WELCOME

Dear Colleagues:

Welcome to the fifth annual University of Maryland School of Medicine **Festival of Science**, a day-long celebration of the groundbreaking research being conducted on campus.

**The theme of this year’s Festival is Mobility and Disability in Aging: Causes, Consequences and Strategies for Restoration.** As we have reflected on our extraordinary 210-year history over this last year, and how adeptly the School has evolved to meet the challenges of each passing decade, we also recognize that not everything can move so nimbly with age, including ourselves. However, humans are living longer than ever before due, in large part, to the incredible advances in biomedical research.

We are tremendously fortunate to have a dedicated cadre of School of Medicine faculty who have devoted their careers to unraveling the causes and consequences of diseases and conditions often associated with aging, as well as developing innovative approaches to preventing, managing and treating patients. Their groundbreaking work is helping to ensure that our “golden years” can also be our “golden age.”

I am pleased that our esteemed Scientific Advisory Council will join us again this year to provide critical advice on our research portfolio. I also wish to extend a warm welcome to our newest Council member, **Dr. George Hill**, Distinguished Professor Emeritus of Pathology, Microbiology and Immunology at Vanderbilt University. We are deeply honored that **Dr. Luigi Ferrucci**, Scientific Director of the National Institute on Aging at the National Institutes of Health, will give the keynote address and has graciously agreed to serve as a guest member of our esteemed Scientific Advisory Council.

The Festival of Science is a cornerstone of **Shared Vision 2020** and the **ACCEL-Med** (Accelerating Innovation and Discovery in Medicine) Initiative. I extend my deep appreciation to all who helped develop today’s program.

I look forward to an engaging and stimulating day of scientific discourse, and appreciate your participation and support of the School of Medicine’s biomedical research enterprise.

Sincerely yours,

E. Albert Reece, MD, PhD, MBA
Executive Vice President for Medical Affairs, University of Maryland
John Z. and Akiko K. Bowers Distinguished Professor and
Dean, University of Maryland School of Medicine
MOBILITY DISABILITY in AGING
Causes, Consequences and Strategies for Restoration

AGENDA

7:30-7:55am  BREAKFAST
Coffee, tea and breakfast pastries will be available in the Atrium of Leadership Hall

8:00-8:10am  WELCOME
E. Albert Reece, MD, PhD, MBA
Executive Vice President for Medical Affairs, University of Maryland
John Z. and Akiko K. Bowers Distinguished Professor and
Dean, University of Maryland School of Medicine

8:15-8:45am  KEYNOTE ADDRESS
Luigi Ferrucci, MD, PhD
Scientific Director, National Institute on Aging
National Institutes of Health

8:50-9:05am  HISTORY AND PRESENT STATE OF RESEARCH ON AGING IN THE UMSOM
AND OVERVIEW OF SESSION ONE
Jay Magaziner, PhD, MSHyg
Professor and Chair, Department of Epidemiology & Public Health
Director, Center for Research on Aging

9:10-11:55am  SESSION ONE: Bones, Muscles, Joints, Energetics, and Mobility
Moderator: Curt Civin, MD
Professor, Department of Pediatrics
Director, Center for Stem Cell Biology & Regenerative Medicine
Associate Dean for Research

9:10-9:30am  Changes in Mobility, Body Composition, and Function After Hip Fracture: Findings From the Baltimore Hip Studies
Denise L. Orwig, PhD
Associate Professor, Department of Epidemiology & Public Health

9:35-9:55am  Bringing Osteoarthritis Into the 21st Century: A Disease of the Whole Joint
Marc C. Hochberg, MD, MPH
Professor, Department of Medicine
Division Head, Rheumatology and Clinical Immunology

10:00-10:20am  Moving Muscles in the Context of Aging and Disease
Alice S. Ryan, PhD
Professor, Department of Medicine

10:25-10:35AM  BREAK

10:40-11:20am  Microtubule Mechanotransduction in Aging Heart, Skeletal Muscle, and Bone

10:40-10:50am  • Heart Muscle
W. Jonathan Lederer, MD, PhD
Professor, Department of Physiology
Director, Center for Biomedical Engineering & Technology

10:50-11:00am  • Skeletal Muscle
Christopher W. Ward, PhD
Associate Professor, Department of Organizational Systems and Adult Health, University of Maryland School of Nursing
Associate Professor, Department of Orthopaedics, University of Maryland School of Medicine
11:00-11:10am • Bone
Joseph P. Stains, PhD
Associate Professor, Department of Orthopaedics
Interim Director of Musculoskeletal Research

11:25-11:55am  SESSION ONE Q&A

NOON-12:55pm  LUNCH  Provided in the Atrium of Leadership Hall

1:00-3:30pm  SESSION TWO: Brain, Balance, Disease and Mobility
Moderator:  James B. Kaper, PhD
Senior Associate Dean for Academic Affairs
Professor and Chair, Department of Microbiology & Immunology

1:00-1:15pm  OVERVIEW OF SESSION TWO
Mark Rogers, PT, PhD
Professor and Chair, Department Physical Therapy & Rehabilitation Science

1:20-1:40pm  Mobility & Disability in Parkinson Disease: Decoding Patterns in Multidimensional Data
Lisa M. Shulman, MD
Eugenia Brin Professorship in Parkinson’s Disease and Movement Disorders
The Rosalyn Newman Distinguished Scholar in Parkinson’s Disease
Professor, Department of Neurology and Director of the Division of Movement Disorders
Director, University of Maryland Parkinson’s Disease and Movement Disorders Center

1:45-2:05pm  Robot-Aided Musculoskeletal Rehabilitation
Li-Qun Zhang, PhD
Professor, Department of Physical Therapy & Rehabilitation Science

2:10-2:30pm  Protective Arm Movements for Fall Prevention in the Elderly
Kelly P. Westlake, PhD, MSc, PT
Assistant Professor, Department of Physical Therapy & Rehabilitation Science

2:35-2:55pm  Vascular Disease, Mobility and Cognition
Brajesh K. Lal, MBBS
Professor, Department of Surgery

3:00-3:30pm  SESSION TWO Q&A

3:35pm  CLOSING REMARKS
E. Albert Reece, MD, PhD, MBA

RECEPTION  Dessert and coffee reception will be held in the Atrium of Leadership Hall immediately following the Festival

Accreditation Statement The UMSOM is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

Credit Designation Statement The UMSOM designates this Live Activity for a maximum of 6.50 AMA PRA Category 1 Credits.™ Physicians should claim only the credit commensurate with the extent of their participation in the activity.
MOBILITY DISABILITY in AGING
Causes, Consequences and Strategies for Restoration

CME INFORMATION

CME SPONSORSHIP
This educational activity is sponsored by the University of Maryland School of Medicine.

ACTIVITY DIRECTOR
E. Albert Reece, MD, PhD, MBA
Executive Vice President for Medical Affairs, University of Maryland
John Z. and Akiko K. Bowers Distinguished Professor and Dean
University of Maryland School of Medicine

TARGET AUDIENCE
The target audience for this educational activity includes physicians, clinicians, researchers and other healthcare professionals with an interest in mobility and disability in the aging.

LEARNING OBJECTIVES
At the conclusion of this activity, participants should be able to:
• Describe the features of bone, muscle and joint function in normal aging and after hip fracture.
• Describe age-dependent alterations in cellular function in heart, skeletal muscle and bone, and the role of exercise and nutrition in muscle recovery.
• Identify the roles of vascular and neurologic diseases and their impact on balance, mobility and cognition.

ACCREDITATION AND CREDIT DESIGNATION
The University of Maryland School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The University of Maryland School of Medicine designates this Live activity for a maximum of 6.50 AMA PRA Category 1 Credits.™ Physicians should claim only the credit commensurate with the extent of their participation in the activity.

DISCLOSURE
It is the policy of the University of Maryland School of Medicine to ensure balance, independence, objectivity, and scientific rigor in all of its educational activities. In accordance with this policy, all persons in a position to control the educational content of this activity must disclose any relevant financial relationships they have with commercial interests. Any identified conflicts of interest must be resolved prior to the speaker’s presentation.

The following individuals have disclosed no relevant financial relationships with commercial interests:
E. Albert Reece, MD, PhD, MBA; Curt Civin, MD; Kevin Enright; Luigi Ferrucci, MD, PhD; Marc Hochberg, MD, MPH; James Kaper, PhD; Brajesh Lal, MBBS; W. Jonathan Lederer, MD, PhD; Jay Magaziner, PhD, MSHyg; Denise Orwig, PhD; Mark Rogers, PT, PhD; Julie Rosen, PhD; Alice Ryan, PhD; Lisa Shulman, MD; Joseph Stains, PhD, Christopher Ward, PhD; and Kelly Westlake, PhD, MSc, PT.
The following individuals have disclosed relevant financial relationships with commercial interests:

Li-Qun Zhang, PhD
Rehabtek LLC - Rehabtek received federal SBIR phase I and II grants in developing the rehabilitation robot and provided it to our relevant research/clinical studies free of charge. I and spouse hold equity position in Rehabtek. I also received relevant research grants.

University of Maryland School of Medicine Office of CME staff members have disclosed no relevant financial relationships.

DISCUSSION OF OFF-LABEL OR INVESTIGATIONAL USES
Presentations in this continuing medical education activity may contain references to unlabeled or unapproved uses of drugs or devices. The audience is advised to consult the full prescribing information of all drugs or devices prior to use. Some drugs/devices identified during this activity may have United States Food and Drug Administration (FDA) clearance for specific purposes only or for use in restricted research settings. The FDA has stated that it is the responsibility of the prescribing health care professional to determine the FDA status of each drug or device that he/she wishes to use in clinical practice, and to use the products in compliance with applicable law.

UMSOM requires that all contributors disclose any unlabeled use or investigational use (not yet approved for any purpose) of pharmaceutical and medical device products and provide adequate scientific and clinical justification for such use. Physicians and other healthcare professionals are urged to fully review all the available data on products or procedures before using them to treat patients.

DISCLAIMER
This CME activity is designed for use by healthcare professionals for educational purposes only. Information and opinions offered by the contributors represent their viewpoints. Conclusions drawn by the participant should be derived from careful consideration of all available scientific information. Prescription information and use of medical devices should be undertaken only after confirmation of information by consulting the FDA-approved uses and information.

While UMSOM makes every effort to have accurate information presented, no warranty, express or implied, is offered with respect to the information presented. Each participant should use his/her clinical judgment, knowledge, experience, and diagnostic decision-making before applying any information provided in this CME activity.
Dr. Reece is the Executive Vice President for Medical Affairs, University of Maryland; the John Z. and Akiko K. Bowers Distinguished Professor, and Dean of the School of Medicine. He is also professor in the departments of Obstetrics and Gynecology, Medicine, and Biochemistry & Molecular Biology. He is a member of the prestigious National Academy of Medicine (NAM).

Originally from Jamaica, West Indies, Dr. Reece completed a Bachelor of Science degree with honors (*Magna Cum Laude*) from Long Island University; a MD degree from New York University School of Medicine; a PhD degree in biochemistry from the University of the West Indies, Kingston, Jamaica; and a MBA degree from the Fox School of Business & Management of Temple University. He completed an internship and residency in obstetrics and gynecology at Columbia University Medical Center, and a postdoctoral fellowship in Maternal-Fetal Medicine at Yale University School of Medicine. He remained on the full-time faculty at Yale for almost 10 years, during which he served as Clinical Instructor from ‘82 to ‘84; Assistant Professor from ‘84 to ‘87; and received accelerated promotion to Associate Professor in 1987. In November 1990, at the age of 39, he was recruited by Temple University to serve as the Abraham Roth Professor and Chairman of the Department of Obstetrics, Gynecology and Reproductive Sciences. Between 2001 and 2006, he served as Vice Chancellor of the University of Arkansas for Medical Sciences and dean of the College of Medicine. In 2006, he was recruited by the University of Maryland to serve in his current capacity. In 2010, Dr. Reece served as Acting President of the University of Maryland.

In addition to his administrative responsibilities, he is actively involved in research and education. His research focuses on diabetes in pregnancy, birth defects and prenatal diagnosis. He directs a National Institutes of Health (NIH) multi-million dollar research laboratory group studying the bio-molecular mechanisms of diabetes-induced birth defects. His laboratory has determined that there are specific cytoarchitectural changes at the epithelial level of the cell associated with these anomalies. Biochemical changes include depletion in membrane lipids and phospholipids as well as excess “free radicals.” His group is now studying the molecular mechanisms, and methods to prevent these anomalies. He and his colleagues have also developed the technique of embryofetoscopy for early prenatal diagnosis and eventually for curative fetal therapy. He is a sought after Visiting Professor and Lecturer at numerous institutions both nationally and internationally.

He has published extensively in the scientific literature: 12 books including revisions; 5 monographs; and more than 500 articles, chapters, and abstracts. He recently served as Chair of the Council of Deans of the Association of American Medical Colleges (AAMC). He serves or has served on many governmental and civic organizations and committees such as, the Food and Drug Administration, the NAM, the NIH, the Secretary of Health & Human Services Committee on Infant Mortality, The March of Dimes Birth Defects Foundation, the Massachusetts General Hospital Scientific Advisory Committee, the Board (Chairman) of the Nelly Berman Classical Music Institute, the Agnes Irwin School for Girls and the Baltimore Symphone Orchestra Board. He receives numerous special recognitions and awards including, the Distinguished Leadership Award in 2009, the 2010 Berson Medical Alumni Achievement Award in Health Sciences from his *alma mater*; New York University School of Medicine, and the 2010 Distinguished Service Award from Loma Linda University, the 2012 American Diabetes Association’s Norbert Freinkel Research Award, the AAMC David E. Rogers Award, the 2016 Maryland House of Delegates Speaker’s Medallion Award and the 2016 *Honoris causa* Doctor of Science Degree from Northern Caribbean University.
Luigi Ferrucci, MD, PhD

Dr. Ferrucci is the Scientific Director at the National Institute on Aging (NIA) at the National Institutes of Health. He is a geriatrician and an epidemiologist who conducts research on the causal pathways leading to progressive physical and cognitive decline in older persons. He has made major contributions in the design of many epidemiological studies conducted in the U.S. and in Europe. Dr. Ferrucci received a Medical Degree and Board Certification in 1980, Board Certification in Geriatrics in 1982 and PhD in Biology and Pathophysiology of Aging in 1998 at the University of Florence, Italy. Between 1985 and 2002 he was Chief of Geriatric Rehabilitation at the Department of Geriatric Medicine and Director of the Laboratory of Clinical Epidemiology at the Italian National Institute of Aging. In September 2002, he became the Chief of the Longitudinal Studies Section at NIA. From 2002 to 2014 he was the Director of the Baltimore Longitudinal Study on Aging. Dr. Ferrucci has served in his current role at the NIA since May 2011.
SCIENCE

The SOM FESTIVAL

of SCIENCE
Ralph Snyderman, MD

Dr. Snyderman is Chancellor Emeritus, Duke University, and the James B. Duke Professor of Medicine in the Duke University School of Medicine. He served as Chancellor for Health Affairs and Dean of the School of Medicine at Duke University from 1989 to July 2004, and led the transition of this excellent medical center into an internationally recognized leader of academic medicine. A graduate of Washington College in Chestertown, Maryland (1961), Snyderman received his MD, magna cum laude, in 1965 from the Downstate Medical Center of the State University of New York. He served his internship and residency in medicine at Duke and later worked as a Public Health Officer doing research in immunology at the National Institutes of Health (NIH) (1967-72).

He oversaw the development of the Duke University Health System, one of the most successful integrated academic health systems in the country, and served as its first President and Chief Executive Officer. Dr. Snyderman has played a leading role in the conception and development of Prospective Health Care, a novel approach to personalized and integrative health care which is evolving as a model for national health care delivery. He was amongst the first to envision and articulate the need to move the current focus of health care from the treatment of disease-events to personalized, preventive, and participatory care. For this work, he received the 2012 David E. Rogers Award from the Association of American Medical Colleges, which referred to Dr. Snyderman as the “father of personalized medicine.”

Earlier in his career, Dr. Snyderman performed seminal research defining how white blood cells respond to chemical signals to mediate host defense or tissue damage and is internationally recognized for his contributions in inflammation research. In 1987, he left Duke to serve as Senior Vice President for Medical Research at Genentech, Inc., a pioneering biomedical technology firm. While at Genentech, he led the development and licensing of several major biotechnology therapeutics. Dr. Snyderman has received numerous honors and awards during his career recognizing his contributions to research and to developing more rational, effective, and compassionate models of health care.

Dr. Snyderman has played a prominent role in the leadership of such important national organizations as the Association of American Physicians, the Institute of Medicine and the Association of American Medical Colleges. He is a member of the National Academy of Medicine (formerly the Institute of Medicine) of the National Academy of Sciences, and the American Academy of Arts & Sciences. Dr. Snyderman is the recipient of numerous scientific and leadership awards. His bibliography exceeds 380 manuscripts, as well as numerous books.
Dr. Colwell is Distinguished University Professor, both at the University of Maryland, College Park and at the Johns Hopkins University Bloomberg School of Public Health; Senior Advisor and Chairman Emeritus, Canon US Life Sciences, Inc.; and President and Chairman of CosmosID, Inc. Her interests are focused on global infectious diseases, water and health, and she is currently developing an international network to address emerging infectious diseases and water issues, including safe drinking water for both the developed and developing world, in collaboration with Safe Water Network.

Dr. Colwell served as the 11th Director of the National Science Foundation (NSF), from 1998 to 2004. In her capacity as NSF Director, she served as Co-chair of the Committee on Science of the National Science and Technology Council. Her major interests include K-12 science and mathematics education, graduate science and engineering education, and the increased participation of women and minorities in science and engineering.

Dr. Colwell has held many advisory positions in the U.S. Government, nonprofit science policy organizations, and private foundations, as well as in the international scientific research community. She is a nationally-respected scientist and educator, and has authored or co-authored 17 books and more than 800 scientific publications. She produced the award-winning film, Invisible Seas, and has served on the editorial boards of numerous scientific journals.

Before going to NSF, Dr. Colwell was President of the University of Maryland Biotechnology Institute and Professor of Microbiology and Biotechnology at the University Maryland. She was also a member of the National Science Board from 1984 to 1990.

Dr. Colwell has previously served as Chairman of the Board of Governors of the American Academy of Microbiology and also as President of the American Association for the Advancement of Science, the Washington Academy of Sciences, the American Society for Microbiology, the Sigma Xi National Science Honorary Society, the International Union of Microbiological Societies, and the American Institute of Biological Sciences (AIBS). Dr. Colwell is a member of the National Academy of Sciences, the Royal Swedish Academy of Sciences, Stockholm, the Royal Society of Canada, the Royal Irish Academy, the American Academy of Arts and Sciences, and the American Philosophical Society.

Dr. Colwell has been awarded 55 honorary degrees from institutions of higher education, including her Alma Mater, Purdue University and is the recipient of the Order of the Rising Sun, Gold and Silver Star, bestowed by the Emperor of Japan; the 2006 National Medal of Science, awarded by the President of the United States; and the 2010 Stockholm Water Prize, awarded by the King of Sweden. Dr. Colwell is an honorary member of the microbiological societies of the UK, Australia, France, Israel, Bangladesh, Czechoslovakia, and the U.S. and has held several honorary professorships, including the University of Queensland, Australia. A geological site in Antarctica, Colwell Massif, has been named in recognition of her work in the polar regions.

Born in Beverly, Massachusetts, Dr. Colwell holds a BS in Bacteriology and an MS in Genetics, from Purdue University, and a PhD in Oceanography from the University of Washington.
Carol Greider, PhD

Dr. Greider is the Daniel Nathans Professor and Director of the Department of Molecular Biology and Genetics at the Institute of Basic Biomedical Sciences in the Johns Hopkins University School of Medicine. She was awarded the 2009 Nobel Prize for Physiology or Medicine, along with Elizabeth Blackburn and Jack W. Szostak, for their discovery that telomeres are protected from progressive shortening by the enzyme telomerase.

Dr. Greider received a BA in biology from the College of Creative Studies at the University of California, Santa Barbara, and completed her PhD in molecular biology at the University of California, Berkeley, working with Elizabeth Blackburn, where she co-discovered telomerase. She went on to be an independent Cold Spring Harbor Fellow and then a faculty member at the Cold Spring Harbor Laboratory, Long Island, New York. While at Cold Spring Harbor, she, in collaboration with Ronald A. DePinho, produced the first telomerase knockout mouse, showing that increasingly short telomeres result in various deleterious phenotypes, including age-related diseases. She joined the faculty at the Johns Hopkins University in 1997, where she currently works.

Her laboratory is focused on understanding telomerase and cellular and organismal consequences of telomere dysfunction, using biochemistry, yeast, and mice to examine telomere function. They have generated telomerase null mice that are viable and show progressive telomere shortening for up to six generations. The research team also is using the telomerase null mice to explore the essential role of telomerase stem cell viability. They are specifically exploring telomerase mutations that cause autosomal dominant dyskeratosis congenita, which leads to bone marrow failure and death. Current work is focused on understanding the DNA damage induced in response to short telomeres, and identifying how telomere length is regulated.

In addition to receiving the 2009 Nobel Prize, Dr. Greider has received the Gairdner Foundation International Award (1998); Academy of Achievement Golden Plate Award (2000); Richard Lounsbery Award, National Academy of Sciences (2003); Albert Lasker Award for Basic Medical Research, shared with Drs. Blackburn and Szostak (2006); Dickson Prize in Medicine (2006); Wiley Prize in Biomedical Sciences, shared with Dr. Blackburn (2006); and Louisa Gross Horwitz Prize, shared with Dr. Blackburn and Joseph G. Gall (2007). Dr. Greider is also a member of the American Society for Cell Biology, American Association for Cancer Research, American Society for Human Genetics, the American Society for Biochemistry and Molecular Biology, and a Fellow of the American Academy of Arts and Sciences. She is also a member of the National Academy of Sciences.
George C. Hill, PhD

Dr. Hill is a Distinguished Professor Emeritus of Pathology, Microbiology and Immunology at Vanderbilt University. He was the first Vice Chancellor for Equity, Diversity and Inclusion and Chief Diversity Officer at Vanderbilt University where he was charged by the Chancellor with articulating the vision and working with institutional constituents to provide leadership in cultivating an inclusive, diverse and equitable academic community.

He is also the past Levi Watkins, Jr., MD Professor in Medical Education at Vanderbilt University School of Medicine. From 2002-2011, he served as Associate Dean for Diversity in Medical Education of Vanderbilt School of Medicine and also served as Assistant Vice Chancellor for Multicultural Affairs and Special Assistant to the Provost for Health Affairs for Vanderbilt University (2011-2012).

Dr. Hill was elected to the Institute of Medicine, now the National Academy of Medicine, of the National Academy of Sciences, in 1998, and a Fellow of the Academy of Microbiology in 2002. He was elected as a Fellow of the American Association for the Advancement of Science in 2011 for distinguished contributions to tropical diseases research, leadership as President of the National Foundation for Infectious Diseases (2007-2009) and for fostering a diverse research and healthcare workforce. He was also a Fulbright Scholar at the University of Nairobi, in Nairobi, Kenya and a National Institutes of Health (NIH) Special Research Fellow at the University of Cambridge in Great Britain. He is also a Fellow of Health Disparities of the Cobb Institute of the National Medical Association.

Dr. Hill is a researcher in the field of molecular biology and biochemistry of African trypanosomiasis. His laboratory was the first to grow the Trypanosoma rhodesiense in culture, the causative agent of African trypanosomiasis. He has received extensive research support from NIH, National Science Foundation and other federal agencies. For his research accomplishments, he received the Seymour Hutner Prize for Research from the Society for Protozoologists. He is a member of the American Society of Biochemistry and Molecular Biology, the American Association for the Advancement of Science and the American Society for Microbiology.

Dr. Hill has trained numerous PhD students, MS students and post-doctoral fellows. In 1999, he was recognized as a “Giant in Science” by the Quality Education for Minorities Network for his commitment to motivating minority students to pursue the sciences. He also chaired the National Science Foundation Committee for Equal Opportunity in Science and Engineering. He works throughout the country to advance opportunities for underrepresented minority students in medicine and the biomedical sciences.

Before joining Vanderbilt, Dr. Hill held a Professorship in Microbiology and served as Vice President for Sponsored Research at Meharry Medical College, where he also served as Dean of the Graduate School, Director of the Division of Biomedical Sciences, and Associate Vice President for International Programs. Dr. Hill obtained his BS from Rutgers University, M.S. from Howard University, and PhD from New York University. Additionally, Dr. Hill served at Colorado State University (CSU) teaching and conducting research and established a mentoring program for minority students in 1974, the CSU Science Motivation Program, bringing minority high school students to the campus for the summer.

He has served on numerous governmental advisory committees focusing on biomedical sciences research and graduate education including for NIH the Fogarty International Center Scientific Advisory Board, National Institute of General Medical Sciences Advisory Council, and the National Institute of Allergy and Infectious Diseases Board of Scientific Counselors.
He also served on the Centers for Disease Control and Prevention Scientific Advisory Board of the National Center for Infectious Diseases. He currently serves on the Cooper Medical School of Rowan University Medical Board, the Cobb Health Institute Board of Directors of the National Medical Association and the NIH Advisory Committee to the Director Working Group on Diversity.

Dr. Hill received the Rutgers Hall of Distinguished Alumni Award from the Rutgers University Alumni Association in May, 2012. He was also appointed in September 2014 by Chancellor Phoebe Haddon to serve on the Leadership Council for Rutgers University – Camden.

In April, 2015, Dr. Hill was elected by the Student National Medical Association (SNMA) to their Hall of Heroes for his lifetime commitment to the support of minority students seeking a career in medicine. In addition, in May 2015, Dr. Hill received the Distinguished Faculty Award from the Organization of Black Graduate and Professional Students of Vanderbilt University in recognition of outstanding and sustained efforts in developing and supporting Vanderbilt black graduate and professional students.

In June, 2016, Dr. Hill was recognized by Cooper Medical School of Rowan University with an Honorary Doctor of Science degree at the first graduation class of the institution.

In November, 2017, he received from the American Association of Medical Colleges the Herbert W. Nickens Award which is given annually to an individual who has made outstanding contributions to promoting justice in medical education and health care.

Dr. Hill is the Founder and President of Leadership Excellence, LLC, which is committed to working toward a diverse workforce of science and medical leaders, the mission of which is to assist institutions and organizations to nurture, mentor, and increase the numbers of leaders from diverse backgrounds in the healthcare and biomedical sciences fields.
Gilbert Omenn, MD, PhD

Dr. Omenn is the Harold T. Shapiro Distinguished University Professor of Internal Medicine, Human Genetics, and Public Health at the University of Michigan, as well as the founder and director of the school’s Center for Computational Medicine and Bioinformatics. He also leads the Human Proteome Project, an international effort to develop a detailed understanding of the myriad proteins in the human body.

Dr. Omenn’s research interests include cancer proteomics, bioinformatics, chemoprevention of cancers, public health genetics, science-based risk analysis, and health policy. He led the beta-Carotene and Retinol Efficacy Trial (CARET) of preventive agents against lung cancers and heart disease. While at the University of Washington and the Fred Hutchinson Cancer Research Center, he created a university-wide initiative to examine public health genetics. He is the author of 548 research papers and scientific reviews, and the author or editor of 18 books.

From 1997 to 2002, he was the CEO of the University of Michigan Health System. Prior to that, he was dean of the School of Public Health and Professor of Medicine and Environmental Health at the University of Washington. During the Carter Administration, he was associate director of the Office of Science and Technology Policy.

He is a member of the National Academy of Medicine, the American Academy of Arts and Sciences, the Association of American Physicians, and the American College of Physicians. In 2013 he received the David E. Rogers Award from the Association of American Medical Colleges.

Dr. Omenn received his BA degree from Princeton, his MD degree from Harvard Medical School, and his PhD degree in genetics from the University of Washington.
Dr. Needleman is a member of the National Academy of Sciences; the Washington University Board of Trustees; the St. Louis Science Center; the Plant and Life Sciences Coalition; the Board of Trustees of the Donald Danforth Plant Science Center; and Research Advisor to the President at Ben-Gurion University, Israel.

Dr. Needleman received his BSc in pharmacy and MSc in pharmacology from the Philadelphia College of Pharmacy and Science, and his PhD in pharmacology from the University of Maryland School of Medicine. He completed a postdoctoral fellowship at Washington University Medical School in St. Louis, where he joined the faculty in 1967, and later became Chairman of the Department of Pharmacology from 1976 to 1989. During that time, he was selected Basic Science Teacher of the Year five times. In 1989 he became senior vice president of Monsanto. In 1993, he became president of Searle Research and Development. He served as senior executive vice president and chief scientist of Pharmacia from 2000 to 2003. In 2004, he served as Associate Dean for Special Projects at Washington University Medical School in St. Louis.

Dr. Needleman’s research focuses on two main areas. His studies of the regulation of vascular, cardiac, and renal function led to the discovery of the mechanism of organic nitrate tolerance, the first peptide angiotensin antagonists, and the atrial natriuretic factor (the hormone by which the heart communicates with the kidney). His second area of research was on the role of prostaglandins in arthritis, an area in which he made multiple contributions culminating in the discovery of Cox-2, the isoform of cyclooxygenase responsible for the inflammation and pain suffered by arthritis patients. His work at Monsanto/Searle resulted in the 1998 FDA approval of Celebrex.

He was elected a member of the National Academy of Sciences (NAS) in 1987, and chaired the NAS Pharmacology-Physiology section from 2001–2004. He was elected to a brief term on the NAS Council in 2004, and currently serves as a member of the NAS Division of Earth and Life Sciences Committee. In 2009, he served as interim President of the Donald Danforth Plant Sciences Center, and in 2011, he became interim President of the St. Louis Science Center. He helped create the National Institute for Biotechnology in the Negev, and served on the Barnes Jewish Hospital Board.

Dr. Needleman has garnered numerous honors, including the John Jacob Abel Award of the American Pharmacology Society (1974); Research Achievement Award from the American Heart Association (1988); Washington University’s Distinguished Faculty Award (1987), Second Century Award from the medical school (1994), and honorary doctorate degree (1999); C. Chester Stock Award from Memorial-Sloan Kettering Cancer Center (2001); and the American Society of Experimental Therapeutics Award. Dr. Needleman was selected for the Industrial Research Institute Medal in 2001, and in 2005, the NAS Award for the Industrial Application of Science. In 2015, Dr. Needleman was elected into the American Academy of Arts and Sciences.
Curt I. Civin, MD

Dr. Civin is a Professor in the Department of Pediatrics, Director of the Center for Stem Cell Biology & Regenerative Medicine, and Associate Dean for Research at the University of Maryland School of Medicine.

Dr. Civin earned his Bachelor of Arts degree, magna cum laude, from Amherst College, and his MD, cum laude, from Harvard Medical School. He completed his residency training in pediatrics at Boston Children’s Hospital, and a fellowship in pediatric hematology-oncology at the National Cancer Institute. Prior to assuming his current position at the University of Maryland School of Medicine in 2009, he spent a highly successful, 30-year tenure at Johns Hopkins University School of Medicine as an endowed professor and leader. In addition to his administrative roles, Dr. Civin works with students to expand his impact on the next generation of scientists and physicians.

While at Hopkins, Dr. Civin built a leading Pediatric Oncology division and inspired an exceptional number of talented trainees to pursue careers in translational research. His own breakthrough discovery of the CD34 hematopoietic stem cell antigen and monoclonal antibody has facilitated basic research in stem cell biology and leukemia and has led to improved stem cell transplantation for thousands of patients. His current research seeks to understand how the survival, proliferation, and differentiation of normal and malignant stem-progenitor cells are regulated. The Civin laboratory has comprehensively described which genes and microRNAs are active and functional in human hematopoietic stem-progenitor cells, using global expression and functional technologies. Their mission is to translate the resulting understanding and tools to clinical use, and they are now evaluating a new class of cancer drugs revealed by their basic studies.

Dr. Civin’s honors include the 1999 National Inventor of the Year Award; a 2001 honorary ScD from Amherst College; the 2006 Leukemia & Lymphoma Society’s Return of the Child Award; and the 2009 Karl Landsteiner Award. In 2015, Dr. Civin received the American Society of Hematology Mentor Award. He has served on many advisory boards, including current membership on the National Cancer Institute’s Board of Scientific Advisors.
Jay Magaziner, PhD, MSHyg

Dr. Magaziner is Professor and Chair of the Department of Epidemiology & Public Health in the University of Maryland School of Medicine. He is also a Professor in the Departments of Medicine and Physical Therapy & Rehabilitation Science in the School of Medicine. Dr. Magaziner leads the University’s Center for Research on Aging. He serves on the Boards of the Fragility Fracture Global Network, the National Palliative Care Research Center, and Keswick Multi-Care, and is deputy editor for the *Journals of Gerontology: Medical Sciences*.

Dr. Magaziner received his Bachelor of Science degree from Case Western Reserve University, and doctoral degree from the University of Chicago, where he was a trainee in adult development and aging. In 1982, he received a Master of Science in Hygiene in epidemiology from the University of Pittsburgh Graduate School of Public Health, where he was a fellow in psychiatric epidemiology. He joined the School of Medicine’s faculty in 1982, starting in its Division of Gerontology in 1986, and led the division until shortly after being appointed as chair of the Department of Epidemiology & Public Health in 2008. Dr. Magaziner was named by the University of Maryland, Baltimore (UMB) President and Dean of the School of Medicine as one of two Directors of the Center for Research on Aging, and become the Center’s and sole director in 2015. Dr. Magaziner also leads the University of Maryland Claude D. Pepper Older Americans Independence Center, a National Institute on Aging (NIA) Center of Excellence. Dr. Magaziner co-directed the two-campus Gerontology Doctoral Program for 10 years, and is Director of a pre- and postdoctoral training program in the Epidemiology of Aging supported by the NIA.

Dr. Magaziner pursues research on aging in three interrelated areas: the consequences of hip fracture, health and long-term care, and methods for studying older populations. The major focus of this work is to identify ways of enhancing functioning and improving the quality-of-life for older persons. Dr. Magaziner is one of the foremost authorities in the world on the consequences of hip fracture. Over the past 30 years, he has concentrated on functional and physiological consequences of hip fracture and on developing and evaluating strategies for maximizing recovery. Dr. Magaziner’s work on hip fracture recovery has earned him two consecutive MERIT Awards from the NIA. He has been funded continuously by the National Institutes of Health (NIH) since 1983.

Dr. Magaziner founded what has become the largest hip fracture research program in the world, the Baltimore Hip Studies (BHS), in 1991. The program’s goal is to identify the consequences of hip fracture with the intent of designing and testing strategies to improve recovery. He directed the program until 2011 and now serves as its executive director. Under his leadership, the BHP has identified multiple consequences of hip fracture, charted the course of recovery from hip fracture in multiple domains of functioning, and identified predictors of good and poor recovery. He and a team of other program faculty and staff have led and collaborated on observational and interventional studies in Baltimore, elsewhere in the U.S., and internationally. Most recently, he has been co-leading the development of a new program to establish a global hip fracture rehabilitation research network comprised of an international group of scientists interested in designing and rapidly testing strategies for maximizing post hip fracture recovery.
Dr. Magaziner has published over 240 manuscripts and mentored more than 25 pre- and postdoctoral trainees in the epidemiology of aging. He also has mentored many junior faculty who now hold leadership roles at his institution and elsewhere. He has served in many leadership positions locally and nationally, including the Governor’s Commission on Aging Services in Maryland; the board of the Maryland Gerontological Association, on which he also served as president from 1989-90; and chair of the Health Sciences Section of the Gerontological Society of America. He was a regular member of the NIH’s Neuroepidemiology, Aging and Musculoskeletal Disease Epidemiology Study Section, which he chaired from 2001-2005.

History and Present State of Research on Aging in the University of Maryland School of Medicine and Overview of Session One

Jay S. Magaziner, PhD, MSHyg

Dr. Magaziner will provide an historical overview of aging-related research, education and clinical programs at the University of Maryland School of Medicine from 1970–1998, when the Center for Research on Aging was established. He will then describe the Center’s mission, programs and some of its accomplishments.

The Center is a collaborative effort of 134 researchers who focus on aging research, education and clinical care at all six University of Maryland, Baltimore (UMB) schools, the University of Maryland’s campuses at College Park and Baltimore County, the Veterans Affairs, and the National Institute on Aging at the National Institutes of Health. The Center has become a national leader in aging research because of its accomplishments and exponential growth over the past 19 years, with the award of six federally funded, peer-reviewed Centers of Excellence and four training programs to its investigators, as well as a bi-campus doctoral program in gerontology.

The primary role of the Center is to stimulate collaborative research among neurologists, neuroscientists, exercise physiologists, physical therapists, epidemiologists, behavioral scientists, health services researchers, molecular and cellular biologists, biostatisticians, and researchers in other disciplines, as well as faculty providing education and clinical care for older persons from all of the UMB professional schools. These collaborations are vital in securing aging-related grants, and in strengthening established areas of research. Total funding for the Center has increased significantly since it was fully operational in 1999, when total funding was $2.7 million, to nearly $62 million in 2017.
Denise L. Orwig, PhD

Dr. Orwig is an Associate Professor in the Department of Epidemiology & Public Health at the University of Maryland School of Medicine. She also is Director of the Baltimore Hip Studies (BHS), a research program dedicated to optimizing recovery from hip fracture, and has established collaborative relationships with key medical personnel in 25 hospitals in the greater Baltimore area, Washington D.C., and southern Pennsylvania.

Dr. Orwig is a gerontologist specializing in biobehavioral aspects of aging with extensive expertise in studying older adults, both in community and hospital settings. Her primary research expertise is in the areas of hip fracture recovery, intervention trials, and longitudinal research methods including study design, recruitment and retention strategies, conducting performance measures, developing interventions to maximize recovery, and translating interventions into the community. She has led eight cohort studies including more than 3,500 hip fracture patients, and four randomized trials involving large interdisciplinary research teams. Dr. Orwig is currently the Director of the Clinical Coordinating Center for a Phase III randomized clinical trial testing two physical therapy interventions post hip fracture.

Dr. Orwig’s second area of research expertise is in pharmacoepidemiology, particularly in medication management issues of older adults and improving treatment of osteoporosis after hip fracture. She developed an instrument, Medication Management Instrument for Deficiencies in the Elderly (MedMaIDE), to assess an older adult’s ability to self-medicate safely in the community. This instrument is unique because it can be used by non-medically trained people (e.g., caregivers) to identify deficiencies of an older adult.

In addition to research activities, Dr. Orwig has been co-director of the joint campus Doctoral Program in Gerontology for six years. This is an interdisciplinary program in collaboration with the University of Maryland Baltimore County with track specializations in epidemiology, policy and sociocultural/behavioral sciences. She has extensive experience with mentoring and advising doctoral students, postdoctoral fellows, and junior faculty.
Changes in Mobility, Body Composition, and Function After Hip Fracture: Findings from the Baltimore Hip Studies

Denise Orwig, PhD

Hip fractures pose a great threat to the health, mobility and independence of older adults, and result in significant morbidity, mortality and burden to the U.S. healthcare system. During 2010, approximately 300,000 adults aged 65 years and older were hospitalized for hip fracture, and the rate of hip fractures is expected to increase almost 12% by 2030. Despite advances in surgical procedures, post-operative care and long term rehabilitation, hip fractures rank in the top ten of all impairments worldwide in terms of disability and functional decline due largely to the fact that patients rarely regain pre-fracture functional ability. Studies have found that in the area of activities of daily living, approximately 50-75% of patients fail to return to their pre-fracture levels of independence. Therefore, hip fracture provides a unique model for studying a population with sudden mobility disablement.

This presentation will introduce pivotal findings from the Baltimore Hip Studies program of research, which has conducted a series of nine cohort studies investigating patterns of recovery after hip fracture and the mechanisms that play a role in recovery trajectories. Findings will focus on outcomes related to mobility disability: changes in bone mineral density and muscle mass, prevalence of sarcopenia, levels of inflammation, hierarchical patterns of functional recovery, functional impairment and residual disability. Several of these findings have served as the impetus for recent intervention trials and for current drug development in hip fracture patients seeking to maximize recovery potential in mobility and independence.
Marc C. Hochberg, MD, MPH

Dr. Hochberg is a Professor in the Departments of Medicine and Epidemiology & Public Health at the University of Maryland School of Medicine. He also serves as Head, Division of Rheumatology and Clinical Immunology and Vice Chair in the Department of Medicine, as well as Director, Medical Care Clinical Center at the Veterans Affairs (VA) Maryland Health Care System.

Dr. Hochberg received his MD and MPH from The Johns Hopkins University School of Medicine and School of Hygiene and Public Health, respectively. He completed residency training in internal medicine and fellowship training in rheumatology at The Johns Hopkins Hospital and was a member of the faculty of The Johns Hopkins University School of Medicine from 1977 to 1991; he joined the faculty at the University of Maryland School of Medicine in 1991.

Dr. Hochberg’s research focuses on the clinical epidemiology of musculoskeletal disorders, particularly osteoarthritis (OA). For the past 15 years, he has been principal investigator of the Baltimore Clinical Center for the Osteoarthritis Initiative. He has made major contributions to the epidemiology of OA including the development of classification criteria and elucidation of risk factors for the development and progression of both hip and knee OA, as well as led the American College of Rheumatology’s efforts in the development of evidence-based recommendations for the management of hand, hip and knee osteoarthritis for over 20 years.

Dr. Hochberg has published over 400 peer-reviewed articles and 60 book chapters, is an editor of the textbooks “Rheumatology, 6th edition” (Mosby/Elsevier, 2015), “Epidemiology of the Rheumatic Diseases, 2nd edition” (Oxford University Press, 2001), and “Rheumatoid Arthritis” (Mosby/Elsevier, 2009), and is the Editor-in-Chief of Seminars in Arthritis and Rheumatism. He has served on several National Institutes of Health and VA grant review committees and study sections.

Dr. Hochberg received the Clinical Research Award from the Osteoarthritis Research Society International (OARSI) in 1999, was named one of only 50 “Postdoctoral Fellow Heroes” by the Arthritis Foundation in 2001, received the Mary Betty Stevens Clinical Research Award from the American College of Physicians (Maryland Chapter) in 2002, the Roger Demers Prize at the 42nd Laurentian Conference of Rheumatology in 2011, the Distinguished Clinical Investigator Award from the American College of Rheumatology (ACR) in 2012, the Lifetime Achievement Award from OARSI in 2013, the Art Modell President Award from the Arthritis Foundation, Maryland Chapter in 2013 and the Distinguished Alumnus Award from both Franklin and Marshall College and The Johns Hopkins University in 2014. He was named a Master of both the American College of Physicians and the American College of Rheumatology in 2014. He was General Secretary and a member of the Board of Directors of OARSI, a member of the Board of Directors of both the ACR and the ACR Research and Education Foundation, a member of the Board of Directors of the U.S. Bone and Joint Initiative (USBJI) and Chair, Standing Committee on Epidemiology of the International League of Associations of Rheumatology. He currently serves as President, USBJI.
Bringing Osteoarthritis into the 21st Century: A Disease of the Whole Joint

Marc C. Hochberg, MD, MPH

Osteoarthritis (OA) is the most common form of arthritis and is the major cause of joint pain, functional limitation, physical disability and reduced health-related quality of life in older Americans. OA used to be considered a “degenerative joint disease.” It is defined as “a disorder involving movable joints characterized by cell stress and extracellular matrix degradation initiated by micro- and macro-injury that activates maladaptive repair responses including pro-inflammatory pathways of innate immunity. The disease manifests first as a molecular derangement (abnormal joint tissue metabolism) followed by anatomic, and/or physiologic derangements (characterized by cartilage degradation, bone remodeling, osteophyte formation, joint inflammation and loss of normal joint function), that can culminate in illness.” The illness is manifest by joint pain and stiffness, fatigue, depression and sleep disturbance.

The Osteoarthritis Initiative (OAI) is a multicenter longitudinal cohort study designed to validate biomarkers for the development and progression of symptomatic radiographic knee OA (SRKOA). Originally, approximately 4,800 subjects aged 45 to 79 years who either had SRKOA in one or both knees or who were at risk for developing SRKOA were recruited at four clinical sites, including the University of Maryland, Baltimore, between 2004 and 2006; subjects have been followed for over 10 years. This presentation will provide results of 1) genome-wide association studies of RKOA in both Caucasians and African Americans, 2) analyses of biomarkers (blood, MRI and tibial bone density) predicting progression of SRKOA, 3) role of early MRI changes predicting the development of SRKOA, and 4) racial disparities in total knee replacement.
Alice S. Ryan, PhD

Dr. Ryan is a Professor in the Department of Medicine at the University of Maryland School of Medicine. She is presently Senior Research Career Scientist at the Veterans Affairs (VA) Rehabilitation Research & Development, Core Director of the Mid-Atlantic Nutrition Obesity Research Center, and Research Director and Core Leader of the University of Maryland Claude D. Pepper Older Americans Independence Center.

Dr. Ryan graduated from the University of Arizona with a Bachelor of Arts degree, earned a Masters of Science degree from Pennsylvania State University, and a PhD in Exercise Physiology from the University of Maryland, College Park. She completed a three-year post-doctoral fellowship in Metabolism and Nutrition at the University of Maryland School of Medicine (UMSOM), and was subsequently appointed as an Assistant Professor in the Division of Gerontology at UMSOM in 1996. She has remained at UMSOM for her 25-year career.

As an internationally recognized scientist, Dr. Ryan’s research focuses on the investigation of the molecular mechanisms underlying the deterioration of glucose and muscle metabolism associated with aging, disease, and disability, and modifications by exercise training and nutrition/weight loss to reduce the loss of mobility and independence. She has contributed important work in the field of obesity, insulin resistance and inflammation in older men and women, and currently is conducting innovative patient-oriented research and clinical trials of exercise rehabilitation in patients with chronic stroke, HIV, and cancer.

Dr. Ryan has published more than 135 manuscripts and 18 book chapters, including one for the American College of Sports Medicine Resource Manual for Exercise Testing and Prescription. She serves on the editorial board of two scientific journals. Her work has been continuously funded and demonstrates multi-disciplinary collaborations with investigators across the University of Maryland School of Medicine. She has a long history of successful mentoring of undergraduate students, pre-doctoral and medical students, postdoctoral fellows, and junior faculty.

Her awards include a two-time renewal of Research Career Scientist Award within CSR&D (Clinical Services Research & Development) between 2004-2014, followed by a 7-year VA Senior Research Career Scientist Award in RR&D, the highest honor bestowed on research scientists by the VA. Dr. Ryan was a member of the American Diabetes Association Review Board, Clinical and Integrative Diabetes and Obesity Study Section, and has served on numerous other Study Sections and Special Emphasis Panels within the National Institutes of Health.
Moving Muscles in the Context of Aging and Disease

Alice S. Ryan, PhD

Lifestyle rehabilitation changes, such as physical activity and nutritional therapies, are advocated for the treatment of chronic diseases and endpoints. Our research suggests that these treatments are beneficial, in part, due to their metabolic and tissue effects. We have identified some of the mechanisms in skeletal muscle by which these and other effective therapies reduce insulin resistance and improve mitochondrial function, thereby enhancing metabolic flexibility in aging. Our data indicate that older overweight individuals with impaired glucose tolerance are metabolically inefficient, with the inability to switch from fat to carbohydrate utilization in response to exercise and insulin. We also report that insulin activation of skeletal muscle glycogen synthase increases after calorie restriction and exercise training in older adults with impaired glucose tolerance. Furthermore, exercise training can enhance activity of key skeletal muscle enzymes involved in lipid partitioning and fatty acid metabolism in older adults. We provide evidence that the addition of aerobic exercise training to weight loss is critical to altering the metabolic components of skeletal muscle for advancement of healthy aging.

Bridging muscle metabolism into aging with stroke, we demonstrate the importance of muscle atrophy, and the roles of intramuscular fat and inflammation in the context of inactivity and sarcopenia. The extreme muscle atrophy and increased intra-muscular fat accumulation in the hemiparetic lower extremity may be one mechanism for physical disability, insulin resistance, and propensity for recurrent cardiovascular complications in stroke survivors. Resting and reactive hyperemic leg blood flow, muscle capillarization, and insulin activation of glycogen synthase in skeletal muscle are significantly reduced in the paretic, compared with the nonparetic, limb after disabling stroke. Our group has investigated different exercise strategies in chronic stroke which not only improve mobility and cardiovascular fitness but have beneficial systemic and tissue effects. Aerobic exercise training improves glucose tolerance and increases resting and reactive leg blood flow evoking an improvement in peripheral hemodynamic function. Resistive training results in skeletal muscle hypertrophy in stroke survivors with modifications in skeletal muscle regulation, potentially halting paretic muscle atrophy. Resistive training also improves hyperinsulinemia and insulin sensitivity, thereby reducing the risk for the development of type 2 diabetes, and provides new mechanistically driven targets for exercise therapy in the field of stroke rehabilitation. Exercise is medicine, regardless of comorbid conditions, and should be included in the prescription for healthy aging.
W. Jonathan Lederer, MD, PhD

Dr. Lederer is a Professor in the Department of Physiology and Director of the Center for Biomedical Engineering & Technology at the University of Maryland School of Medicine. He is an Honorary Fellow of the Physiological Society, a fellow of the Biophysical Society, a fellow of the American Heart Association and a member of the New York Academy of Science and 9 other Societies, Councils and Associations.

Dr. Lederer attended Harvard University as an undergraduate and Yale University for medical and graduate school. After medical internship at the University of Washington in Seattle, he received a British-American Heart Fellowship to work at Oxford University in 1977. In 1979, Dr. Lederer joined the University of Maryland School of Medicine, first in the Department of Physiology, then becoming Chair of Molecular Biology and Biophysics at University of Maryland Biotechnology Institute in 1995, and then Director of the Medical Biotechnology Center. In 2010, he assumed his current position.

An innovator in cardiac research, Dr. Lederer has and continues to make fundamental discoveries that change our view of biology and medicine. He discovered a Ca\(^{2+}\)-activated membrane current that is now known to be the primary membrane current underlying Ca\(^{2+}\)-dependent arrhythmias. He and his co-workers made important discoveries in how protons affect cellular signaling, how Na\(^+\) is linked to Ca\(^{2+}\) signaling in excitable cells, how the Na\(^+\)/Ca\(^{2+}\) exchanger works as an ion transporter and charge carrier, how the spatial organization of these proteins at the nanoscopic level underlie their signaling. This understanding enabled Lederer and his colleagues to discover and characterize Ca\(^{2+}\) sparks, the primary units of Ca\(^{2+}\) release, in heart, in vascular smooth muscle and skeletal muscle. Lederer and co-workers also have shown that Ca\(^{2+}\) sparks are the essential component of Ca\(^{2+}\) leak in the heart that produce Ca\(^{2+}\) waves in single cells and arrhythmias in the heart. Importantly, these Ca\(^{2+}\) signals underlie the arrhythmogenic current. Lederer and colleagues recently linked Ca\(^{2+}\) sparks, Ca\(^{2+}\) leak and the arrhythmogenic current to diverse genetic and acquired arrhythmias.

Significantly, Lederer and his co-workers also demonstrated that the principles of local Ca\(^{2+}\) signaling identified and characterized as Ca\(^{2+}\) sparks in heart were a general phenomenon in biology, particularly in muscle. This work has led to critical new discoveries on how blood flow is regulated in diverse excitable tissues including the brain (i.e., neurovascular coupling). While examining this process, Lederer and Dr. Christopher Ward discovered a key new signaling pathway in the heart that links cellular mechanical behavior to Ca\(^{2+}\) signaling via a new signaling pathway, called “X-ROS signaling.” Recent work now also focuses on cardiac mitochondrial biology. Lederer has thus made surprising discoveries that have fundamentally changed the way we see and think about signaling in biology and medicine.
Dr. Ward is an Associate Professor in the Department of Organizational Systems and Adult Health at the University of Maryland School of Nursing, and an adjunct Associate Professor in the Department of Orthopaedics at the University of Maryland School of Medicine.

Dr. Ward graduated with BS and MS degrees from Virginia Tech, and a PhD in Biomedical Sciences/Physiology from the Virginia-Maryland Regional College of Veterinary Medicine. In 1997, Dr. Ward moved to the University of Maryland, Baltimore, for his post-doctoral training.

For the past 20 years Dr. Ward’s research has focused on the mechanisms by which local calcium (Ca\(^{2+}\)) signals contribute to physiological and pathological adaptations in striated muscle. Since 2009, a main focus of his research has been on mechanotransduction, specifically, the mechanisms by which the mechanical stress of stretch or contraction modulates local Ca\(^{2+}\) signaling. Initial discoveries made in the heart, in collaboration with Dr. W. Jonathan Lederer, Professor in the Department of Physiology and Director of the Center for Biomedical Engineering & Technology at the University of Maryland School of Medicine, led to the discovery that the microtubule (MT) cytoskeleton was a critical mechanotransduction element for the activation of stretch activated Ca\(^{2+}\) sparks.

Using novel techniques, Dr. Ward and his team discovered a mechanotransduction pathway in striated muscle which linked the mechanical force of stretch/contraction to a burst of reactive oxygen species (ROS) from NADPH oxidase2; a pathway termed “X-ROS signaling.” Discoveries in both heart and skeletal muscle place the MT network central to the activation of X-ROS in healthy muscle, whereas in Duchenne muscular dystrophy (DMD) and in the failing heart, the disease dependent increase in MT proliferation and its post-translational modification has been linked to the excess X-ROS and Ca\(^{2+}\) signaling responsible for contraction induced injury. The mechanistic discoveries in heart and skeletal muscle were accelerated by a collaboration with Dr. Stuart Martin in the Department of Physiology at the University of Maryland School of Medicine. Dr. Ward’s team demonstrated that in vivo MT-targeted therapeutics effectively protect the DMD skeletal muscle and heart from the enhanced contraction-induced pathology. In 2014, Dr. Ward began a collaboration with Dr. Joseph Stains, in the Department of Orthopaedics at the University of Maryland School of Medicine, working on mechanisms of mechano-signaling in bone. Results from this pilot study showed that MT dependent X-ROS is conserved in osteocytes where it regulates Ca\(^{2+}\) and signaling events that control bone turnover. Dr. Ward’s discoveries have led to the hypothesis that MT alterations are a conserved response to disease stress, leading to altered mechanotransduction and function.

Dr. Ward’s research has been published in *Science, Science Signaling, Nature Medicine, Journal of Clinical Investigation,* and *Nature Communications.* His work has been supported by multiple grants from the National Institutes of Health, as well as foundation and corporate sponsors. In addition, he has been awarded multiple patents for the novel tools he has developed for the mechanical manipulation of single, isolated muscle and bone cells and means to mechanically load bone in vivo, and cytoskeletal targeted therapeutics for neuromuscular and bone diseases.
Joseph P. Stains, PhD

Dr. Stains is an Associate Professor in the Department of Orthopaedics with a secondary appointment in the Department of Physiology at University of Maryland School of Medicine. He also has membership in the University of Maryland School of Medicine Center for Research on Aging, Center for Stem Cell Biology & Regenerative Medicine, and Center for Biomedical Engineering & Technology.

Dr. Stains graduated from the Pennsylvania State University with a Bachelor of Science degree in Molecular & Cell Biology, and a PhD in Biochemistry, Microbiology, and Molecular Biology. From 2001 to 2004, he was a postdoctoral fellow at Washington University in St. Louis in the Division of Bone & Mineral Diseases. In 2004, Dr. Stains was recruited to the University of Maryland School of Medicine as an Assistant Professor.

Dr. Stains has used a molecular level perspective to study intercellular communication and the regulation of bone formation. His research has provided foundational insights into how cell-to-cell coordination of function can contribute to the formation and activity of bone forming cells. His recent projects have uncovered novel mechanisms of how cells of the skeletal system sense and translate mechanical signals into biological activities.

Dr. Stains has published more than 50 peer reviewed articles and two book chapters, and his work has been consistently funded by the National Institutes of Health (NIH), Department of Defense and the Maryland Stem Cell Research Fund. He is active in the American Society of Bone and Mineral Research, where he serves as a member of the finance committee, and is on the editorial board for the societies’ two journals, the *Journal of Bone and Mineral Research* (JBMR) and *JBMR Plus*. In addition, he has been a frequent ad hoc member of grant review study sections for the NIH, Arthritis Foundation, and Veterans Affairs.

In 2015, Dr. Stains was recognized as a University System of Maryland’s PROMISE AGEP Outstanding Faculty Mentor, and the Research Preceptor of the Year in the Department of Medical and Research Technology at the University of Maryland School of Medicine. In 2017, he and his collaborators were awarded a U.S. patent for a multi-functional fluid flow device to test the mechanical response of cells in culture, and a provisional patent on targeting the cytoskeleton to improve bone mass. Several of the manuscripts originating from his laboratory have been recognized for content, access and citations.
Microtubule Mechanotransduction in Aging Heart, Skeletal Muscle and Bone

W. Jonathan Lederer, MD, PhD
Christopher W. Ward, PhD
Joseph P. Stains, PhD

Bone, cardiac muscle and skeletal muscle are exquisitely sensitive to mechanical load, integrating mechanical cues and translating them into biological signals important to function. Although our collective work has revealed microtubule dependent mechanosignaling through reactive oxygen species (ROS) and calcium (Ca\(^{2+}\)) in each tissue, each has a unique implementation of these mechano-activated signals. In a series of three short talks, the array of signals underlying the mechanotransduction of each tissue will be presented and parallels highlighted and differences noted. A key element is the central role played by the microtubule cytoskeleton and diverse and dynamic post-translational modifications (PTMs) that regulate its cytoskeletal mechanics, which, in turn, regulate mechanotransduction. In each tissue microtubule mechanotransduction activates NADPH oxidase type 2 (Nox2), which elicits ROS signals that target Ca\(^{2+}\) channels to generate Ca\(^{2+}\) signals; each signal then regulation diverse physiology within each tissue. Here, we will present evidence that the trajectory of cellular aging in each tissue is underscored by alterations in the microtubules and Nox2 that alter the cells’ response to mechanical stress. Our evidence suggests that the inflammation and oxidative stress “inflammaging,” well described as a negative modifier in the aging process, alters mechanosignaling in these systems by dysregulation of the microtubule, Nox2, Ca\(^{2+}\) signaling axis. We propose that this age-related alteration in microtubule mechanosignaling enhances arrhythmogenicity in the heart, initiates and accelerates sarcopenia in skeletal muscle and diminishes the bones’ response to mechanical load which leads to decreased bone quality and skeletal fragility. Early findings suggest several potential therapeutic targets that may effectively rescue the dysregulated microtubule mechanotransduction through ROS and Ca\(^{2+}\) towards restoring function within each tissue.
SCIENCE

The SOM FESTIVAL of SCIENCE
Dr. Kaper is Professor and Chair of the Department of Microbiology & Immunology, and the Senior Associate Dean for Academic Affairs at the University of Maryland School of Medicine. He also holds secondary appointments in the Departments of Biochemistry & Molecular Biology and Medicine.

Dr. Kaper received his bachelor’s degree in microbiology from the University of Maryland, College Park. He went on to complete his PhD in microbiology at College Park, under the mentorship of Rita Colwell, PhD. He completed his postdoctoral fellowship in molecular pathogenesis at the University of Washington in Seattle. In 1981, he came to the University of Maryland School of Medicine, where he served as chief of the Bacterial Genetics Section of the Center for Vaccine Development (CVD) and currently serves as Associate Director for Bacterial Pathogenesis Research. today. Dr. Kaper rose through the ranks of Assistant Professor, Associate Professor, and full Professor, and assumed his current position as Chair in the Department of Microbiology and Immunology in 2007.

Research in Dr. Kaper’s laboratory focuses on the molecular pathogenesis of enteric bacterial pathogens, specifically Vibrio cholerae and diarrheagenic Escherichia coli, including enteropathogenic E. coli (EPEC) and enterohemorrhagic E. coli O157:H7 (EHEC). The studies range from basic research on pathogenesis and prokaryotic gene regulation, to translational research such as the development of new vaccines and diagnostic probes. Dr. Kaper’s work with V. cholerae has resulted in the development of an attenuated live oral cholera vaccine that was the first recombinant bacterial vaccine to be tested in and licensed for humans. His work with EHEC, a cause of bloody diarrhea and hemolytic uremic syndrome, has yielded many insights into the pathogenesis and evolution of these pathogens, including the discovery of a 35,000 base pair “pathogenicity island” that mediates epithelial cell adherence and intestinal histopathology, global regulators of virulence gene transcription, a cell-to-cell signaling system (quorum sensing) that regulates virulence gene expression, and diagnostic DNA probes.

Dr. Kaper’s research has been continuously funded by the National Institutes of Health (NIH) since 1982, and in 2004, he received a MERIT Award from NIH’s National Institute of Allergy and Infectious Diseases. He is a Fellow of the American Academy of Microbiology, Fellow of the American Association for the Advancement of Science and is currently President of the Association of Medical School Microbiology and Immunology Chairs. He has served on numerous NIH study sections, is associate editor of the International Journal of Medical Microbiology and Gut Microbes, served as the editor for Infection & Immunity, and currently serves as the editor-in-chief of EcoSal: Escherichia coli and Salmonella Cellular & Molecular Biology. Dr. Kaper has edited six books, and authored or co-authored 300 peer-reviewed journal articles, 67 book chapters and 22 letters, editorials, book reviews and reports. Over the course of his career, he has mentored 47 MD and PhD postdoctoral fellows and 14 PhD students, and has served as the program director for the T32 training program in Immunity and Infection since 2007. In 2010, Dr. Kaper was elected to the Pass & Susel Academy of Educational Excellence at the University of Maryland School of Medicine.
Mark Rogers, PT, PhD

Dr. Rogers is Professor and Chair in the Department of Physical Therapy & Rehabilitation Science, and Professor in the Departments of Neurology and Anatomy & Neurobiology. He is a Catherine Worthingham Fellow of the American Physical Therapy Association (APTA), and is a member of the Society for Neuroscience, the International Society for Posture and Gait Research, and the American Heart Association.

Dr. Rogers graduated from the University of Connecticut, Storrs with a Bachelor of Science degree in Physical Therapy. He practiced clinical physical therapy in rehabilitation and acute care medical centers and in extended care and home health settings. He earned his Master of Science degree in Exercise Science, concentrating on motor learning and behavior, from the University of Massachusetts, Amherst, and his PhD in neuromuscular therapeutics at the University of Iowa, Iowa City. His postdoctoral studies in rehabilitation and neurophysiology were completed at McGill University, School of Medicine, Montréal, Canada. From 1986 to 2008, he was a faculty member in the Department of Physical Therapy and Human Movement Sciences at Northwestern University Feinberg School of Medicine in Chicago, Illinois. Dr. Rogers was recruited to the University of Maryland School of Medicine in 2008 as a tenured Professor and Vice Chair for Research in the Department of Physical Therapy & Rehabilitation Science. He is currently Director of the National Institute for Disability and Independent Living Rehabilitation Research, University of Maryland Advanced Neuromotor Rehabilitation Research Training Program, and leads the Neuromotor Mechanisms and Rehabilitation Core of the University of Maryland Claude D. Pepper Older Americans Independence Center.

An internationally recognized scientist in motor control and rehabilitation, Dr. Rogers’s research focuses on understanding the neuromotor, biomechanical, and behavioral processes that control human balance and mobility, and how these processes are altered during aging, by adult neurologic conditions, such as Parkinson’s disease, and following stroke that lead to falls and associated injuries. His work is directed at determining the pathological changes in balance and movement control that disrupt standing, stepping, walking and the use of the upper limbs to accomplish functional tasks. These mechanistic studies underpin the development of therapeutic approaches to enhance independent balance and mobility functions and to prevent falls and related injuries.

Dr. Rogers’s research has been consistently supported by grants from the National Institutes of Health and other agencies for the last 25 years. He has published extensively in basic and applied journals and in book chapters, and has presented numerous invited national and international lectures. In addition to being an honorary Worthingham Fellow of the APTA, his awards and honors include the Marian Williams Award for Research in Physical Therapy, and the Excellence in Research Award from both the neurology and geriatrics sections of the APTA.
Overview of Session Two: Brain, Balance, Disease and Mobility

Mark W. Rogers, PT, PhD

Physiological and degenerative changes affecting multiple systems of the body with aging and related disease conditions are major contributors to limitations in autonomous functional movements needed to perform the essential tasks of daily living. Concomitant impairments in physiological, psychological, and cognitive function are common in older age and across diseases. Thus, multiple impairments add cumulatively to limitations in physical activity and to mobility disability. Neuromotor impairment is often the final common pathway that causes physical disability in a broad range of age-related health conditions. This presentation provides an overview of some of the underpinnings of aging and disease-related mobility disability, with examples related to Parkinson’s disease, the role of robotics in advancing restoration of mobility, balance control and fall prevention, and the impact of vascular disease on cognition and mobility. As a bridge between these seemingly singular conditions and disabilities, the International Classification of Functioning, Disability and Health (ICF), developed by the World Health Organization, is a linking framework for describing and organizing information on functioning and mobility disability at both individual and population levels irrespective of health condition. It provides a scientific basis for understanding and studying health-related states related to functioning, that conceptually supports the development of large multi-investigator projects. Our research has investigated the neuromechanical determinants of impaired balance control reflected in aging limitations in stepping as a physiological protective mechanism against loss of balance and falls. This focus will illustrate the utility of the ICF as a model to guide multi-investigator research across a wide spectrum of mobility disabilities.
Lisa M. Shulman, MD

Dr. Shulman is the Eugenia Brin Professor of Parkinson’s Disease and Movement Disorders, the Rosalyn Newman Distinguished Scholar in Parkinson Disease, Professor in the Department of Medicine and Director of the University of Maryland Movement Disorders Center at the University of Maryland School of Medicine. She served as Treasurer of the American Academy of Neurology and on the Board of Directors of both the American Academy of Neurology and the American Brain Foundation.

Dr. Shulman is a neurologist specializing in Parkinson’s disease and other movement disorders. In addition to neurology, her diverse background includes training in health policy, nursing and education. Her major research interest is the impact of chronic neurologic diseases such as Parkinson disease on daily function and quality of life. Related interests include outcomes measurement, health disparities, exercise interventions, biosensor assessments of mobility, and cognitive/behavioral problems in Parkinson’s and related movement disorders.

She has served as an investigator and principal investigator on numerous investigator-initiated and sponsored clinical trials, including trials of exercise interventions in Parkinson disease, development of new instruments for measurement of outcomes, and investigation of Parkinson disease genetics. Dr. Shulman served as the principal investigator for the National Institutes of Health’s PROMIS (Patient-reported Outcomes Information System) Initiative to develop a new measure of self-efficacy for managing chronic conditions. She is currently co-principal investigator on a seed grant to develop innovative quantitative models for data visualization and analysis of big data/complex datasets of health outcomes.

Dr. Shulman is editor-in-chief of Neurology Now Books and co-author of the reference book Parkinson’s Disease: A Complete Guide for Patients and Families, now in its third edition and translated in three languages. She is author or editor of 200 books, chapters and peer-reviewed publications.
Mobility & Disability in Parkinson Disease: Decoding Patterns in Multidimensional Data

Lisa M. Shulman, MD

Mobility is a complex construct requiring innovative approaches to decode patterns in multidimensional data. Large multidimensional datasets, including clinical features, genetics and imaging data, are an “embarrassment of riches” with largely untapped potential. This presentation is an overview of our work exploring inter-relationships between clinical features, biometrics and genetics in large longitudinal datasets. As in most chronic medical conditions, our priorities and goals are: a) investigating disease progression, b) identifying disease subtypes and c) developing improved disease biomarkers.

Recent genetic analyses of our University of Maryland Parkinson’s cohort show associations between single nucleotide polymorphisms from Parkinson’s Disease (PD) genetic loci and recognized PD subtypes, differentiated by levels of gait difficulty versus tremor. Analyses also show the potential of biosensors to a) discriminate between these same Parkinson’s gait versus tremor subtypes, b) detect emerging parkinsonism in a community-based sample and c) detect gait alterations in healthy carriers of the leucine-rich repeat kinase 2 PD susceptibility gene. Biosensor gait parameters are associated with not only the motor features of parkinsonism, but also non-motor features, including depression, cognitive impairment and fear of falling. These analyses reveal the potential of harnessing data across diverse domains (i.e., genetic, biosensor and clinical).

Our new visual analytics tool, Winnow™, was developed to enable interactive exploration and analysis of multidimensional datasets to generate hypotheses. Future directions of inquiry include expanding analyses to new domains such as imaging and serologic markers. Our long-term goal is to employ Winnow™ and new computational models of clustering analysis to describe disease risk, causation and progression from a broad and inclusive perspective.
Li-Qun Zhang, PhD

Dr. Zhang is a Professor in the Departments of Physical Therapy & Rehabilitation Science and Orthopaedics at the University of Maryland School of Medicine. He is a fellow of the American Institute for Medical and Biological Engineering.

Dr. Zhang graduated from Tsinghua University with a Bachelor of Science degree in electrical engineering, and earned his Master’s and PhD degrees in Biomedical Engineering from Vanderbilt University. From 1997 to 2016, he was a Senior Research Scientist at the Rehabilitation Institute of Chicago, and Professor in the Department of Physical Medicine and Rehabilitation and Department of Orthopaedic Surgery at Northwestern University Feinberg School of Medicine. He was also a Professor in the Department Biomedical Engineering at Northwestern University McCormick School of Engineering. In 2017, Dr. Zhang joined the University of Maryland School of Medicine. He also is a Professor in the Fischell Department of Bioengineering in the A. James Clark School of Engineering at University of Maryland, College Park.

Dr. Zhang’s research helps gain insight into the mechanisms underlying pathological changes in sensorimotor impairments in neurological disorders, investigates mechanisms of musculoskeletal injuries and compensatory mechanisms post-injury, and develops new rehabilitation protocols and devices to translate research in the laboratory into improved treatment of injuries or impairments.

Dr. Zhang’s work has been supported by research grants from the National Institutes of Health’s National Institute of Arthritis and Musculoskeletal and Skin Diseases, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development and National Institute of Neurological Disorders and Stroke; the National Institute on Disability, Independent Living, and Rehabilitation Research of the Department of Health and Human Services; National Science Foundation; and private foundations. Dr. Zhang has published more than 100 journal articles, and serves as an associate editor of the Institute of Electrical and Electronics Engineers’ journal, *Transactions on Biomedical Engineering*. 
Robot-Aided Musculoskeletal Rehabilitation

Li-Qun Zhang, PhD

The knee is the most often injured region of the body and knee osteoarthritis is the most prevalent form of osteoarthritis, which affects more than 27 million Americans. Knee injuries and osteoarthritis are associated with aging-related changes in muscle weakness, joint laxity, loss of proprioception, reduced balance and gait performance. Although primary knee motions occur in knee flexion/extension, traumatic knee injuries and knee osteoarthritis are mostly caused by excessive off-axis loadings (frontal plane knee abduction/adduction and/or axial plane tibial rotation loadings), especially the knee adduction moment, which is related to the most common medial compartment knee osteoarthritis. Similarly, the development and progression of knee osteoarthritis are associated with excessive off-axis loadings to the knee joint.

There has been a lack of rehabilitation protocols and practical devices to diagnose specific off-axis loadings associated with knee injuries and osteoarthritis in individual subjects, followed by rehabilitation training of off-axis neuromuscular control and reducing excessive off-axis joint loads in clinical practice. We seek to address these needs and conduct neuromuscular rehabilitation training using a robot-aided multi-axis evaluation and stepping training system, which assesses major-axis and off-axis sensorimotor impairments, provides subject-specific real-time feedback on controlling excessive off-axis knee joint loads associated with osteoarthritis development without using major gait lab equipment, guides subjects to improve off-axis sensory-motor performance during functional movements, and potentially mitigate osteoarthritis based on the impairment/injury-specific neuromuscular training.

The robot-aided off-axis stepping training has been investigated in adults with knee injuries, in elderly individuals with knee osteoarthritis, and in children with cerebral palsy and in-toeing gait.
Kelly P. Westlake, PhD, MSc, PT

Dr. Westlake is an Assistant Professor in the Department of Physical Therapy & Rehabilitation Sciences at the University of Maryland School of Medicine.

She received a Bachelor of Science degree in Physical Therapy from McGill University, and earned her Master’s and PhD degrees in Rehabilitation Sciences from Queen’s University in Kingston, Canada. She completed one year of postdoctoral research at the Veterans Affairs Rehabilitation Research and Development Center/Stanford University, and three years in the Department of Radiology and Biomedical Imaging at the University of California, San Francisco. During her postdoctoral years, she developed expertise in functional neuroimaging as a means to understand the processes of brain plasticity to better inform rehabilitation interventions. She participated in several intensive neuroimaging courses at the University of California, Berkeley and at the Athinoula A. Martinos Center for Biomedical Imaging at Massachusetts General Hospital, as well as software specific courses. In 2011, she joined the faculty at the University of Maryland School of Medicine. Since this time, she was granted the University of Maryland Claude D. Pepper Junior Scholar Award for her research in balance and falls in older adults.

The overall focus of Dr. Westlake’s research is to develop targeted and novel methods of rehabilitation that will optimize and individualize motor learning. She currently has three active primary research areas.

First, she is investigating the role of cognitive brain networks in relation to arm protective response in older adults. Using fMRI, kinematic data, and executive function tests, preliminary data provided the first evidence of a direct relationship between altered neural cognitive networks and impaired balance, suggesting an impaired ability to shift attention towards important sensory information related to balance recovery. Results of this work will enable the development of cognitive based fall prevention strategies and interventions, particularly as they relate to improving the effectiveness of upper limb use.

Second, she is investigating factors that contribute to motor learning consolidation, and is currently evaluating methods by which this process may be enhanced through targeted memory reactivation during sleep in individuals with stroke. This work is being conducted by her PhD student and collaborators at the University of Maryland Sleep Center.

Third, she is investigating the predictive value and differential response of functional brain networks to two upper extremity stroke interventions – bilateral versus unilateral training. This research has been conducted with collaborators in the Department of Computer Science and Electrical Engineering at University of Maryland, Baltimore County, and in the Department of Kinesiology at Pennsylvania State University. Our overall goals are to better characterize the stroke population, predict recovery potential, and develop targeted and novel methods of rehabilitation that will optimize and individualize motor learning.
Protective Arm Movements for Fall Prevention in the Elderly

Kelly Westlake, PT, PhD

Although numerous rehabilitation interventions have been developed to improve balance in older adults, these improvements do not effectively reduce the incidence of falls and fall-related injuries. Moreover, such interventions have emphasized lower limb balance stabilizing responses (e.g., stepping), while training directed at upper limb responses (i.e., reach to grasp) is commonly overlooked. In confined areas, stepping recovery strategies are restricted, and movements of the arms to grasp stable surfaces and secure balance, or to protect against ground impact, become crucial to the prevention of head trauma and other major injuries. An important consideration during protective arm movements is the time-critical cortical integration of visuospatial information of graspable surfaces, with online sensory feedback reflecting an evolving state of instability of the body. The challenge for older adults, however, is the presence of age-related changes in both attentional control and sensory function to enable optimal balance recovery strategies. Within this talk, I will discuss our recent findings related to the effect of attention switching on reach-grasp stabilizing arm responses, and will highlight differences between older fallers, older non-fallers, and young healthy adults. I will also discuss group differences in attentional control from both a behavioral and fMRI neurocognitive perspective. This research marks the first characterization of the importance of attention shifting on protective arm responses during balance perturbations in older adults. Results have also provided the impetus to develop the first fully integrated cognitive and physical rehabilitation intervention, moving beyond correlative designs and parallel treatments to enhance balance and to prevent falls.
Dr. Lal is a Professor in the Department of Surgery at the University of Maryland School of Medicine, and the Director of the Center for Vascular Diagnostics at the University of Maryland Medical Center. He is Chief of Vascular Surgery at the Baltimore Veterans Affairs (VA) Medical Center.

Dr. Lal received his medical degree from the All India Institute of Medical Sciences in Delhi, and completed his Surgical Residency at Rutgers New Jersey Medical School. He completed a Fogarty Fellowship at the National Institutes of Health (NIH) and a Vascular Fellowship at Rutgers in 2004. From 2004 to 2009 he was and Assistant and then Associate Professor and Vascular Fellowship Director at Rutgers. In 2010, Dr. Lal was recruited to the University of Maryland School of Medicine.

A world-renowned clinician-scientist in the field of cerebrovascular disease and stroke, Dr. Lal launched the new field of cognitive-mobility function in carotid stenosis through his ground-breaking research and pioneering leadership. He has fundamentally changed our understanding of the range of morbidity associated with carotid atherosclerosis, well beyond stroke. His collective work over a decade has made sustained and transformational changes to our understanding of cerebrovascular disease. His current research is an integral part of the stroke-prevention drive of the National Institute of Neurological Disorders and Stroke (NINDS), NIH, and is focused on how the structure and biomechanics of atherosclerotic plaque in the carotid artery affects brain function, and impacts plaque disruption, stroke, cognitive function and mobility function; and how these adverse outcomes respond to interventions such as pharmacotherapy, rehabilitation and surgical revascularization.

As co-principal investigator of the largest randomized trial in stroke-prevention, funded by the NINDS, Dr. Lal will be instrumental in determining the optimal treatment approach for over 10 million individuals in the United States with carotid atherosclerosis, and many more world-wide. As principal investigator of the National Carotid Stenting Registry, with its administrative center at the School of Medicine, he is working with the NIH and the Centers for Medicare and Medicaid to establish national physician credentialing, clinical performance and reimbursement standards for carotid artery stenting. As Director of the Center for Vascular Diagnostics, he manages one of the largest clinical vascular laboratories in the country with over 15,000 tests performed every year. The Center adjudicates imaging data from several National Institute on Aging, NINDS, Department of Defense and the VA funded studies, during which he has developed several novel diagnostic vascular tests for vascular disease.

Dr. Lal is a highly cited investigator worldwide in the field of carotid atherosclerosis. He has authored more than 125 publications, including the Society for Vascular Surgery guidelines for carotid occlusive disease management. He serves on the Advisory Board of the Joint Commission on Accreditation of Healthcare Organizations for Stroke Center policy development, and is the Vice President of the national venous disease society. He has also led numerous collaborations with investigators in vascular disease epidemiology, mechanisms, diagnostics and therapeutics.
Vascular Disease, Mobility and Cognition

Brajesh K Lal, MBBS

Atherosclerosis of the carotid artery with plaque formation causes asymptomatic carotid stenosis (ACAS). Although ACAS affects approximately 10% of older adults (8–10 million people), the traditional clinical focus has been the prevention of stroke in these patients, an outcome that occurs in only 2% of patients with ACAS.

Approximately half of ACAS patients harbor previously unrecognized cognitive dysfunction. These patients also have cerebral hemodynamic compromise. Not all individuals with ACAS have cerebral hypo-perfusion, suggesting that other mechanisms, such as plaque-induced inflammation, also contribute to cognitive and mobility dysfunction.

Cerebral hypo-perfusion and inflammation also impair mobility function. Loss of mobility is a key factor in loss of independent living and mortality. Our recent analysis of data collected in a longitudinal study of community-dwelling older adults, and of our own patients, finds that ACAS patients also have mobility dysfunction.

Carotid revascularization improves cognitive function and quality of life (QOL). This suggests that cognitive and mobility impairment related to hemodynamic compromise and inflammation in ACAS may be improved by revascularization.

Our planned National Institutes of Health application (Feb 2018) hypothesizes that cerebral hemodynamic compromise and inflammation from ACAS worsens cognitive and mobility function and QOL, which can be improved with carotid revascularization. Confirmation of this hypothesis would have important public-health implications. It would identify a unique example of reversible cognitive and mobility impairment, and establish a novel indication for carotid surgery in select patients to prevent dementia and disability.

Eight-to-ten million older adults with ACAS are living with potentially reversible cognitive and mobility dysfunction. Sixteen million older adults with early cognitive and mobility impairment are currently not being evaluated for carotid disease, treatment for which may ameliorate their impairments.

The geometry of the plaque and intra-cerebral cross-collateralization collectively influence stenosis-related pressure drop and brain perfusion. Systemic and plaque-related inflammation likely affect ACAS-related cognitive and mobility function. Finally, cerebral hypo-perfusion affects a multitude of motor and cognitive pathways that may benefit from cognitive-motor training. This multitude of mechanisms provides fertile ground for a multi-dimensional investigation involving our Epidemiology, Rehabilitation, Neuropsychology, Bioengineering and Neuroradiology collaborators.

Preservation of physical independence in older adults is a significant clinical, and public health priority. These investigations could shift the diagnostic approach for identifying potentially modifiable etiologies of cognitive and mobility impairment, and the treatment decisions for carotid disease.
Research Affairs Advisory Committee

2017-2018

CHAIR
Richard L. Eckert, PhD
John F.B. Weaver Professor
Chair, Department of Biochemistry & Molecular Biology

BASIC SCIENCE
Joseph L. Bryant, DVM, MS
Associate Professor, Department of Pathology
Director, Animal Model Division and Animal Core Facility, Institute of Human Virology

James B. Kaper, PhD
Senior Associate Dean for Academic Affairs
Professor and Chair, Department of Microbiology and Immunology

Jay S. Magaziner, PhD, MSHyg
Professor and Chair, Department of Epidemiology & Public Health
Division Head, Gerontology
Director, Center for Research on Aging

Michael T. Shipley, PhD
Donald E. Wilson Distinguished Professor
Chair, Department of Anatomy & Neurobiology
Director, Program in Neuroscience

Scott M. Thompson, PhD
Professor and Chair, Department of Physiology

CLINICAL SCIENCE
Stephen T. Bartlett, MD
Peter Angelos Distinguished Professor in Surgery
Chair, Department of Surgery
Senior Vice President and Surgeon-in-Chief, University of Maryland Medical System

Cynthia F. Bearer, MD, PhD
Mary Gray Cobey Chair in Neonatology
Professor and Associate Chair for Research, Department of Pediatrics
Division Head, Neonatology

Stephen N. Davis, MBBS
Theodore E. Woodward Chair and Professor, Department of Medicine
Director, University of Maryland Clinical Translational Sciences Institute
Program Director, University of Maryland General Clinical Research Center
Physician-in-Chief, University of Maryland Medical Center

Jean-Pierre Raufman, MD
The David S. Brown Professor in Trauma
Director, Center for Shock, Trauma and Anesthesiology Research (STAR) & National Study Center for Trauma and EMS
Associate Dean, Trans-Campus Research Advancement

EX-OFFICIO
Curt I. Civin, MD
Professor, Department of Pediatrics
Director, Center for Stem Cell Biology & Regenerative Medicine
Associate Dean for Research

Terry B. Rogers, PhD
Professor, Department of Biochemistry & Molecular Biology
Assistant Dean, Research Affairs
Executive Director, Office of Research Affairs

Mary-Claire Roghmann, MD, MS
Professor, Departments of Epidemiology & Public Health and Medicine
Director, Medical Scientist Training Program
Associate Dean, Trans-Disciplinary Research Advancement and Physician-Scientist Training

RESEARCH CENTERS
Alan I. Faden, MD
The David S. Brown Professor in Trauma
Director, Center for Shock, Trauma and Anesthesiology Research (STAR) & National Study Center for Trauma and EMS
Associate Dean, Trans-Campus Research Advancement

Zeljko Vujaskovic, MD, PhD
Professor, Department of Radiation Oncology
Director, Division of Translational Radiation Sciences
Organizing Committee

2017

2017 FESTIVAL OF SCIENCE STEERING COMMITTEE

Jay Magaziner, PhD, MSHyg
Chair, Department of Epidemiology & Public Health
Director, Center for Research on Aging

Mark Rogers, PhD, PT
Chair, Department of Physical Therapy and Rehabilitation Science

Kevin Enright
Executive Director for Administration, Dean’s Office

Julie Rosen, PhD
Executive Director, Medical Research and Scientific Publications

Terry Rogers, PhD
Assistant Dean, Office of Research Affairs

Michael Terrin, MDCM, MPH
Professor, Department of Epidemiology & Public Health

Leslie Katzel, MD, PhD
Associate Professor, Department of Medicine
Associate Director for Clinical of the Baltimore GRECC
Assistant Program Director University of Maryland GCRC

Peter Crino, MD, PhD
Chair, Department of Neurology

2017 FESTIVAL OF SCIENCE ORGANIZING COMMITTEE

Kevin Enright
Executive Director for Administration, Dean’s Office

Julie Rosen, PhD
Executive Director, Medical Research and Scientific Publications

Jay Magaziner, PhD, MSHyg
Chair, Department of Epidemiology & Public Health
Director, Center for Research On Aging

Kris Rifkin
Manager of Special Projects, Office of Public Affairs and Communications

Heather Kavanagh
Director of Board Relations and Special Events, Office of Development

Christopher Hardwick, MA
Assistant Dean, Office of Public Affairs and Communications

David Kohn, MA
Director of Medical/Science Media Relations, Office of Public Affairs and Communications
Notes