

Skare, Jon T.

Jon T. Skare, PhD

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Pathogenesis-related features of Borrelia burgdorferi

Jon Skare is Professor and Associate Head of the Department of Microbial Pathogenesis and Immunology in the College of Medicine at Texas A&M University. His research program has been funded continuously by the National Institute of Health since 1999 . Dr. Skare has trained over 40 students in his research group during his time at Texas A&M and several of his postdoctoral trainees and students have gone on to hold academic positions.

Specifically, the Skare lab is interested in spirochetal infections, particularly *Borrelia burgdorferi*, the etiologic agent of Lyme disease. The long-term interests of his research group are centered on understanding how *B. burgdorferi* promotes its pathogenic potential and persists in the disparate hosts it occupies in nature (e.g., both ticks and mammals). In this regard, the research program is aligned with: (i) regulatory pathways that contribute to the establishment of infection during the arthropod to mammalian transition; (ii) characterizing the response to oxidative stressors in *B. burgdorferi* and the regulation thereof; (iii) identifying and characterizing surface structures that contribute to the colonization and maintenance of infection via adherence mechanisms; and (iv) the ability of *B.*

burgdorferi and relapsing fever *Borrelia* to persistently infect hosts in the face of a potent innate and adaptive immune response.

Conference Lecture Summary

In this presentation, Dr. Jon Skare will present a background of Lyme borreliosis as well as a discussion of some of the limitations and challenges that are currently under investigation from the basic science perspective. He will also present some of the work being done in his research group to evaluate how *B. burgdorferi* carries out its pathogenic potential at the molecular level.

Fallon, Brian



Brian A. Fallon, MD, MPH (Conference Director)

Professor of Psychiatry

Director, Lyme & TBD Research Center

Director, Ctr. Study of Neuroinflammatory
Disorders/Biobehavioral Medicine

Columbia University

New York, NY

[Lyme and Tick-Borne Diseases Research Center](#)

Borrelia and the Brain: Phase 1 of a Post-Mortem Study

Brian A. Fallon, MD, MPH. Dr. Fallon is director of the Lyme & Tick-borne Diseases Research Center at Columbia University Medical Center where he leads a team focused on biomarkers, diagnostics and treatment of chronic Lyme symptoms. His team's recent work has included the testing of novel diagnostic assays in a large community study, with the net result of the identification of a more sensitive Lyme Western blot. His team's work on Lyme encephalopathy led to the discovery of hundreds of unique proteins present in the CSF of Lyme patients but not in the CSF of patients with chronic fatigue syndrome or healthy controls. His team's current focus is on clarifying the immunologic profile and neural circuitry of patients with persistent symptoms. His team is also investigating the CNS metabolic effects of intravenous ceftriaxone using MR Spectroscopy to probe glutamatergic transmission. Dr. Dwork in his Center is examining the neuropathologic findings in post-mortem studies of patients with chronic Lyme symptoms. Dr. Moeller in his Center is examining the interaction between peripheral immunologic markers, central immune markers, and brain neurocircuitry among patients with chronic symptoms with the goal of identifying of biomarkers to help guide treatment recommendations.

Dr. Fallon serves on the editorial and review board of three journals, has lectured and published widely, and most recently has led an international team for the American Psychiatric Association's revision of DSM-5 to clarify the prevalence of illness anxiety in the general population.

Conference Lecture Summary:

This talk consists of three parts. First, the animal and human peer-reviewed literature will be reviewed regarding whether *Borrelia* has been found in brain tissue as well as the link between *Borrelia* and dementia. Second, the design of a new

study probing human brains for evidence of *Borrelia burgdorferi* will be described. Third, results from the clinical and gross neuropathologic assessment of a small sample of donor brains with a history of treated Lyme disease will be presented.

Aucott, John

John Aucott, MD

Associate Professor of Medicine, Johns Hopkins University School of Medicine;
Director, Johns Hopkins Rheumatology Lyme Disease Clinical Research Center
Baltimore, MD

HopkinsLyme.org



Updates on Research in Lyme Disease

Dr. Aucott is an Associate Professor of Medicine in the Division of Rheumatology at Johns Hopkins University Medical School and the Director of the Johns Hopkins Lyme Disease Research Center. He is principal investigator for the SLICE studies of acute Lyme disease and Post-treatment Lyme disease Syndrome. His research interests center on the pathophysiology, diagnosis and treatment of persistent illness after initial antibiotic treatment of Lyme disease and has resulted in over 25 peer reviewed publications. Dr. Aucott is an internationally recognized authority on Lyme disease and has served on panels sponsored by the Institute of Medicine, the Canadian Institutes of Health Research, and the American Academy for the Advancement of Science.

Conference Lecture Summary

Chronic Lyme disease is one of the most misunderstood and controversial diagnosis in modern medicine. This talk will examine the origin of the term and how it has evolved over time. The relationship of the Chronic Lyme diagnosis to disease phenotype, pathophysiology, and available diagnostic biomarkers will be examined. The research case definition of post-treatment Lyme disease syndrome will be examined in the context of chronic Lyme disease. Finally, the importance of defining terms will be highlighted using clinical and research case examples

Tokarz, Rafał

Rafał Tokarz, PhD

Associate Research Scientist

Center for Infection and Immunity

Mailman School of Public Health, Columbia University

New York, NY



Novel Approaches to Serologic Diagnosis of TBD

Dr. Tokarz's research focuses on microbial discovery and the epidemiology of human infectious diseases. His primary interests center on investigating respiratory and tick-borne pathogens and understanding their roles in human disease.

Dr. Tokarz's work in the field of tick-borne disease has been driven by two main hypotheses: 1) co-infections in human-biting ticks are common and can result in human poly-microbial infections; and 2) viral infections represent a proportion of undiagnosed tick-transmitted diseases. He designed and implemented one of the first

multiplex PCR assays that targeted tick-borne agents and was one of the first scientists to document high rates of pathogen co-infections in ticks within New York State. His recent work has focused on exploring the diversity of the tick virome. He performed the first investigation of the virome of the three main human-biting ticks in New York State and thus far has discovered over 20 novel tick-associated viruses. He is now examining the potential for transmissibility and pathogenesis of these viruses.

In an effort to understand the etiology of respiratory diseases, Dr. Tokarz has participated in pathogen surveillance studies on specimens originating from Asia, Africa, Europe, South and North America. As part of this work, he used cutting edge molecular platforms to identify and characterize novel viral agents. Dr. Tokarz identified and characterized the first defined cluster of one such virus, enterovirus D68, an emerging agent implicated in a severe outbreak of pediatric respiratory disease in the US in 2014. He performed the first comprehensive phylogenetic characterization of this virus, identified the three main clades circulating worldwide and developed a classification system now employed by investigators in this field. In his current work, Dr. Tokarz is examining the pathogenesis of this virus and how its genetic variation influences the severity of disease.

Conference Lecture Summary

Tick-borne diseases are the most common vector-borne diseases in the United States, with serology being the primary method of diagnosis. We developed the first multiplex, array-based assay for serodiagnosis of tick-borne diseases called the TBD-Serochip. The TBD-Serochip was designed to discriminate antibody responses to 8 major tick-borne pathogens present in the United States, including *Anaplasma phagocytophilum*, *Babesia microti*, *Borrelia burgdorferi*, *Borrelia miyamotoi*, *Ehrlichia chaffeensis*, *Rickettsia rickettsii*, Heartland virus and Powassan virus. Each assay contains approximately 170,000 12-mer linear peptides that tile along the protein sequence of the major antigens from each agent with 11 amino acid overlap. This permits accurate identification of a wide range of specific immunodominant IgG and IgM epitopes that can then be used to enhance diagnostic accuracy and integrate differential diagnosis into a single assay. To test the performance of the TBD-Serochip, we examined sera from patients with confirmed Lyme disease, babesiosis,

anaplasmosis, and Powassan virus disease. We identified a wide range of specific discriminatory epitopes that facilitated accurate diagnosis of each disease. We also identified previously undiagnosed infections. Our results indicate that the TBD-Serochip is a promising tool for a differential diagnosis not available with currently employed serologic assays for TBDs.

Gulia-Nuss, Monika

Monika Gulia-Nuss, PhD

Assistant Professor, Howard Medical Sciences
Department of Biochemistry and molecular Biology
University of Nevada
Reno, NV

<https://naes.unr.edu/gulia/>



Generating Transgenic Ticks for Ticks and Tick-Borne Diseases Management

Monika Gulia-Nuss is an Assistant Professor in the Department of Biochemistry and Molecular Biology at the University of Nevada, Reno. Dr. Gulia-Nuss's research focuses on understanding the basic biology of ticks in order to identify novel targets for tick control. Her long-term goal is to develop novel strategies to control ticks and tick-borne disease transmission. To this end, she is generating first-ever transgenic ticks using CRISPR-Cas gene-editing system and employing other cutting-edge genomic techniques such as Hi C based genome scaffolding for better assembly and annotation of the tick genome.

Her current work focuses on understanding the role of insulin signaling in tick-pathogen interactions and differences in chemoreception circuit in different *Ixodes* species. Understanding tick-pathogen interactions and genes involved in host seeking are vital to development of novel disease transmission control strategies. She has also initiated research to understand the epigenetic changes in patients due to Lyme *Borrelia* infection and will potentially be able to identify novel methylation markers soon after the infection with Lyme bacteria.

Conference Lecture Summary

The sequencing and annotation of *Ixodes scapularis* genome opened up new avenues for functional characterization of tick genes and tick-pathogen interaction research. However, the large genome size posed its own challenges for assembly and resulted in a fragmented genome. My laboratory has now reassembled the genome using Hi C genome scaffolding method. This allows us to reannotate the genome and correct existing gene models. We are now applying the gene editing technique to dissect out the gene functions in order to identify the genes that are important for tick development, survival, or immune response to the pathogens. We expect that gene-editing in ticks will provide new opportunities for identification of targets for vaccine for Lyme disease and other tick-borne diseases. Additionally, it will also lead to acaricide candidates identification. I will be presenting this work at the meeting

Smith, Patricia

Patricia V. Smith, BA

Pres, Lyme Disease Assoc., Inc.

Advisory Bd., Columbia Lyme & Tick-Borne
Diseases Research Center

Programmatic Panel, TBD, DoD Congressionally

Directed Medical Research Program

Conference Planning Com./Organizer

Jackson, NJ



Welcome/Overview of Lyme/Introductions

Patricia V. Smith, a Monmouth University graduate, is in her 20th year as President of the all-volunteer run national non-profit Lyme Disease Association, LDA and is a member of Columbia University's Lyme & Tick-Borne Diseases Research Center Advisory Committee, member of the Food & Drug Administration's (FDA) PESP Partnership to promote avoidance of tick exposure, and member of the Tick IPM Working Group with federal and non federal members, from the IPM Institute of North America, to eradicate tick-borne diseases. She was appointed in 2016 as a member of the US Army Medical Research and Materiel Command (USAMRMC) Tick-Borne Disease Research Program (TBDRP) as a member of the Congressionally Directed Medical Research Program Programmatic Panel.

Ms. Smith is also former Chair, (NJ) Governor's Lyme Disease Advisory Council. She was EPA's PESP 2011 Lyme prevention conference session co-chair with CDC. In 2011 she presented a Lyme session to the New Jersey Education Association's Annual Meeting. She is a member & former officer of ILADS, International Lyme & Associated Diseases Society, a professional medical and research organization.

Ms. Smith is former President/12-year member of the Wall NJ Board of Education where she earned state board member-certified status. She is a former officer of Monmouth County School Boards Assn. and was a member of the Federal Relations Network for New Jersey School Boards Association/National School Boards Assn.

During her LDA presidency, Ms. Smith has led the effort to raise funds for researchers nationally, with more than 106 research grants awarded – research acknowledged in 42 scientific journals. She has organized 18 continuing medical education (CME) accredited Lyme scientific conferences for doctors and researchers with international faculty, held in different areas of the US, most jointly sponsored by Columbia University. She has spoken at many conferences on Lyme including those presented by the University of New Haven (CT) and the California Lyme Disease Association (now LymeDisease.org), Midcoast Maine Lyme Education and Support, Colorado Tick-Borne Awareness Association, and ILADS. She has been a speaker at hundreds of public, school, business, & government events.

She led the LDA in its effort with a partner organization, to endow the Columbia Lyme & Tick-Borne Diseases Research Center in New York, which opened in 2007. She developed the ABCs of Lyme Disease pamphlet for parents and educators and also the LymeR Primer brochure now featuring 20 tick-borne diseases, the Tick Mark bookmark, and helped design Tick Awareness cards. More than 2.5 million education items have been distributed.

Ms. Smith has testified for and secured passage of state and federal bills for Lyme research and physician's right to treat. She has been invited to state capitals in CT, MA, MD, MN, NH, NJ, NY, PA, RI, to present oral testimony and education on Lyme and has provided written testimony in many others. Based on her written testimony, LDA was recently included in ground breaking Maine legislation as a website

resource on Lyme disease on Maine's DPH website. She was invited to testify on two occasions before the NY Assembly Health Care Committee and also before the Rhode Island (Governor's) Lyme Disease Advisory Commission and has spoken before the California Lyme Disease Advisory Council. Over time, she has personally met with many State Health Commissioners and with Governors in NH, RI CT on Lyme issues and with then Governor Pataki's office on many occasions along with several NY state legislators. She has also presented before the Pennsylvania House of Representatives Majority Policy Committee and was an invited speaker for Lyme forums hosted by a member of the Massachusetts House of Representatives and the Majority Caucus Administrator for the Pennsylvania House of Representatives and the Minnesota State Senate Health Committee.

She has twice been invited to present to CDC Vector-Borne Diseases Division, Ft. Collins (2007, 2013); met with then CDC Director Dr. Julie Gerberding/5 Congressmen in DC; organized & led a team that met with HHS Asst. Sec. of Health with CDC/NIH officials teleconferenced in; met with military leaders in DC; and briefed the Senate HELP Committee Members and House Subcommittee on Health. She met several times with US Army CHPPM/Public Health Command at Aberdeen Proving Grounds. She met in DC with the NIH Program Director and research coordinator and presented educational PowerPoints on Lyme to employees at the Environmental Protection Agency (2008, 2014), to the Dept. of Energy, and to Homeland Security in 2014. In 2014, she helped develop language for a federal bill on Lyme and led the nationwide effort which successfully passed the bill through the House. Ms. Smith spoke at a 2014 press conference with Senator Charles Schumer (NY) on the doxycycline shortage for Lyme patients. In 2012, she testified before the House Foreign Affairs Committee, Africa, Global Health & Human Rights Subcommittee on issues affecting Lyme patients. In 2013, she testified before the House Energy & Commerce Health Subcommittee on HR 610 to establish a federal

Lyme & Tick-Borne Diseases Advisory Committee. She co-authored an article which was read into the Congressional Record on Lyme disease research priorities from the patient perspective. In 2015, she spoke at the American Association for the Advancement of Science in DC on patient research priorities. In 2016, she spoke before the Women in Government's annual conference. In 2016, she led the negotiations with House leadership for the Lyme language subsequently passed in the 21st Century Cures Act which creates a federal working group on tick-borne diseases with patient and advocates reps.

Chosen Jackson NJ's Chamber of Commerce 2008 Woman of the Year, she has also received commendation from the NJ legislature, a Special Congressional Recognition certificate from RI Cong. Langevin, and had a flag flown over the US Capitol by request of NJ Cong. Chris Smith in honor of her Lyme work. Ms. Smith helped to organize and presented at educational forums held by 3 congressmen (Langevin, Pitts, C. Smith). She has received awards from Dr. Brian Fallon, Columbia, from various Lyme groups, and was given the Courage in Advocacy Award in 2015 from Connecticut based Lyme Connection and Focus on Lyme Excellence in Advocacy (AZ) award in 2017.

Other activities include providing input into a NJ law requiring teacher education for staff who teach students with Lyme disease, performing school in-services for educators on Lyme disease, and working with parents of students who are classified due to Lyme disease. Working with author Amy Tan, she created LDA's LymeAid 4 Kids, a fund for children with no health coverage for Lyme, a fund that has awarded \$338,400 for uninsured children to date.

Maloney, Elizabeth

Elizabeth L. Maloney, MD

(Conference Planning Committee)

President, Partnership for Tick-Borne Diseases Education

Family Practice Physician

Wyoming, MN

www.partnershipfortickbornediseases.org



Concurrent Tick-Borne Illnesses: A Case Report and Review of the Literature

Dr. Elizabeth L. Maloney is the President of Partnership for Tick-Borne Diseases Education, a non-profit organization providing online and live evidence-based continuing medical education programming and materials on tick-borne diseases for physicians and other healthcare professionals. She is a graduate of the University of Minnesota Medical School and its affiliated Family Medicine residency.

Dr. Maloney also acts as a consultant to government agencies and private organizations. She recently served on the Pathogenesis, Transmission and Treatment subcommittee of the federally mandated Tick-borne Diseases Working group. She frequently speaks to the general public on tick-borne diseases, emphasizing the need for primary and secondary prevention.

Conference Lecture Summary

The list of known tick-borne diseases has grown in the last several years and cases numbers for several of these infections are on the rise. Many of these infections are transmitted by blacklegged ticks, which are known to simultaneously harbor more than one pathogen. As such, when managing patients with a blacklegged tick-borne disease,

clinicians must consider whether these individuals have additional co-infections. This presentation uses a case study as a springboard to a literature review regarding concurrent black-legged tick-borne diseases.

Lewis, Kim

Kim Lewis, PhD

University Distinguished Professor
Director, Antimicrobial Discovery Center
Northeastern University
Boston, MA

<https://web.northeastern.edu/adc/>



Developing Therapies for Treating Lyme Disease

Kim Lewis is a University Distinguished Professor and Director, Antimicrobial Discovery Center at Northeastern University in Boston, and a Fellow of the American Society of Microbiology. He obtained his Ph.D. in Biochemistry from Moscow University in 1980, and has been on the Faculty of MIT, University of Maryland, and Tufts University prior to coming to Northeastern.

Dr. Lewis has authored over 100 papers and is an inventor on several patents. His more notable findings include the development of general methods to grow previously uncultured bacteria that make up >99% of biodiversity on the planet, the discovery of the culprit of recalcitrant biofilm infections, drug-tolerant persister cells; and antimicrobials for sterilizing biofilm infections and killing *M. tuberculosis*.

Dr. Lewis presented over 90 invited talks. Dr. Lewis has been a permanent member of the Drug Discovery and Drug Resistance NIH Study Section, and Chair of two NIH Study Sections on Drug Discovery. Dr. Lewis has served as a panelist and contributor to the National Academies Institute of Medicine reports on antibiotic resistance in 2010, 2011 and 2014, and the European Academies Science Advisory Meeting in 2014. Dr. Lewis is a member of Faculty 1000, a world-wide panel of experts evaluating research advancements. He is a recipient of the MIT C.E. Reed Faculty Initiative Award for an innovative research project (1992), and is a recipient of the NIH Director's Transformative Grant (2009).

Apart from his work in Academia, Dr. Lewis has served as a consultant to the Pharmaceutical Industry, The Biotech, and is a founder of two Biotech Companies, NovoBiotic Pharmaceuticals, and Arietis Corporation.

Conference Lecture Summary

The nature of Post-Treatment Lyme Disease Syndrome (PTLDS) remains unknown, but it is reasonable to assume that minimizing the duration of an acute infection will diminish if not prevent the chronic form of the disease. With this in mind, we set out to identify antimicrobials that efficiently kill *Borrelia burgdorferi*. This led to the identification of two experimental compounds. One is disulfiram, an FDA approved drug for treating alcoholism that eradicates persisters of *B. burgdorferi* and acts selectively against the pathogen. We developed a stable formulation of disulfiram that is effective in a mouse model of Lyme disease. If the pathogen is present at the chronic stage, disulfiram is also expected to clear it. The other compound is a natural product selective against *B. burgdorferi*. An aberrant microbiome is known to contribute to a number of autoimmune diseases, and patients with PTLDS exhibit changes in the microbiome as well. This suggests

microbiome restoration, and using antibiotics that do not harm gut symbionts.

Spector, Neil

Neil Lee Spector, MD

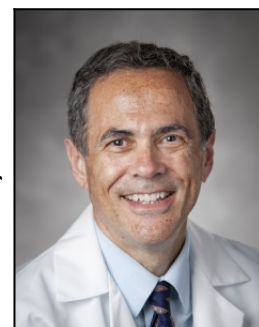
Associate Professor of Medicine

Sandra Coates Associate Professor

Associate Professor of Pharmacology & Cancer Biology

Member of the Duke Cancer Institute

Durham, NC



<https://medicine.duke.edu/faculty/neil-lee-spector-md>

Applying the Lessons From Cancer Research to the Diagnosis and Treatment of TBD

Dr. Neil Spector completed a medical oncology-hematology and bone marrow transplant fellowships at Massachusetts General Hospital and Dana-Farber Cancer Institute, Harvard Medical School, where he remained on the faculty as an attending physician, pursuing his research on the molecular events that promote the switch from a normal to malignant cells. From 1998 through 2006, Dr. Spector directed the Translational Oncology Research Program at GlaxoSmithKline where his innovative bench to bedside strategy is credited with leading to FDA approval of two molecularly targeted therapies, (i) nelarabine, an ara-G prodrug approved for the treatment of pediatric T-cell acute lymphoblastic leukemia; and (ii) lapatinib, the only small molecule inhibitor of the EGFR and HER2 tyrosine kinases currently approved for the treatment of HER2 overexpressing breast cancer. His application of translational research to the preclinical and clinical development of lapatinib remains

an example of how precision oncology can transform treatment of cancer patients, and facilitate the development of targeted cancer therapies. In 2006, Dr. Spector joined the faculty at Duke University School of Medicine where he is currently the Sandra Coates Associate Professor Medicine. His research focuses on elucidating molecular mechanisms of therapeutic resistance to targeted therapies and strategies to prevent and/or overcome resistance, and more recently, the design of targeted strategies to block specific steps in the earliest stages of cancer development. He was selected by his peers as a Komen Research Scholar, a group representing the top 50 breast cancer researchers from around the world. In addition to his research, Dr. Spector continues to see oncology patients and was recently appointed National Director of Precision Oncology for the VA Healthcare System. Dr. Spector also detailed his personal journey with Lyme disease and the life-threatening cardiac complications that ensued in his recent book, *Gone In a Heartbeat: A Physician's Search for True Healing*.

Conference Lecture Summary:

There are striking similarities in the pathogenesis of many cancers and *Borrelia* infection. The insights that have been made in understanding tumorigenesis and cancer progression and metastatic dissemination have led to paradigm shift in drug development, from the historical reliance on cytotoxic chemotherapies to small molecules targeting oncogenic driver mutations and immunotherapies designed to activate antitumor immune responses. The latter targeted therapies have transformed clinical outcomes for many patients with solid tumor and hematological malignancies. In this presentation, I will discuss how the successful lessons learned in cancer biology and targeted/immunotherapy drug development may apply to the way think in terms of new, non-antibiotic therapies for *Borrelia* and other tick-borne illnesses. I will discuss an

ongoing collaborative project in our lab and others to utilize a platform technology that has successfully identified novel small molecule therapies for cancer, metabolic and certain infectious diseases, to identify a new class of molecularly targeted therapies for Borrelia.

Oaklander, Anne Louise

Anne Louise Oaklander, MD, PhD

Associate Professor of Neurology

Harvard Medical School

Assistant in Neurology and Neuropathology at
Massachusetts General Hospital

Director of Massachusetts General Hospital's
Nerve Unit Group.

Boston, MA

<https://www.massgeneral.org/doctors/doctor.aspx?id=17253#>

[NeuropathyCommons.org](https://www.massgeneral.org/doctors/doctor.aspx?id=17253#)



Small-Fiber Peripheral Neuropathy: A Pathway for Some Patients

Dr. Oaklander, Associate Professor of Neurology at Harvard Medical School and Assistant in Neurology and Neuropathology at Massachusetts General Hospital, directs MGH's Nerve Unit group. After undergraduate studies at Columbia and Cornell she received M.D. and Ph.D. degrees (neuroscience) from Albert Einstein College of Medicine. She completed neurology residency at Rutgers, fellowships in peripheral nerve and neurosurgery at Johns Hopkins, then joined Hopkins' faculty. At Harvard she directs the federally-funded Nerve Unit research team that identified the causes of chronic pain after shingles and limb injuries. They discovered a new small-fiber polyneuropathy that causes disabling multi-symptom illnesses

in young people, and that small-fiber polyneuropathy underlies 40% of fibromyalgia cases. They proposed that some small-fiber neuropathies are autoimmune and demonstrated efficacy of immunotherapy (IVIg). She has more than 100 publications and serves on editorial boards of professional journals. A Fellow of the American Academy of Neurology and the American Neurological Association, her research has been profiled in Science, Scientific American Mind, and by PBS. She is listed in America's Top Doctors, America's Top Physicians, and US News and World Report. She serves on NIH's Research Council and has served on panels for the NIH, the FDA, and the Institute of Medicine.

Conference Lecture Summary:

Our research team investigates biological causes of unexplained sensory and other symptoms. We have studied unexplained multisymptom illnesses that include chronic widespread pain, itching, dizziness on standing and rapid heartbeat (POTS), and gastrointestinal symptoms. In some but not all clinical patients and research subjects, we find objective evidence suggesting that small-fiber polyneuropathy (SFPN) may be part of the problem. The strongest studies so far are for fibromyalgia. Our lab and others around the world have published that about 40% of fibromyalgia patients have skin biopsies and other neurological evidence of SFPN. For them, we recommend the standard blood tests to look for potentially treatable causes or contributors, especially smoking and diabetes, and then medical treatment targeting their own problem. We have helped identify disease-specific treatments for genetic and autoimmune types of SFPN. We provide non-commercial information for the public at <https://neuropathycommons.org/> and in a public lecture at Radcliffe posted at <https://www.youtube.com/watch?v=s66LvWQ5Qso>.