkers Alliance (QIBA), and one of the Founders of the Quantitative Medical Imaging Coalition (QMIC). QMIC coordinates a wide range of national and international activities related to the evaluation and validation of quantitative imaging biomarkers for clinical research and practice. His areas of clinical and research expertise focus on improving the use of imaging as a biomarker in clinical trials and clinical practice.

Dr. **Charles A. Taylor** is the W.A. “Tex” Moncrief, Jr., Chair in Computational Medicine, Professor, in the Department of Internal Medicine and the Oden Institute for Computational Engineering and Sciences and Director of the Center for Computational Medicine at the University of Texas at Austin. Dr. Taylor is also a Founder and Member of the Board of Directors of HeartFlow Inc, a company that provides patient-specific computer models of the coronary arteries for diagnosing and treating heart disease. He was Chief Technology Officer at HeartFlow from 2010 to 2021 and then Chief Scientific Officer from 2021 to 2023. Dr. Taylor is also the Chairman of Ebenbuild, GmBh, a company building patient-specific lung digital twins for diagnosing and treating respiratory diseases. Prior to HeartFlow, he was an Associate Professor in the Departments of Bioengineering and Surgery at Stanford University. He is internationally recognized for his pioneering work over the last 30 years in combining computer simulation methods with medical imaging data for patient-specific modeling of blood flow to aid in the diagnosis and treatment of cardiovascular disease. Dr. Taylor has published over 450 peer-reviewed journal and conference papers and has more than 300 issued patents worldwide. He received his B.S. degree in Mechanical Engineering, M.S. degree in Mechanical Engineering and M.S. degree in Mathematics from Rensselaer Polytechnic Institute and a Ph.D. in Mechanical Engineering from Stanford University. Charles became a fellow of the American Institute of Medical and Biological Engineering in 2007 and was elected into the U.S. National Academy of Engineering in 2024.

Mike Tilkin, MS, is the Chief Information Officer (CIO) and the Executive Vice President for Technology at the American College of Radiology. In that capacity, he leads IT and informatics initiatives that support the broad ACR portfolio, including accreditation, national data registries, education, and clinical research. Mr. Tilkin is engaged in standards and informatics efforts nationally and is responsible for the ACR Data Science Institute, a division of the ACR dedicated to promoting the research, development, and adoption of artificial intelligence in imaging.

Jon Walsh is the co-founder of Unlearn and a scientist passionate about bringing ideas to life and helping teams succeed. He began his career in high-energy physics with a Ph.D. from the University of Washington and a postdoc at UC Berkeley, where he worked on modeling and simulating experiments at the Large Hardon Collider. Jon met his Unlearn co-founders while working as a Data Scientist at Leap Motion. At Unlearn, Jon has built technology across data science, machine learning, and statistics, leading and growing several teams across disciplines. He enjoys working with teams to solve challenging problems for customers.

Dr. **Jia Wu** is a tenured Associate Professor leading a multi-modal machine learning lab at the intersection of imaging physics, oncology, and computational sciences. His research specializes in machine learning, medical image analysis, and radio-immunogenomics, with a strong focus on developing innovative computational tools to improve cancer prevention, diagnosis, treatment selection, and monitoring. As a Principal Investigator (PI) or co-Investigator on multiple NIH- and CPRIT-funded projects, Dr. Wu has made significant contributions to radiomics, pathomics, and radiogenomics, publishing over 80 peer-reviewed journal articles—more than 40 as a first or senior author. His work has been featured in top-tier journals, including Lancet Digital Health, Nature Machine Intelligence, Radiology, Cell Reports Medicine, The Journal of Pathology, and Modern Pathology. Dr. Wu's research continues to push the boundaries of AI-driven oncology, shaping the future of precision medicine.

Dr. **Lei Xing** is the Jacob Haimson and Sarah S. Donaldson Professor and Director of Medical Physics Division of Radiation Oncology Department at Stanford University School of Medicine. His research has been focused on AI in medicine, data science, medical imaging, treatment planning and clinical decision-making. Dr. Xing is an author on more than 450 publications in high impact journals, an inventor/co-inventor on many issued and pending patents, and a co- investigator or PI on numerous grants. He is a fellow of AAPM, ASTRO, and AIMBE. He is the recipient of the 2023 Edith Quimby Lifetime Achievement Award of AAPM.

Nur Yildirim is a Human-Computer Interaction (HCI) designer and an assistant professor at the University of Virginia’s School of Data Science. Her research focuses on bringing design thinking and participatory approaches to AI innovation to make AI technologies useful in real-world contexts. Nur received her Ph.D. from Carnegie Mellon’s HCI Institute and spent time at Google Research and Microsoft Research working on human-centered AI innovation. She was named a Rising Star by Michigan AI Lab and MIT EECS. The National Institutes of Health, the National Science Foundation, and Accenture have supported her work. Before academia, Nur worked as a design practitioner in the industry, shipping award-winning products ranging from medical to consumer electronics to assistive robots to toys.

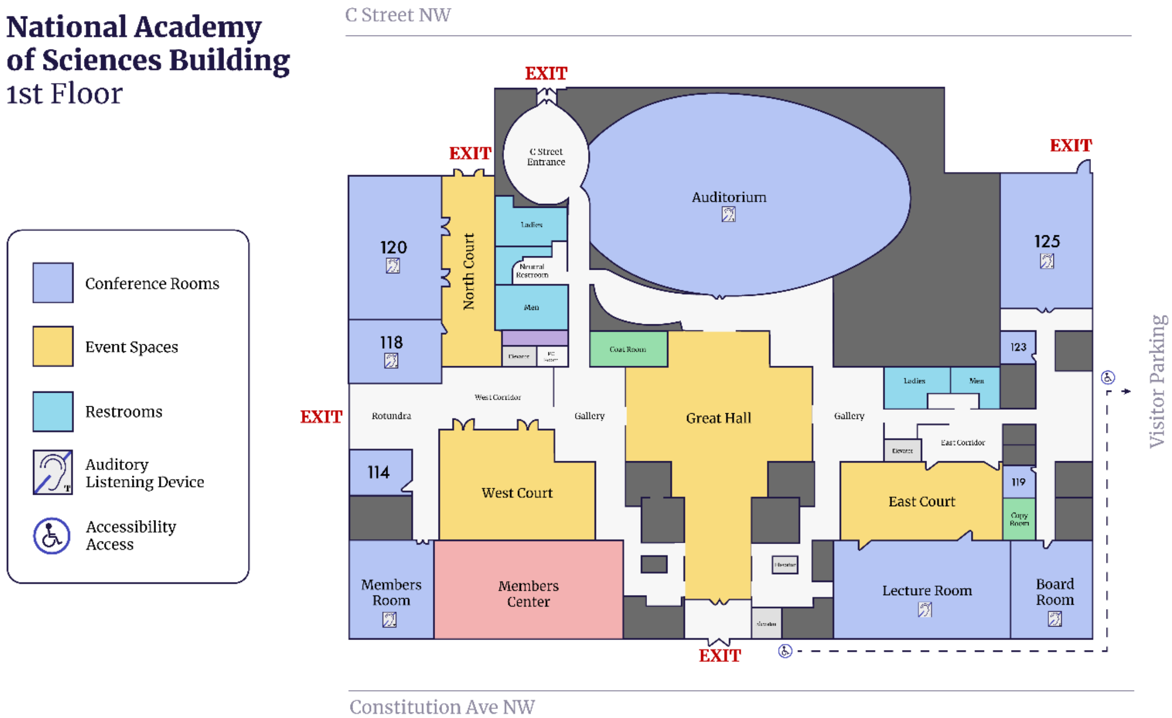
Jie Yu is the Head of Digital & Data Science Product Management at Johnson & Johnson. He is leading the digital product management team for enterprise functions and driving the digital transformation journey in supply chain across sectors in J&J, including strategy, portfolio roadmap, and lifecycle management of digital products and solutions. Meantime, Jie leads the Impact Pillar of J&J AI Council as well as co-chair J&J Data Science Community of Practice (CoP). Jie has over 15 years of experience in digital transformation, AI, machine learning, data science, and digital product management. Prior to joining Johnson & Johnson, Jie held various technical and leadership roles at Shell and McMaster university. Jie holds a Ph.D. in Chemical Engineering with a focus on AI and Machine Learning from the University of Texas at Austin, and a Bachelor of Science in Bioengineering from Zhejiang University in China.

STAFF

Daniel Mulrow, Ph.D., is a program officer of the Nuclear and Radiation Studies Board (NRSB) and this Beebe Symposium's staff director. While at the national academies he is the primary staff officer for NRSBs portfolio on radiation health effects and has supported two consensus studies. He serves as the National Academies program manager for the Radiation Effects Research Foundation (RERF) Program, a U.S.-Japan cooperative research institute that investigates the health effects of atomic bomb radiation for peaceful purposes. Before the National Academies, Dr. Mulrow worked at the National Nuclear Security Administration for multiple years supporting efforts in stockpile stewardship and strategic partnerships and engagements. He received his Ph.D. in Chemistry from Washington University in St. Louis. His research interests included initial studies in ultra-high dose rate (or FLASH) radiation therapy, and the development and characterization of dosimeters and radiation detectors.

Francis Amankwah, MPH, serves as Co-Director of the National Cancer Policy Forum and as a Senior Program Officer with the Board on Health Care Services. He has managed consensus study committees and guided those committees in consensus building. He was the responsible staff officer on the National Academies consensus study which produced the report, Ending Unequal Treatment: Strategies to Achieve Equitable Health Care and Optimal Health for All. He served as the responsible staff officer on the National Academies congressionally mandated consensus study which produced the consensus report, Medications in Single Dose Vials: Implications of Discarded Drug. He also played an integral role in the development of the National Academies consensus reports, Guiding Cancer Control: A Path to Transformation; and Making Medicines Affordable: A National Imperative. He has also served as the responsible staff officer on numerous workshops and convening activities, and rapporteur of several workshop proceedings. He is a recipient of the Health and Medicine Division Elena Nightingale, Veteran, Mount Everest, and Fineberg staff achievement awards. He earned his M.P.H. and a graduate certificate in global planning and international development from Virginia Tech. He was raised in Ghana, where he earned his B.S. degree in agricultural science from Kwame Nkrumah University of Science and Technology.

Charles D. Ferguson is the Senior Board Director of the Nuclear and Radiation Studies Board and the Board on Chemical Sciences and Technology in the Division on Earth and Life Studies at the National Academies of Sciences, Engineering, and Medicine. Previously, he was the president of the Federation of American Scientists (FAS). Prior to FAS, he worked as the Philip D. Reed senior fellow for science and technology at the Council on Foreign Relations (CFR), where he specialized in nuclear issues, and served as project director for the Independent Task Force on U.S. Nuclear Weapons Policy chaired by William J. Perry and Brent Scowcroft. Before CFR, he was the scientist-in-residence at the Monterey Institute's Center for Nonproliferation Studies, where he co-authored the book The Four Faces of Nuclear Terrorism (Routledge, 2005) and was lead author of the January 2003 report Commercial Radioactive Sources: Surveying the Security Risks. For his work on security of radioactive sources, he was awarded the Robert S. Landauer Memorial Lecture Award from the Health Physics Society in 2003. He is also the author of Nuclear Energy: What Everyone Needs to Know (Oxford University Press, 2011). In addition, he has worked as a physical scientist in the Office of Nuclear Safety at the U.S. Department of State, and he has served as a nuclear engineering officer and submarine officer in the U.S. Navy. He is an elected fellow of the American Physical Society in recognition of his service to public policy and public education on nuclear issues. Dr. Ferguson earned a BS in physics with distinction from the U.S. Naval Academy and MA and PhD degrees, also in physics, from Boston University.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