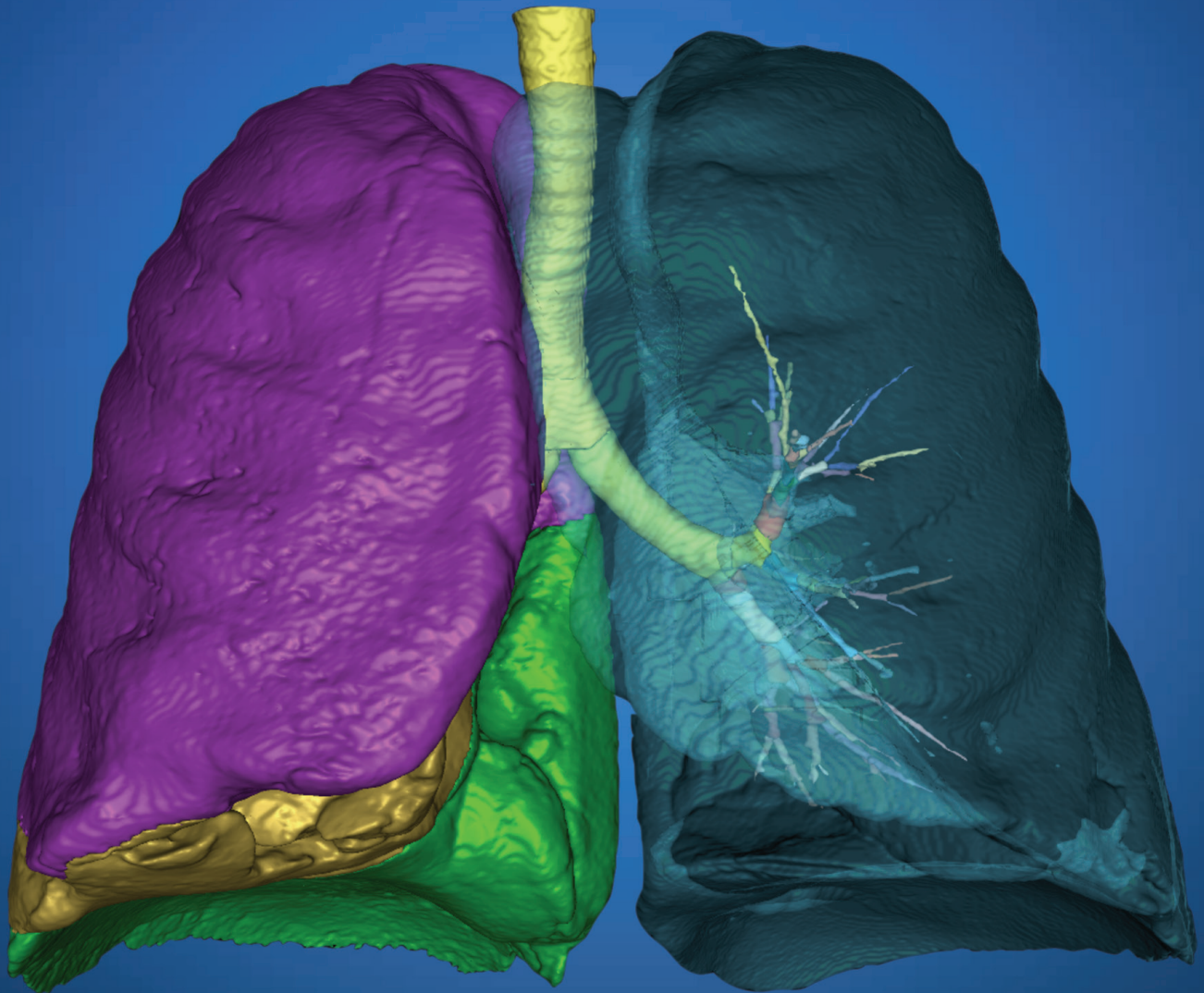




**National Jewish
Health[®]**

Breathing Science is Life.[®]

#1 in Respiratory Care



PULMONARY HIGHLIGHTS **2018**

Clinical Expertise, Research and Education

THE TUCHMAN FAMILY

DIVISION OF PULMONARY,
CRITICAL CARE AND SLEEP MEDICINE



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National Jewish Health acknowledges The Tuchman Family Foundation and Debra and Ken Tuchman for their generous gift to establish The Tuchman Family Division of Pulmonary, Critical Care and Sleep Medicine.

For more than 20 years, Debra and Ken Tuchman and the Tuchman Family have been committed to National Jewish Health through board service and as outstanding advocates for the institution.



Dear Colleague,

For 120 years, National Jewish Health has focused on respiratory and related disorders. In any given week, our pulmonologists see patients with rare conditions that most pulmonologists see only a few times in their careers. We are accustomed to recognizing the zebras in herds of horses. We welcome your most challenging cases.

At National Jewish Health, we have one of the largest pulmonary divisions in the nation, and our dedicated faculty includes recognized national leaders in their fields, ranging from asthma, COPD and interstitial lung disease to diffuse panbronchiolitis and granulomatosis with polyangiitis. This year we were named the #1 respiratory hospital in the nation for the 17th time by *U.S. News & World Report*.

Our unique model of care relies on extensive evaluations by expert pulmonologists in collaboration with cardiologists, gastroenterologists, allergists, oncologists, rheumatologists and others, all under one roof at National Jewish Health. Patients who come from around the nation receive a combination of tests not available anywhere else. In just a few days they can see specialists in several disciplines, who then confer with their colleagues to determine a diagnosis.

We have extensive experience developing effective treatment plans for patients with common and rare conditions. We provide access to hundreds of clinical trials at National Jewish Health. Once we develop a diagnosis and treatment plan, we work with each patient's hometown physician to implement the plan.

We share our expertise with the next generation of health care providers by training medical students, residents and postgraduate fellows in affiliation with the University of Colorado School of Medicine and through our robust, nationwide continuing medical education program. Our dynamic clinical and basic research programs continuously seek answers to the many questions and challenges that remain in pulmonary medicine.

With great pleasure, we present *National Jewish Health Pulmonary Highlights 2018*, our annual compilation of clinical, research and educational capabilities and accomplishments in pulmonary medicine. We hope you will take a few moments to read and discover how we are advancing pulmonary medicine and improving treatment options for our patients.

Irina Petrache, MD
Chief, Division of Pulmonary,
Critical Care and Sleep Medicine
National Jewish Health

Richard J. Martin, MD
Chair, Department of Medicine
National Jewish Health

CLINICAL EXPERTISE

National Jewish Health provides people from around the nation and the world with comprehensive evaluations, diagnoses and treatment plans. Our pulmonary specialists and their colleagues in cardiology, gastroenterology, oncology, immunology, rheumatology and radiology lead the way in providing this unique, comprehensive approach to care. And, our physicians and staff work with each patient's hometown physician to help monitor and adjust care as needed. Our expertise includes the following:

Advanced Diagnostic Laboratories

We provide unparalleled immune and respiratory disease expertise to our clinical, biotech, pharmaceutical, public health and diagnostic partners. Our CLIA and CAP15189SM-certified laboratories have decades of experience developing immunology, complement, infectious disease and molecular genomic tests.

Allergy and Immunology

Multidisciplinary teams of nationally recognized experts use the latest testing and treatments to diagnose and manage allergies and other immune disorders, which can impact respiratory health. Our patients also have access to the latest allergy and immunology clinical trials.

Asthma

Thorough upper and lower airway evaluations in the multi-day adult and pediatric asthma programs help us phenotype patients and understand complicating factors from aspiration to allergies, vocal cord dysfunction and inhaler technique.

Our faculty members lead numerous National Institutes of Health (NIH) studies and industry-sponsored clinical trials.

Behavioral Health

Teaching patients to understand and manage behavioral health issues that often accompany chronic respiratory diseases is an integrated part of our whole patient approach. In addition, our prevention and wellness programs offer help with tobacco cessation and weight management.

Cardiology

Our cardiologists are experts in the heart-lung interface. They work closely with pulmonologists to diagnose and treat the cardiac causes and consequences of lung disease, including pulmonary hypertension, cardiac sarcoidosis and other rare diseases.

Chronic Beryllium Disease

National Jewish Health has more experience with the diagnosis and treatment of chronic beryllium disease than any other group in the world. We emphasize early disease detection and intervention.

COPD

A multidisciplinary evaluation allows our team of physicians and therapists to address COPD medications, education, compliance, nutrition and rehabilitation.

We are advancing pulmonary medicine with COPDGene

and other studies to diagnose and phenotype COPD, striving to individualize therapies for chronic bronchitis, bronchiolitis, emphysema and bronchiectasis.

In addition, we are a leading center in the diagnosis and management of alpha-1 antitrypsin deficiency and offer clinical trials for those with this condition.

Cystic Fibrosis

We have the largest and most experienced adult cystic fibrosis program in the nation. Our team of pulmonary specialists, nurse coordinators, respiratory therapists, registered dietitians, psychologists and social workers provides treatment for more than 400 adults annually.

We have more than two dozen ongoing clinical trials to evaluate new cystic fibrosis therapies.

Electrophysiology

Our electrophysiology program manages the outpatient and surgical needs of patients with arrhythmias, including atrial fibrillation, cardiomyopathy, ventricular tachycardia, bradycardia, palpitations, syncope and sudden cardiac death/familial genetic syndromes. Additionally, we have clinical trials in this area and provide the latest treatment options.

CLINICAL EXPERTISE

Environmental Health

A multidisciplinary team approach helps us define, diagnose and treat patients with a broad range of occupational, environmental and granulomatous lung diseases, including chronic beryllium disease, bronchiolitis obliterans and respiratory disease among warfighters returning from deployment in the Middle East.

Gastroenterology

We diagnose and treat the entire range of GI illnesses including liver disease, biliary disorders, inflammatory bowel disease, GERD and esophageal disorders, pancreatic disease, gut motility disorders and functional disorders of the gut.

We have special expertise in GI motility disorders, pulmonary-related GI conditions, GI cancer screening and treating GI malignancies.

Interstitial Lung Disease

We have vast experience with interstitial lung disease (ILD). Through detailed evaluations, we diagnose the wide range of ILDs of idiopathic, exposure and autoimmune origins.

Care plans are based on the most current information, much of which has been discovered at National Jewish Health.

Also, we have several ongoing clinical trials of approved and experimental ILD therapies.

Interventional Pulmonology

Minimally invasive diagnostic, therapeutic and palliative procedures include identification, diagnosis, treatment and monitoring of pulmonary nodules; early detection of lung cancer; diagnosis and treatment of airway obstruction and tracheomalacia; pleural procedures; implantation and removal of airway stents; and bronchial thermoplasty for severe asthma.

Interventional pulmonologists work closely with thoracic surgeons to individualize therapeutic options for those with severe emphysema, including bronchoscopic lung volume reduction and intra-bronchial valve placement.

Mycobacterial Infections: TB and NTM

Our origins as a hospital for destitute tuberculosis patients make mycobacterial disease a part of the DNA of National Jewish Health. Today, we continue to provide consultations and manage nontuberculous mycobacterial (NTM) infections.

Experience with thousands of complex mycobacterial infections throughout our 120-year history has given us a deep knowledge of personalized antibiotic regimens and surgical options.



Specialized tests are used to discover what is blocking the smooth flow of air through the lungs.

CLINICAL EXPERTISE

Oncology

Expert pulmonologists, thoracic radiologists, gastroenterologists and surgeons help us diagnose and treat cancers of the lungs, head and neck and digestive system. Lung cancer screening and our tumor registry help us screen and monitor patients at high risk for lung cancer.

Pediatrics

National Jewish Health *for Kids* is shaping the evolving knowledge about diagnosis and treatment of asthma, vocal cord dysfunction

and other pediatric pulmonary diseases.

Our Severe Asthma Clinic and Pediatric Day Program offer multi-day evaluations, education and management plans for children with pulmonary and atopic diseases.

Pulmonary Hypertension

Pulmonologists and cardiologists collaborate to provide comprehensive and sophisticated outpatient and inpatient services for pulmonary hypertension. These include detailed diagnostic

procedures, such as right heart catheterization with cardiopulmonary exercise testing, which allows for more precise phenotyping and treatment for complex patients.

Pulmonary Palliative Care

This multidisciplinary team improves the quality of life and symptom management by integrating interventions with existing clinical care plans for individuals suffering from diverse respiratory conditions.

Pulmonary Pathology

Vast pathology experience examining lung tissue and diagnosing respiratory diseases contributes to our unparalleled diagnostic capabilities and generates consultation requests from around the country.

Pulmonary Physiological Services

Our state-of-the-art laboratory offers many unique tests, including cardiopulmonary exercise tests with full metabolic testing; arterial line; lactate levels and cardiac data; and continuous laryngoscopy with exercise tolerance to evaluate exercise-induced respiratory distress.

Radiology

Our highly experienced team of radiologists and technicians perform imaging studies on more lungs than any other facility.

Our experts provide interpretations of imaging test results and consultations to help doctors nationwide make accurate and timely diagnoses.



Pediatric Pulmonologist Tod Olin, MD, coaches a patient to manage and overcome exercise-induced vocal cord dysfunction.

CLINICAL EXPERTISE

Rare Lung Diseases

As a national pulmonary referral center we have extensive experience diagnosing and managing a variety of rare lung diseases, including pulmonary alveolar proteinosis (PAP), lymphangioleiomyomatosis (LAM) and eosinophilic syndromes that most pulmonologists rarely see. We are recognized around the world for our expertise in thoracic imaging.

Rheumatology

Our rheumatologists work to manage a variety of rheumatologic disorders. Our Autoimmune Lung Center specializes in interstitial lung diseases caused by systemic autoimmune diseases.

Sarcoidosis

Experience with thousands of sarcoidosis patients has helped us better define and address the multi-organ nature of the disease and gain insight into its causes.

Sleep

Our comprehensive sleep center relies on a full complement of pulmonologists, sleep medicine specialists, psychologists, respiratory therapists and polysomnographic technologists to address the entire spectrum of sleep disorders.



DONALD LEUNG RECOGNIZED FOR SEMINAL WORK

For almost three decades, Donald Leung, MD, PhD, head of pediatric allergy and clinical immunology, has been one of the nation's leading physician scientists.

This year, Dr. Leung received the 2018 Distinguished Scientist Award from the American Academy of Allergy, Asthma & Immunology for his seminal work in atopic dermatitis that will improve patients' lives.

Dr. Leung is one of the nation's leading experts on the care of patients with the most difficult and intractable atopic dermatitis, also known as eczema. His research has helped identify the roles of the skin barrier, the immune response and the skin microbiome in atopic dermatitis. Dr. Leung served for 17 years as editor of the *Journal of Allergy and Clinical Immunology*, is an author of more than 800 scientific publications and is a Principal Investigator of the NIH/NIAID Atopic Dermatitis Research Network.

National Jewish Health is always searching for new, more effective treatments and medications for patients. Today, we have more than 300 active clinical trials offering cutting edge, experimental treatments for a wide range of respiratory and related diseases. We collaborate with the National Institutes of Health, industry and leading research institutions as members of numerous research networks and consortiums.

SELECTED 2018 CLINICAL RESEARCH RESULTS

Combination Therapy Promises Help for 90 Percent of Cystic Fibrosis Patients

Jennifer Taylor-Cousar, MD, MSCS, and her colleagues reported that two different three-drug combinations are more effective than current therapies and could help 90 percent of people with cystic fibrosis live healthier, longer lives. Dual-drug therapy with lumacaftor/ivacaftor (Orkambi[®]) or tezacaftor/ivacaftor (Symdeko[®]) are the current standard of care but have been less than optimal for patients homozygous for the most common CF mutation, del508, and remain unapproved for people with one copy of del508.

A four week treatment of the VX-445-tezacaftor-ivacaftor therapy improved lung function in patients with two copies of del508 by 11 percent over their response to the tezacaftor-ivacaftor combination. Patients with one copy of del508 experienced a 13.8 percent improvement in lung function compared to placebo. The trial of VX-659-tezacaftor-ivacaftor demonstrated similar results. The triple-combination therapies also improved results of sweat chloride concentrations and dramatically improved scores on a cystic fibrosis-specific quality-of-life test (*N Engl J Med.* 2018 Oct 25).

Solving the Puzzle of Chronic Cough

Cough is the most common symptom causing patients to seek medical attention. In spite of published guidelines for diagnosis and treatment of unexplained chronic cough, many patients continue to suffer.

James Good, MD; Richard Martin, MD; and their National Jewish Health colleagues reported their experience with 99 patients who suffered chronic refractory cough. The patients had suffered regular coughing anywhere from less than a year to more than 10 years.

Intake evaluation included history, physical examination, spirometry and fiberoptic laryngoscopy. Chest CTs were obtained for 95 of 99 patients. The physicians identified 10 different diagnoses that contributed to patients' coughs, with an average of four distinct disorders per patient. Obstructive sleep apnea and tracheobronchomalacia were common diagnoses not recognized in current guidelines. With directed therapy, 93 percent of patients had resolution or improvement in cough symptoms (*Respir Med.* 2018 Aug).

Gene Variant Associated with Lung Disease in Rheumatoid Arthritis

In 2011, **Max Seibold, PhD,** reported that a mutation in promoter region of the muc5b gene is the strongest genetic risk factor for idiopathic pulmonary fibrosis, increasing by seven to 22 times the risk of developing the devastating disease (*N Engl J Med.* 2011 Apr 21).

In 2018, **Tasha Fingerlin, PhD; Joshua Solomon, MD;** and their colleagues around the world reported that the same mutation raises the risk by three to five times that people will develop interstitial lung disease associated with rheumatoid arthritis (RA-ILD).

Evidence of usual interstitial pneumonia on CT scans was even more closely associated with RA-ILD. The findings suggest the muc5b promoter mutation may be a generalized risk factor for usual interstitial pneumonia beyond rheumatoid arthritis and idiopathic pulmonary fibrosis. The mutation may also be useful to detect preclinical RA-ILD (*N Engl J Med.* 2018 Oct 20).

SEEKING A CURE FOR ASTHMA

The Cohen Family Asthma Institute, which was established in 2016 with a grant from The Michele and Martin Cohen Family Foundation, seeks to address unmet needs in severe, uncontrolled asthma, while also pursuing a cure for the disease. Through innovative care, research and education, National Jewish Health is steadily advancing toward those goals.

National Jewish Health has a long history of pioneering asthma care and research, which began in the 1950s with residential inpatient programs for both adults and children. In 1960, we developed the “inhalation challenge test,” the first clinically useful method of diagnosing asthma. Decades of pioneering research in immunology and asthma have revealed the biological drivers of asthma. Clinical trials at National Jewish Health helped establish inhaled corticosteroids as the standard of care for asthma and contributed to the introduction of several medications to help improve asthma, including recently FDA-approved biologics for severe asthma.

In its first two years of existence, the Cohen Family Asthma Institute has developed protocols and tracking systems to power research, introduced innovative clinical programs and collaborations to improve asthma care and delivered educational programs to share the latest evidence-based guidance with clinicians around the nation.

Below are a few selected accomplishments of the Cohen Family Asthma Institute:

- Developed a custom order set and protocols to collect biological samples and build a well-characterized asthma cohort for future research at our main campus in Denver, the Mount Sinai – National Jewish Health Respiratory Institute in New York and the Jane and Leonard Korman Respiratory Institute Jefferson Health – National Jewish Health in Philadelphia.
- Developed a system with our clinical partners at Saint Joseph Hospital in Denver to track asthma patient outcomes.
- Began exploring the optimization of diagnostic imaging in asthma.
- Participated in ongoing NIH multicenter trials targeting specific proteins for novel therapeutics, asthma phenotyping, gene suppression changes during early childhood and more.
- Received a joint grant from the American Lung Association to participate in its airway research network and published a related article in *The Lancet Respiratory Medicine* about asthma in the older population.
- Established a clinical program to transition pediatric asthma and allergy patients to adult care.
- Started a monthly airways conference call with colleagues at all National Jewish Health Respiratory Institutes of the most challenging asthma cases.
- Developed an online interactive, multimedia provider education program.

Impact of Asthma	
Adults with asthma	20.4 million
Children with asthma	6.1 million
Missed school days	13.8 million
Missed work days	14.2 million
Emergency room visits	1.9 million
Hospitalizations	439,000
Deaths	3,630

Source: Centers for Disease Control and Prevention

SELECTED OPEN CLINICAL TRIALS

Asthma

New Antibody Targets Severe Asthma

Michael Wechsler, MD, is recruiting people who have had poorly controlled asthma for at least 12 months in spite of a physician prescribed asthma controller medication, to learn if the experimental medication tezepelumab is effective in treating severe asthma and if it causes side effects. Tezepelumab is a man-made antibody that reacts with thymic stromal lymphopoietin (TSLP), which is known to play a role in causing asthma.

Steroid-Resistant Asthma Medication Study

Donald Leung, MD, PhD, and **Elena Goleva, PhD**, are recruiting adults who have asthma symptoms despite daily treatment with inhaled corticosteroid or inhaled corticosteroid with long-acting beta agonists and/or long-acting muscarinic antagonist medications. They are seeking to learn if an investigational p38 inhibitor medication can control inflammation, mucous production and difficulty breathing.

COPD

Preventing COPD Flare-Ups with Beta Blockers

Barry Make, MD, and his colleagues are evaluating metoprolol, a commonly prescribed heart medication, to see if it can reduce the frequency and severity of COPD flare-ups.

Investigational Medication for AATD & COPD

Robert Sandhaus, MD, PhD, is recruiting adults with alpha-1 antitrypsin deficiency (AATD) and COPD to learn if an investigational medication, hyaluronic acid inhalation solution, can be used to treat AATD and emphysema. A common substance made by the human body, hyaluronic acid is found in the highest concentrations in the skin, joint fluid and eyes.

Cystic Fibrosis

Investigational Medications for Cystic Fibrosis

Several researchers are recruiting adults with cystic fibrosis to evaluate the safety and efficacy of various experimental medications including:

- Glycerol phenylbutyrate (RAVICTI®), an FDA – approved medication for urea-cycle disorders, to learn if it improves symptoms of patients with F508del mutation and how typical pancreatic enzyme replacement therapy (PERT) affects absorption of active phenylbutyrate.
- QBW276, an inhaled compound designed to block the function of the sodium (Na+) channel found in the lungs. Blocking these channels may help maintain fluid within the airways to improve mucus clearance.
- PTI-801, an experimental CFTR corrector for treatment of cystic fibrosis.

Impact of Combination Therapy on Cystic Fibrosis (TEACH Study)

Jerry Nick, MD, is recruiting cystic fibrosis patients 12 years old and older who have had a pseudomonas aeruginosa (PA) infection in the past year and have taken inhaled tobramycin in the last six months, to determine how azithromycin and inhaled tobramycin work when taken together. Dr. Nick has published data suggesting that azithromycin and inhaled tobramycin do not work well when used together.

Pulmonary Hypertension

Pulmonary Hypertension & Lung Disease

Patty George, MD, and **Amy Olson, MD**, are recruiting adults with pulmonary hypertension related to interstitial lung disease (ILD), including combined pulmonary fibrosis and emphysema (CPFE) to determine the safety and effectiveness of an inhaled investigational medication, treprostinil, in treating pulmonary hypertension related to ILD.

Interstitial Lung Disease

Pirfenidone for Fibrotic Hypersensitivity Pneumonitis

Evans Fernandez Perez, MD, is recruiting adults who have a possible or definite clinical, radiographic or pathologic diagnosis of fibrotic hypersensitivity pneumonitis (FHP) to study the safety and potential benefits of treating FHP with pirfenidone, which has been approved to treat patients with idiopathic pulmonary fibrosis.

RESEARCH

Pulmonary Fibrosis & Genetic Factors

Kevin Brown, MD, is recruiting people who have at least two family members diagnosed with idiopathic pulmonary fibrosis (IPF) to investigate genetic factors that play a role in the development of familial pulmonary fibrosis and to identify a group of genes that predispose individuals to develop pulmonary fibrosis. Finding the genes that play a role in pulmonary fibrosis is the first step toward developing better methods for early diagnosis and improved treatment for pulmonary fibrosis.

Rare Diseases

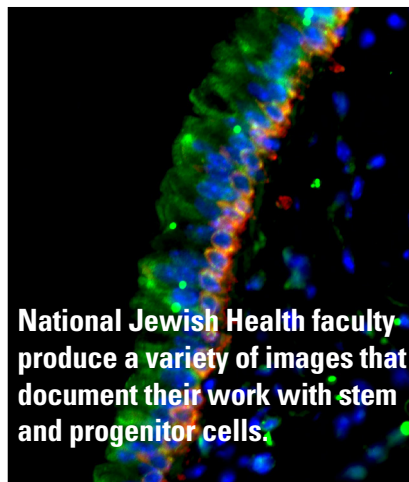
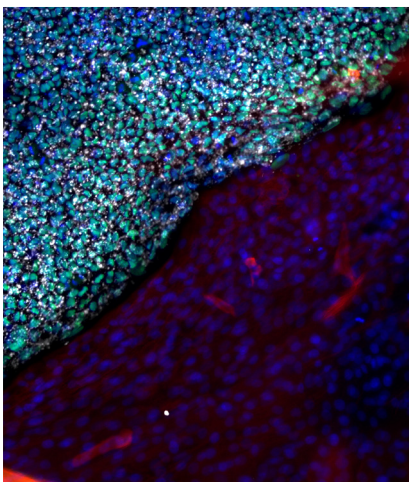
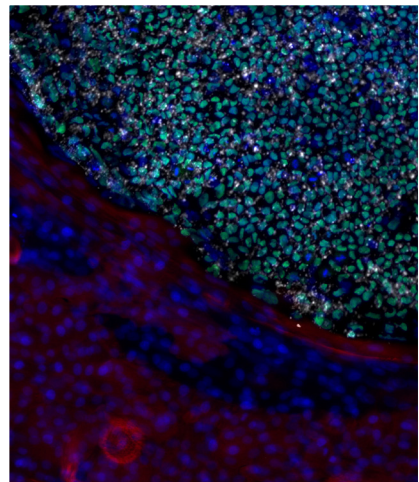
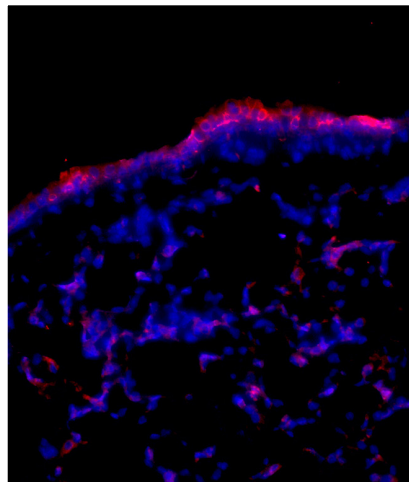
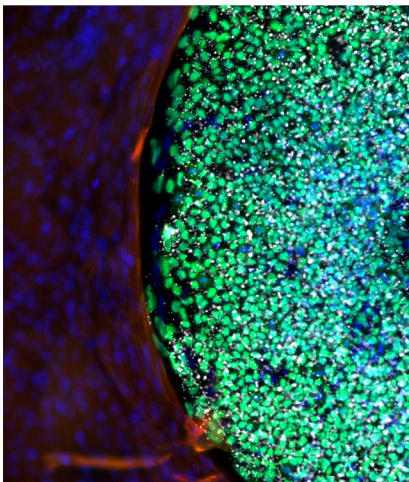
Investigational Medication for Lymphangioliomyomatosis (LAM)

A recent trial showed that sirolimus stabilizes lung function in patients with moderate and severe

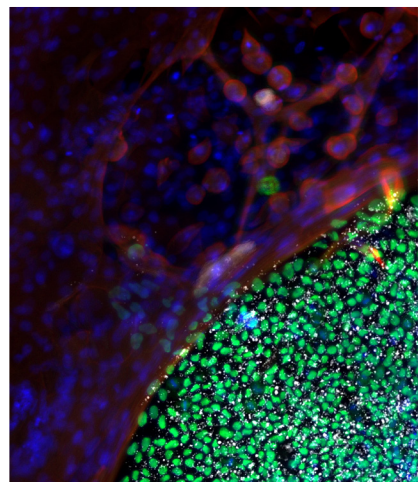
lymphangioliomyomatosis (LAM). **Gregory Downey, MD**, is recruiting adults diagnosed with LAM to find out if giving low-dose sirolimus earlier in the course of treatment safely and effectively prevents further lung damage from LAM.

Immune Pathways & Development of Sarcoidosis

Lisa Maier, MD, is recruiting adult nonsmokers who have biopsy-proven sarcoidosis and who are not on immunosuppressive therapy to learn more about patients who have sarcoidosis and those who do not in order to define different types of sarcoidosis and what may predict how the disease develops over time.



National Jewish Health faculty produce a variety of images that document their work with stem and progenitor cells.



Laboratory scientists at National Jewish Health are advancing the frontiers of pulmonary science. Working closely with physicians, who bring crucial insights and questions from the clinic, our scientists delve deeply into the genetics and epigenetics of lung disease, the fundamental mechanisms of lung injury and repair and the immunological function of the lungs. The answers they find will inspire the therapies of tomorrow.

SELECTED 2018 RESEARCH REPORTS

Drivers of Lung Repair

William Janssen, MD; Kara Mould, MD; and their colleagues have discovered that monocytes recruited to the lungs in response to lung injury develop into CD11bhi macrophages that secrete molecules that promote tissue repair. (*Am J Respir Cell Mol Biol.* 2017 Sep). When this newly discovered subset of lung macrophages fail to die at the appropriate time, however, they may contribute to pathologic lung fibrosis. In January 2018, Dr. Janssen and his colleagues demonstrated that malfunctioning CD11bhi macrophages produce less scar tissue and self-destruct when the researchers deleted the anti-apoptotic protein c-FLIP in those cells. (*Am J Respir Cell Mol Biol.* 2018 Jan).

Destroy the Zombies

In idiopathic pulmonary fibrosis (IPF), scarring continues well beyond its useful response to tissue destruction. Fibroblasts fail to die when they should and

continue zombielike to pump out collagen and other scar materials that make lungs stiff and impervious to oxygen. **David Riches, PhD; Elizabeth Redente, PhD;** and their colleagues reported that an enzyme known as PTPN13 is prevalent in malfunctioning fibroblasts in IPF patients' lungs. Blocking PTPN13 activity allowed fibroblasts to die and thus stop producing scar tissue. National Jewish Health has a patent pending on PTPN13 as a potential therapeutic target to stop scarring in IPF (*Am J Respir Crit Care Med.* 2018 Oct 1).

Reinvigorating Progenitor Cells

Irina Petrache, MD, has shown that cigarette smoke significantly reduces the number and function of progenitor cells in the bone marrow. These cells are crucial to lung repair because they can migrate to the lungs and develop into blood vessels necessary for gas exchange. Dr. Petrache and her colleagues recently reported that an FDA-approved medication for cancer and HIV, AMD3100,

mobilizes progenitor cells out of the bone marrow, reduces the destruction of lung tissue in emphysema and even improves the elasticity of lung tissue (*Am J Physiol Lung Cell Mol Physiol.* 2018 Sep 1).

Genetic "Erasers" Identified

A central question in the study of epigenetics has been to understand how epigenetic marks are added and removed from DNA and associated proteins. **Jim Hagman, PhD; Gongyi Zhang, PhD;** and their colleagues reported that two proteins, JMJD5 and JMJD7, act as epigenetic "erasers." They remove methyl groups from histone proteins that hold DNA inside the cell. Some epigenetic modifications have been associated with various cancers. The modifications Drs. Hagman and Zhang discovered may contribute to the growth of tumors and could be targets for future therapies (*Sci Rep.* 2018 Feb 19).

NOTEWORTHY ONGOING RESEARCH

COPDGene — Genetic Epidemiology of COPD

James D. Crapo, MD, co-leads one of the largest studies ever to investigate the underlying genetic factors of chronic obstructive pulmonary disease (COPD). Now entering its twelfth year, with 10,000 enrolled individuals, the COPDGene Study aims to find inherited or genetic factors that increase risk for COPD and to better classify COPD subtypes that may respond to precision medicine interventions.

Mechanisms and Treatment of Deployment-Related Lung Injury

Gregory P. Downey, MD, and **Cecile Rose, MD**, are working with a unique cohort of more than 100 previously deployed veterans with lung disease to understand why warfighters deployed to Southwest Asia suffer increased rates of respiratory disease and to test potential treatments.

Immunosuppressive Injurious Effects of E-cigarettes on Human Lung Parenchyma

Irina Petrache, MD, and **Hong Wei Chu, MD**, are testing their hypothesis that e-cigarettes impair antiviral immunity, causing increased neutrophilic inflammation and injury to distal lung structure.

Steroid Resistance of Airway ILC2s

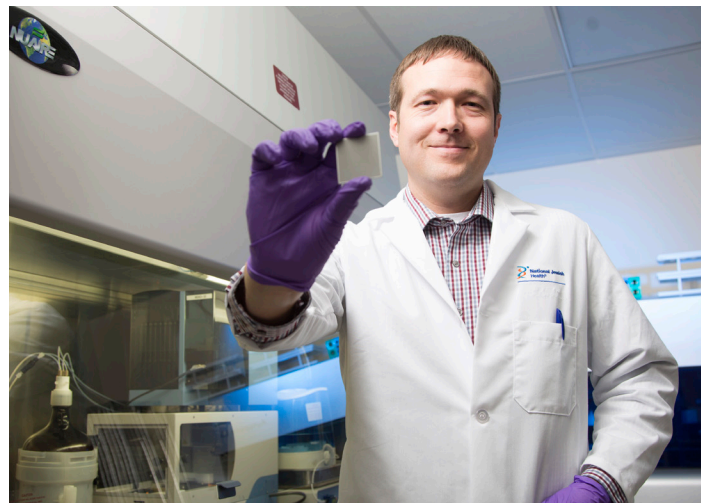
Rafeul Alam, MD, PhD, is studying how TSLP and related signaling pathways contribute to steroid resistance of Type 2 innate lymphoid cells.

Regulation of Gene Expression in the Anaphylactic Pathway

Hua Huang, MD, PhD, is investigating regulation of genes that encode proteins critical for allergic anaphylaxis mediated by IgE and mast cells.

Environmental and Host Determinants of NTM Lung Disease in Hawaii

Michael Strong, PhD, is investigating nontuberculous mycobacteria (NTM) in the environment and in patients in Hawaii, which has the highest prevalence of NTM lung infections, to better understand why only some people are infected by this nearly ubiquitous microorganism.



Max Seibold, PhD

BIRTH COHORT TO STUDY ORIGINS OF ASTHMA

Max Seibold, PhD, and researchers at the University of California, San Francisco and Centro de Neumología Pediátrica in Puerto Rico have been awarded \$10 million to develop a birth cohort of 4,000 infants in Puerto Rico to study the origins of asthma. Asthma prevalence and deaths in Puerto Rico are among the highest in the world. The team will follow the children from birth through early childhood to learn how genes and viral infections affect respiratory disease.

The Puerto Rican Infant Metagenomic and Epidemiologic study of Respiratory Outcomes (PRIMERO) will be one of the largest birth cohort studies ever conducted in a minority population. Novel genetic techniques and strategies developed by Dr. Seibold will allow researchers to easily obtain and analyze genetic samples from children's airways.

The researchers will seek biological drivers of disease and biomarkers that could predict disease outcomes. These discoveries can inform development of therapeutics for early intervention and prevention of disease.

EDUCATION

ACADEMIC TRAINING

National Jewish Health physicians and scientists are thought leaders in their fields who elevate the standard of patient care and teach the next generation of health care professionals with fellowships, training and continuing medical education. National Jewish Health is an accredited teaching affiliate of the University of Colorado School of Medicine, where our physicians and scientists have faculty appointments.

Clinical Fellowships

Based at National Jewish Health:

- Adult Sleep Medicine
- Pediatric Allergy and Immunology
- Adult Allergy and Immunology
- Mycobacterial Disease

Based at University of Colorado School of Medicine with rotations at National Jewish Health:

- Adult Pulmonary and Critical Care Medicine
- Interventional Pulmonology
- Infectious Disease
- Pediatric Pulmonary Medicine
- Rheumatology
- Cardiothoracic Radiology

In collaboration with the Colorado School of Public Health, National Jewish Health also offers fellowships in:

- Occupational and Environmental Medicine
- Pediatric Sleep Medicine



Postdoctoral Fellowships

National Jewish Health has a robust discovery and translation research enterprise, placing it in the top 7 percent of institutions funded by the National Institutes of Health.

Numerous opportunities exist for postdoctoral training in laboratories in the Department of Biomedical Research, the Division of Cell Biology and the Basic Science Section of the Department of Medicine.

Graduate Education

Students enrolled in one of the PhD programs offered by the Graduate School of the University of Colorado Denver have the opportunity to perform their thesis research in the laboratories of the faculty at National Jewish Health.

Residents and Medical Students

Residents and medical students at the University of Colorado School of Medicine have rotations at National Jewish Health in a variety of specialties including pulmonary medicine, cardiology, allergy and gastroenterology. In addition, our faculty train residents in family medicine at National Jewish Health | Saint Joseph Hospital.



CONTINUING MEDICAL EDUCATION

Building on the expertise of world-renowned faculty at National Jewish Health, the Office of Professional Education strives to create innovative educational activities for physicians, pharmacists, nurses and other health care providers to develop and enhance their knowledge and competency related to the diseases National Jewish Health treats and researches.

Through robust educational offerings, with the ultimate goal of improved patient outcomes, we work to deliver on our mission to educate as a preeminent health care institution.

Program Provides Roadmap for Diagnosing and Treating Severe Asthma

What began as a live continuing medical education (CME) program presented nationwide in 2018 continues into 2019 as an online CME activity. “A Severe Asthma Roadmap for Improved Diagnosis and Personalized Treatment – A Guided Workflow” covers the diagnosis, treatment and management of patients with severe and difficult-to-treat asthma using a test-and-teach simulation-based structure that follows the workflow of a Severe Asthma Roadmap Infographic.

The case-based, interactive, multimedia enduring activity and the downloadable infographic can be accessed by visiting njhealth.org/CME.

Pulmonologists **Michael Wechsler, MD**, of National Jewish Health, and **Linda Rogers, MD**, of the Icahn School of Medicine at Mount Sinai, served as the faculty for this education collaboration with the Mount Sinai – National Jewish Health Respiratory Institute.

National Outreach in Person and Online

Each year, the Office of Professional Education manages CME activities in cities coast-to-coast. In 2018, this included satellite symposia at the CHEST Annual Meeting on nontuberculous mycobacteria and interstitial lung disease and on cystic fibrosis at the North American Cystic Fibrosis Conference.

These initiatives, as well as our other live meetings on severe asthma, COPD and idiopathic pulmonary fibrosis, offer complementary online CME-certified activities, making the same great education accessible to health care professionals around the world.



To see all of our courses and learn more about the Office of Professional Education, please visit njhealth.org/CME or call 800.844.2305 or email proed@njhealth.org.

COLLABORATIONS

From Denver to New York and Philadelphia and hospitals across the West, collaborations with other leading health care organizations are a key component of our growth at National Jewish Health. In addition to being an extension of our unique model of care and elevating respiratory care for patients, these collaborations create opportunities for research and training of health professionals. And, our collaborative approach is linked into new technology which allows us to maximize our expertise in respiratory care through tele-ICU services.

NATIONAL JEWISH HEALTH | SAINT JOSEPH HOSPITAL

In Colorado, our joint operating agreement with state-of-the-art Saint Joseph Hospital, part of the SCL Health System, allows us to extend the services we offer our patients and to provide the entire continuum of care, from outpatient to inpatient, emergency and intensive care.

Four years into our collaboration, both organizations continue to grow in the number of patients served and services offered together. Identifying new ways to collaborate on clinical research and developing innovative projects, such as lung cancer screening and intensive cardiac rehabilitation, also demonstrate the impact that is being made.

This year we expanded many of our programs. We opened a new Respiratory Institute inpatient unit at Saint Joseph Hospital, developed an advanced extracorporeal membrane oxygenation program and began offering inpatient pulmonary and critical care clinical trials. Collectively, we were designated as a Lung Cancer Center of Excellence by the Bonnie J. Addario Foundation. We also opened the Critical Illness Recovery Center at National Jewish Health to help patients who have ongoing challenges recover faster and more fully.

Our integrated leadership teams collaborated to jointly recruit **Glenn A. Hirsch, MD**, the new chief of the Division of Cardiology at both National Jewish Health and Saint Joseph Hospital.



RESPIRATORY INSTITUTES OFFER HOPE FOR PATIENTS NATIONWIDE

National Jewish Health continues collaboration with Mount Sinai in New York and Jefferson Health in Philadelphia to advance and expand the Respiratory Institutes based in those cities.

The Respiratory Institutes bring the multidisciplinary, team-based model of care practiced at the National Jewish Health main campus in Colorado to respiratory patients in New York, Philadelphia and throughout the northeastern United States. The Respiratory Institutes also focus on research, bringing together investigators from all three organizations to advance care for complex respiratory diseases.



The Mount Sinai – National Jewish Health Respiratory Institute, led by **CEO Charles Powell, MD**, continued growth during 2018, highlighted by the opening of a second location at Union Square in New York City. The new location has a completely renovated and updated space with examination rooms and treatment suites designed specifically for the diagnosis and treatment of respiratory diseases, as well as spacious waiting areas and comfortable consultation offices.

During this past year, the Mount Sinai – National Jewish Health Respiratory Institute also focused on increasing options for patient education and expanding support groups for patients. Research thrived with ongoing collaborations and an emphasis on physician education.

Jane and Leonard Korman Respiratory Institute™



The Jane and Leonard Korman Respiratory Institute Jefferson Health – National Jewish Health, was first announced in 2017, and this past year recruited a talented leader. **Jesse Roman, MD**, was appointed CEO for the Philadelphia-based Respiratory Institute in February 2018. He brings extensive experience in respiratory disease and proven leadership skills to this endeavor.

Dr. Roman and the Respiratory Institute leadership have recruited several key physicians over the year who are seeing patients in the Philadelphia area. Education and research are also a priority for the Institute, which has many clinical trials underway. In addition, Institute leadership is actively working toward developing a designated flagship space, which is expected to open in 2019.

Tele-ICU Serves Banner Health Patients

The Banner Health – National Jewish Health Tele-ICU Collaboration leverages the expertise of National Jewish Health intensivists with Tele-ICU services for acutely ill patients in intensive care units (ICUs) at 25 Banner Health hospitals across the western United States. From an office on the National Jewish Health campus in Denver, Colorado, our intensivists use a suite of electronic resources to monitor seriously ill patients and provide real-time guidance on their care. Banner has found that collaborating with National Jewish Health using Tele-ICU technology improves patient care, saves lives and shortens ICU stays for patients.

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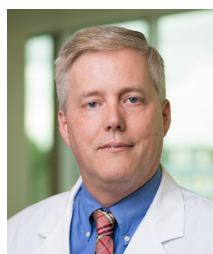
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Jeffrey B. King, MD

SELECTED 2018 PUBLICATIONS

National Jewish Health faculty publish more than 400 articles each year in peer-reviewed scientific and medical journals. Included is a selection of noteworthy articles from the past year.

Asthma

Phenotypes of Recurrent Wheezing in Preschool Children: Identification by Latent Class Analysis and Utility in Prediction of Future Exacerbation.

Fitzpatrick AM, Bacharier LB, Guilbert TW, Jackson DJ, Szeffler SJ, Beigelman A, Cabana MD, Covar R, Holguin F, Lemanske RF Jr, Martinez FD, Morgan W, Phipatanakul W, Pongratic JA, Zeiger RS, Mauger DT; NIH/NHLBI AsthmaNet. *J Allergy Clin Immunol Pract.* 2018 Sep 26.

Predictors of inhaled corticosteroid taper failure in adults with asthma.

Cardet JC, Codispoti CD, King TS, Bacharier L, Carr T, Castro M, Chinchilli V, Dunn R, Holquing F, Engle L, Nelson K, Ortega VE, Peters M, Ramratnam S, Krishnan JA, Wechsler ME, Israel E; National Heart, Lung, and Blood Institute AsthmaNet. *J Allergy Clin Immunol Pract.* 2018 Sep 19.

Implementing Health Care Technology Research into Practice to Improve Adult Asthma Management.

Cvietusa PJ, Goodrich GK, Shoup JA, Steffen DA, Tacinas C, Wagner NM, Anderson CB, Ritzwoller DP, Bender BG. *J Allergy Clin Immunol Pract.* 2018 Sep 7.

Effects of Reslizumab on Asthma Outcomes in a Subgroup of Eosinophilic Asthma Patients with Self-Reported Chronic Rhinosinusitis with Nasal Polyps.

Weinstein SF, Katial RK, Bardin P, Korn S, McDonald M, Garin M, Bateman ED, Hoyte FCL, Germinaro M. *J Allergy Clin Immunol Pract.* 2018 Sep 5.

Baseline patient factors impact on the clinical efficacy of benralizumab for severe asthma.

Bleecker ER, Wechsler ME, FitzGerald JM, Menzies-Gow A, Wu Y, Hirsch I, Goldman M, Newbold P, Zangrilli JG. *Eur Respir J.* 2018 Oct 18;52(4).

The Emerging Roles of Surfactant Protein-A in Asthma.

Dy ABC, Tanyaratrisakul S, Voelker DR, Ledford JG. *J Clin Cell Immunol.* 2018;9(4).

Expression of corticosteroid-regulated genes by PBMCs in children with asthma.

Goleva E, Babineau DC, Gill MA, Jackson LP, Shao B, Hu Z, Liu AH, Visness CM, Sorkness CA, Leung DYM, Togias A, Busse WW. *J Allergy Clin Immunol.* 2018 Jul 27.

Selecting the right biologic for your patients with severe asthma.

Manka LA, Wechsler ME. *Ann Allergy Asthma Immunol.* 2018 Oct;121(4):406-413.

New insights in the diagnosis of chronic refractory cough.

Good JT Jr, Rollins DR, Kolakowski CA, Stevens AD, Denson JL, Martin RJ. *Respir Med.* 2018 Aug;141:103-110.

Health Services Utilization in Asthma Exacerbations and PM(10) Levels in Rural Colorado.

James KA, Strand M, Hamer MK, Cicutto L. *Ann Am Thorac Soc.* 2018 Aug;15(8):947-954.

Susceptibility to Exacerbations in Black Adults with Asthma.

Grossman NL, Doros GD, Fandino N, Fuhlbrigge AL, Pace WD, Wechsler ME, Yawn BP, Israel E. *J Asthma.* 2018 Jul 4:1-20.

Association of free vitamin D(3) concentrations and asthma treatment failures in the VIDA Trial.

Lima JJ, Castro M, King TS, Lang JE, Ortega VE, Peters SP, Denlinger LC, Israel E, Sorkness CA, Wechsler ME, Wenzel SE, Smith LJ. *Ann Allergy Asthma Immunol.* 2018 Oct;121(4):444-450.e1.

Consistently very poorly controlled asthma is associated with greater activity and school impairment in children with severe or difficult-to-treat asthma.

Bacharier LB, Covar RA, Haselkorn T, Iqbal A, Alvarez C, Mink DR, Chen H, Zeiger RS. *J Allergy Clin Immunol Pract.* 2018 Jun 5.

The Tempest: Difficult to Control Asthma in Adolescence.

Burg GT, Covar R, Oland AA, Guilbert TW. *J Allergy Clin Immunol Pract.* 2018 May - Jun;6(3):738-748.

Identification of remission in adult-onset asthma.

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A prototypic small molecule database for bronchoalveolar lavage-based metabolomics.

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Non-response to Communication Technology Outreach for Beta-agonist Overuse in a Pragmatic Randomized Trial of Patients with Asthma.

Raebel MA, Shetterly SM, Goodrich GK, Anderson CB, Shoup JA, Wagner N, Bender BG. *J Gen Intern Med.* 2018 Jun;33(6):809-811.

Quintupling Inhaled Glucocorticoids to Prevent Childhood Asthma Exacerbations.

Jackson DJ, Bacharier LB, Mauger DT, Boehmer S, Beigelman A, Chmiel JF, Fitzpatrick AM, Gaffin JM, Morgan WJ, Peters SP, Phipatanakul W, Sheehan WJ, Cabana MD, Holguin F, Martinez FD, Pongratic JA, Baxi SN, Benson M, Blake K, Covar R, Gentile DA, Israel E, et al. *N Engl J Med.* 2018 Mar 8;378(10):891-901.

Environmental Concerns for Children with Asthma on the Navajo Nation.

Lowe AA, Bender B, Liu AH, Solomon T, Kobernick A, Morgan W, Gerald LB. *Ann Am Thorac Soc.* 2018 Jun;15(6):745-753.

Relationship between traffic-related air pollution particle exposure and asthma exacerbations: Association or causation?

Lee YJ, Rabinovitch N. *Ann Allergy Asthma Immunol.* 2018 May;120(5):458-460.

A Randomized, Double-Blind, Placebo-Controlled Trial of Escitalopram in Patients with Asthma and Major Depressive Disorder.

Brown ES, Sayed N, Van Enkevort E, Kulikova A, Nakamura A, Khan DA, Ivleva EI, Sunderajan P, Bender BG, Holmes T. *J Allergy Clin Immunol Pract.* 2018 Sep - Oct;6(5):1604-1612.

Efficacy and safety of dupilumab in perennial allergic rhinitis and comorbid asthma.

Weinstein SF, Katial RK, Jayawardena S, Pirozzi G, Staudinger H, Eckert L, Joish VN, Amin N, Maroni J, Rowe P, Graham NMH, Teper A. *J Allergy Clin Immunol.* 2018 Jul;142(1):171-177.e1.

Overweight/obesity status in preschool children associates with worse asthma but robust improvement on inhaled corticosteroids.

Lang JE, Fitzpatrick AM, Mauger DT, Guilbert TW, Jackson DJ, Lemanske RF Jr, Martinez FD, Strunk RC, Zeiger RS, Phipatanakul W, Bacharier LB, Pongratic JA, Holguin F, Cabana MD, Covar RA, Raissy HH, Tang M, Szeffler SJ; National Institutes of Health/National Heart, Lung and Blood Institute AsthmaNet. *J Allergy Clin Immunol.* 2018 Apr;141(4):1459-1467.e2.

Care pathways for the selection of a biologic in severe asthma.

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The association between ambient temperature and childhood asthma: a systematic review.

Xu Z, Crooks JL, Davies JM, Khan AF, Hu W, Tong S. *Int J Biometeorol.* 2018 Mar;62(3):471-481.

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Severe Asthma and the Primary Care Provider: Identifying Patients and Coordinating Multidisciplinary Care.

Yawn BP, Wechsler ME. *Am J Med.* 2017 Dec;130(12):1479.

Pre-pregnancy exposure to diesel exhaust predisposes offspring to asthma through IL-1 and IL-17A.

Lenberg J, Qian Q, Sun Z, Alam R, Gorska MM. *J Allergy Clin Immunol.* 2018 Mar;141(3):1118-1122.e3.

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COPD

Women manifest more severe COPD symptoms across the life course.

DeMeo DL, Ramagopalan S, Kavati A, Vegesna A, Han MK, Yadao A, Wilcox TK, Make BJ; COPDGene Investigators. *Int J Chron Obstruct Pulmon Dis.* 2018 Oct 1;13:3021-3029.

Breathing Life Into COPD Management: Ongoing Monitoring, Pulmonary Rehabilitation, and Individualized Care.

Make BJ, Yawn BP. *Chest.* 2018 Oct;154(4):980-981.

GWAS and systems biology analysis of depressive symptoms among smokers from the COPDGene cohort.

Heinzman JT, Hoth KF, Cho MH, Sakornsakolpat P, Regan EA, Make BJ, Kinney GL, Wamboldt FS, Holm KE, Bormann N, Robles J, Kim V, Iyer AS, Silverman EK, Crapo JD, Han S, Potash JB, Shinozaki G; COPDGene Investigators. *J Affect Disord.* 2019 Jan 15;243:16-22.

Whole exome sequencing analysis in severe chronic obstructive pulmonary disease.

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New insights in the diagnosis of chronic refractory cough.

Good JT Jr, Rollins DR, Kolakowski CA, Stevens AD, Denson JL, Martin RJ. *Respir Med.* 2018 Aug;141:103-110.

NT-proBNP in stable COPD and future exacerbation risk: Analysis of the SPIROMICS cohort.

Labaki WW, Xia M, Murray S, Curtis JL, Barr RG, Bhatt SP, Bleecker ER, Hansel NN, Cooper CB, Dransfield MT, Wells JM, Hoffman EA, Kanner RE, Paine R 3rd, Ortega VE, Peters SP, Krishnan JA, Bowler RP, Couper DJ, Woodruff PG, Martinez FJ, Martinez CH, et al. *Respir Med.* 2018 Jul;140:87-93.

Can CAPTURE be used to identify undiagnosed patients with mild-to-moderate COPD likely to benefit from treatment?

Leidy NK, Martinez FJ, Malley KG, Mannino DM, Han MK, Bacci ED, Brown RW, Houfek JF, Labaki WW, Make BJ, Meldrum CA, Quezada W, Rennard S, Thomashow B, Yawn BP. *Int J Chron Obstruct Pulmon Dis.* 2018 Jun 13;13:1901-1912.

Interstitial Features at Chest CT Enhance the Deleterious Effects of Emphysema in the COPDGene Cohort.

Ash SY, Harmouche R, Ross JC, Diaz AA, Rahaghi FN, Vegas Sanchez-Ferrero G, Putman RK, Hunninghake GM, Onieva Onieva J, Martinez FJ, Choi AM, Bowler RP, Lynch DA, Hatabu H, Bhatt SP, Dransfield MT, Wells JM, Rosas IO, San Jose Estepar R, Washko GR; COPDGene Investigators. *Radiology.* 2018 Aug;288(2):600-609.

Evaluation of the psychometric properties of the Early Morning Symptoms of COPD Instrument (EMSCI).

Hareendran A, Make BJ, Zaiser E, Garcia Gil E. *Int J Chron Obstruct Pulmon Dis.* 2018 May 18;13:1633-1645.

Treatment of Chronic Obstructive Pulmonary Disease in the Primary Care Setting: How Can We Achieve More for Our Patients?

Yawn BP, Make B. *Am J Med.* 2018 Sep;131(9S):7-14.

Identification of Chronic Obstructive Pulmonary Disease Axes That Predict All-Cause Mortality: The COPDGene Study.

Kinney GL, Santorico SA, Young KA, Cho MH, Castaldi PJ, San José Estépar R, Ross JC, Dy JG, Make BJ, Regan EA, Lynch DA, Everett DC, Lutz SM, Silverman EK, Washko GR, Crapo JD, Hokanson JE; COPDGene Investigators. *Am J Epidemiol.* 2018 Oct 1;187(10):2109-2116.

Lower serum IgA is associated with COPD exacerbation risk in SPIROMICS.

Putcha N, Paul GG, Azar A, Wise RA, O'Neal WK, Dransfield MT, Woodruff PG, Curtis JL, Comellas AP, Drummond MB, Lambert AA, Paulin LM, Fawzy A, Kanner RE, Paine R 3rd, Han MK, Martinez FJ, Bowler RP, Barr RG, Hansel NN; SPIROMICS investigators. *PLoS One.* 2018 Apr 12;13(4):e0194924.

The development of AZD7624 for prevention of exacerbations in COPD: a randomized controlled trial.

Patel NR, Cunoosamy DM, Fagerås M, Taib Z, Asimus S, Hegelund-Myrbäck T, Lundin S, Pardali K, Kurian N, Ersdal E, Kristensson C, Korsback K, Palmér R, Brown MN, Greenaway S, Siew L, Clarke GW, Rennard SI, Make BJ, Wise RA, Jansson P. *Int J Chron Obstruct Pulmon Dis.* 2018 Mar 27;13:1009-1019.

CT measurements of central pulmonary vasculature as predictors of severe exacerbation in COPD.

Rho JY, Lynch DA, Suh YJ, Nah JW, Zach JA, Schroeder JD, Cox CW, Bowler RP, Fenster BE, Dransfield MT, Wells JM, Hokanson JE, Curran-Everett D, Williams A, Han MK, Crapo JD, Silverman EK. *Medicine (Baltimore).* 2018 Jan;97(3):e9542.

Association between Emphysema and Chronic Obstructive Pulmonary Disease Outcomes in the COPDGene and SPIROMICS Cohorts: A Post Hoc Analysis of Two Clinical Trials.

Han MK, Tayob N, Murray S, Woodruff PG, Curtis JL, Kim V, Criner G, Galban CJ, Ross BD, Hoffman EA, Lynch DA, Kazerooni E, Martinez FJ; COPDGene and SPIROMICS Investigators. *Am J Respir Crit Care Med.* 2018 Jul 15;198(2):265-267.

Features of COPD as Predictors of Lung Cancer.

Carr LL, Jacobson S, Lynch DA, Foreman MG, Flanagan EL, Hersh CP, Scierba FC, Wilson DO, Sieren JC, Mulhall P, Kim V, Kinsey CM, Bowler RP. *Chest.* 2018 Jun;153(6):1326-1335.

Smoking duration alone provides stronger risk estimates of chronic obstructive pulmonary disease than pack-years.

Bhatt SP, Kim YI, Harrington KF, Hokanson JE, Lutz SM, Cho MH, DeMeo DL, Wells JM, Make BJ, Rennard SI, Washko GR, Foreman MG, Tashkin DP, Wise RA, Dransfield MT, Bailey WC; COPDGene Investigators. *Thorax.* 2018 May;73(5):414-421.

Exhaustion of Airway Basal Progenitor Cells in Early and Established Chronic Obstructive Pulmonary Disease.

Ghosh M, Miller YE, Nakachi I, Kwon JB, Barón AE, Brantley AE, Merrick DT, Franklin WA, Keith RL, Vandivier RW. *Am J Respir Crit Care Med.* 2018 Apr 1;197(7):885-896.

Systemic Markers of Adaptive and Innate Immunity Are Associated with Chronic Obstructive Pulmonary Disease Severity and Spirometric Disease Progression.

Halper-Stromberg E, Yun JH, Parker MM, Singer RT, Gaggari A, Silverman EK, Leach S, Bowler RP, Castaldi PJ. *Am J Respir Cell Mol Biol.* 2018 Apr;58(4):500-509.

Examining the Effects of Age on Health Outcomes of Chronic Obstructive Pulmonary Disease: Results From the Genetic Epidemiology of Chronic Obstructive Pulmonary Disease Study and Evaluation of Chronic Obstructive Pulmonary Disease Longitudinally to Identify Predictive Surrogate Endpoints Cohorts.

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A machine learning approach to triaging patients with chronic obstructive pulmonary disease.

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SELECTED 2018 PUBLICATIONS

Handgrip Strength in Chronic Obstructive Pulmonary Disease. Associations with Acute Exacerbations and Body Composition.

Martinez CH, Diaz AA, Meldrum CA, McDonald MN, Murray S, Kinney GL, Hokanson JE, Curtis JL, **Bowler RP**, Han MK, Washko GR, **Regan EA**; COPDGene Investigators. *Ann Am Thorac Soc*. 2017 Nov;14(11):1638-1645.

The value of blood cytokines and chemokines in assessing COPD.

Bradford E, Jacobson S, Varasteh J, Comellas AP, Woodruff P, O'Neal W, DeMeo DL, Li X, Kim V, Cho M, Castaldi PJ, Hersh C, Silverman EK, **Crapo JD**, Kechris K, **Bowler RP**. *Respir Res*. 2017 Oct 24;18(1):180.

Electronic Cigarette Use in US Adults at Risk for or with COPD: Analysis from Two Observational Cohorts.

Bowler RP, Hansel NN, Jacobson S, Graham Barr R, **Make BJ**, Han MK, O'Neal WK, Oelsner EC, Casaburi R, Barjaktarevic I, Cooper C, Foreman M, Wise RA, DeMeo DL, Silverman EK, Bailey W, Harrington KF, Woodruff PG, Drummond MB; for COPDGene and SPIROMICS Investigators. *J Gen Intern Med*. 2017 Dec;32(12):1315-1322.

Do COPD subtypes really exist? COPD heterogeneity and clustering in 10 independent cohorts.

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Cystic Fibrosis

Characteristics and Health-care Utilization History of Patients With Bronchiectasis in US Medicare Enrollees With Prescription Drug Plans, 2006 to 2014.

Henkle E, Chan B, Curtis JR, Aksamit TR, **Daley CL**, Winthrop KL. *Chest*. 2018 Jul 25.

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RECOGNITION

National Jewish Health is the leading respiratory hospital in the nation and the only health care organization to be focused on respiratory and related illnesses.

National Jewish Health has been named the #1 respiratory hospital in the nation by *U.S. News & World Report* in its 2018-2019 Best Hospitals rankings. National Jewish Health has ranked #1 or #2 all 22 years that *U.S. News* has ranked pulmonology in its Best Hospitals list. This is the 17th time we have ranked #1.

National Jewish Health has more than 55 doctors, nearly one-third of our faculty, named on various lists, including "America's Top Doctors" by Castle Connolly and "Top Docs" in *5280 Magazine's* 2018 rankings of Denver-area physicians.

National Jewish Health is in the top 7 percent of institutions in the country funded by the NIH, in terms of absolute dollars. This is a tremendous achievement for a specialty hospital/research center.



#1 in Respiratory Care

BREAKTHROUGHS IN RESEARCH

National Jewish Health is responsible for many important scientific advances, including:

IgE, the molecule responsible for allergic reactions. This discovery has become the basis for many new treatments for asthma and allergies.

The T cell receptor gene, which plays a crucial role in recognizing foreign invaders and orchestrating an immune response. Identifying this gene opened the door to understanding how bodies fight viruses, bacteria and cancer.

Superantigens, extremely powerful bacterial toxins associated with particularly virulent diseases, such as toxic shock syndrome and Legionnaires' disease.

Combined chemotherapy for tuberculosis, our National Jewish Health physicians were among the leaders in developing this crucial tool for fighting tuberculosis.

Mechanisms of apoptosis, our pioneering efforts have helped doctors understand how the body effectively removes and recycles up to two billion cells a day and resolves inflammation in the lungs.

Allergies to artificial joints, National Jewish Health researchers have developed a blood test that can detect allergies to nickel used in artificial joints, a common cause of failure.





FOCUS, EXPERIENCE, COLLABORATION

With a 120-year history of transformative medicine, National Jewish Health is the only health care organization in the world dedicated exclusively to respiratory and related diseases. Today, National Jewish Health has unparalleled pulmonary expertise with internationally recognized physician-scientists bringing their extensive experience and knowledge to the most challenging respiratory cases for our patients around the world.

Pulmonologists work closely with their colleagues in cardiology, gastroenterology, allergy, immunology, oncology and radiology to understand the whole person and find solutions for our patients.

**For referrals and consults,
call our Physician Line at 800.652.9555.
Learn more at njhealth.org/for-professionals.**



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