# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message from the Chief</td>
<td>1</td>
</tr>
<tr>
<td>Faculty Listing</td>
<td>3</td>
</tr>
<tr>
<td>Clinical Activities</td>
<td>5</td>
</tr>
<tr>
<td>Clinical Quality Improvements</td>
<td>12</td>
</tr>
<tr>
<td>Clinical Locations</td>
<td>13</td>
</tr>
<tr>
<td>Research and Other Scholarly Activities</td>
<td>17</td>
</tr>
<tr>
<td>Teaching Activities</td>
<td>30</td>
</tr>
<tr>
<td>Three-Year Bibliography</td>
<td>34</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>53</td>
</tr>
</tbody>
</table>
2019 Overview

The Division of Rheumatology and Clinical Immunology continues to be a worldwide leader both clinically and academically, and it is on the leading edge of research that will ultimately offer patients the latest clinical therapies. UPMC has been named one of the top rheumatology programs in the United States by U.S. News & World Report every year since 2007; our program was ranked 13th in the magazine’s most recent rankings. The Division has several physicians and faculty members who are included among the peer-selected “Best Doctors in America.”
Among this year’s Division highlights are:

- Innovative clinical and laboratory research programs
- Unique research and clinical opportunities for future academic rheumatologists
- Extramural funding to investigate:
  - Pathogenesis of autoimmune diseases
  - Systemic lupus erythematosus
  - Polymyositis
  - Rheumatoid arthritis
  - Vasculitis
  - Osteoarthritis
  - Systemic sclerosis
  - Sjögren’s syndrome
  - Mechanisms of pain
  - Lung disease associated with autoimmune diseases

We are committed to a mission of providing the highest quality care for patients with arthritis and autoimmune diseases, and to mentoring and training medical students, residents, fellows, and junior faculty. Our research mission is to better understand arthritis, autoimmune, and other connective tissue diseases in order to improve diagnosis and therapies, with the ultimate goal of finding ways to cure and prevent these disorders.
FACULTY

Larry W. Moreland, MD
Chief, Division of Rheumatology and Clinical Immunology
Professor of Medicine
Margaret Jane Miller Endowed Professor of Arthritis Research

Antonio A. Achkar, MD
Clinical Assistant Professor of Medicine

Rohit Aggarwal, MD, MS
Associate Professor of Medicine
Medical Director, Arthritis and Autoimmunity Center
Sub-Specialty Education Coordinator, Division of Rheumatology and Clinical Immunology

Dana P. Ascherman, MD
Professor of Medicine

Noah Bass, MD
Clinical Assistant Professor of Medicine
Co-Medical Director, AIM practice

Alan M. Berg, MD
Clinical Assistant Professor of Medicine

Santosh Bhusal, MD
Clinical Instructor of Medicine

Mehret Birru-Talabi, MD, PhD
Assistant Professor of Medicine
Co-Program Director, UPMC Rheumatology Fellowship Training Program

Partha S. Biswas, MVSc, PhD
Associate Professor of Medicine

Jennifer Brackney, DO
Clinical Assistant Professor of Medicine
Staff Physician, VA Pittsburgh Healthcare System

Deborah J. Co, MD
Clinical Assistant Professor of Medicine

Andreea Coca, MD, MPH
Associate Professor of Medicine
Medical Director, Lupus Center of Excellence

Robyn T. Domsic, MD, MPH
Associate Professor of Medicine

Patrizia Fuschiotti, PhD
Assistant Professor of Medicine

Sarah L. Gaffen, PhD
Professor of Medicine
Gerald P. Rodnan Endowed Chair, Professor of Rheumatology

Kenneth N. Gold, MD
Clinical Assistant Professor of Medicine

David J. Helfrich, MD
Clinical Assistant Professor of Medicine
Clinical Director

* Faculty who left the division over the course of FY 2019.
Faculty

Larry W. Moreland, MD
Chief, Division of Rheumatology and Clinical Immunology
Professor of Medicine
Margaret Jane Miller Endowed Professor of Arthritis Research

Antonio A. Achkar, MD
Clinical Assistant Professor of Medicine

Rohit Aggarwal, MD, MS
Associate Professor of Medicine
Medical Director, Arthritis and Autoimmunity Center
Sub-Specialty Education Coordinator, Division of Rheumatology and Clinical Immunology

Dana P. Ascherman, MD
Professor of Medicine

Noah Bass, MD
Clinical Assistant Professor of Medicine
Co-Medical Director, AIM practice

Alan M. Berg, MD
Clinical Assistant Professor of Medicine

Santosh Bhusal, MD
Clinical Instructor of Medicine

Mehret Birru-Talabi, MD, PhD
Assistant Professor of Medicine
Co-Program Director, UPMC Rheumatology Fellowship Training Program

Partha S. Biswas, MVSc, PhD
Associate Professor of Medicine

Jennifer Brackney, DO
Clinical Assistant Professor of Medicine
Staff Physician, VA Pittsburgh Healthcare System

Deborah J. Co, MD
Clinical Assistant Professor of Medicine

Andreea Coca, MD, MPH
Associate Professor of Medicine
Medical Director, Lupus Center of Excellence

Robyn T. Domsic, MD, MPH
Associate Professor of Medicine

Patrizia Fuschiotti, PhD
Assistant Professor of Medicine

Sarah L. Gaffen, PhD
Professor of Medicine
Gerald P. Rodnan Endowed Chair, Professor of Rheumatology

Kenneth N. Gold, MD
Clinical Assistant Professor of Medicine

David J. Helfrich, MD
Clinical Assistant Professor of Medicine
Clinical Director

Taik Hyun (Josh) Kim, MD
Clinical Instructor of Medicine

Robert A. Lafyatis, MD
Professor of Medicine
Thomas A. Medsger, Jr., MD, Endowed Professor for Arthritis Research

Kimberly P. Liang, MD
Assistant Professor of Medicine

Douglas W. Lienesch, MD*
Associate Professor of Medicine

Mandy J. McGeachy, PhD
Associate Professor of Medicine

Thomas A. Medsger, Jr., MD
Emeritus Professor of Medicine

Siamak Moghadam-Kia, MD, MPH
Assistant Professor of Medicine
Staff Rheumatologist-VA Pittsburgh Healthcare System

Niveditha Mohan, MD
Clinical Assistant Professor of Medicine
Program Director, UPMC Rheumatology Fellowship Training Program

Mandy J. McGeachy, PhD
Associate Professor of Medicine

Douglas W. Lienesch, MD*
Associate Professor of Medicine

Niveditha Mohan, MD
Clinical Assistant Professor of Medicine
Program Director, UPMC Rheumatology Fellowship Training Program

Ghaith Noaiseh, MD*
Assistant Professor of Medicine

Anna O’Connor, MD*
Clinical Instructor of Medicine

Chester V. Oddis, MD
Professor of Medicine
Director, Myositis Center

Thaddeus A. Osial, Jr., MD
Clinical Associate Professor of Medicine

Christine Peoples, MD
Clinical Assistant Professor of Medicine

John S. Richards, MD
Associate Professor of Medicine

Terence Starz, MD
Clinical Professor of Medicine and Occupational Therapy

Jeremy S. Tilstra, MD, PhD
Assistant Professor of Medicine

* Faculty who left the division over the course of FY 2019.
CLINICAL ACTIVITIES

Fifteen division faculty members are actively involved in seeing outpatients at the UPMC Arthritis and Autoimmunity Center at Falk Clinic, UPMC Mercy, the Oakland Veterans Affairs Medical Center Arthritis Clinic, and the UPMC Lupus Center of Excellence. In addition, the Division includes twelve community physicians at six outpatient practice locations in Western Pennsylvania. Locations include Downtown Pittsburgh, Aspinwall, Bethel Park, Monroeville, Shadyside, and Wexford. In FY19, the total number of outpatient visits to Division facilities (4,237 new visits and 39,486 return visits) totaled 43,723. The total number of inpatient visits was 3,402 (figures 1 and 2).

Significant clinical highlights this year include:

- The Division of Rheumatology initiated a telemedicine partnership with Guthrie Health system. UPP Rheumatology provides Guthrie with telemedicine services, 3 half-day sessions each week. Drs. Andreea Coca and Christine Peoples are the Medical Directors of this Program.
- The Division relocated and consolidated clinic locations from University Center to the 5th Floor of the Medical Arts Building, joining the Renal-Electrolyte Division in the shared clinic space.
- The Divisions of Rheumatology, Pulmonary, Endocrinology, Renal-Electrolyte, and Gastroenterology consolidated their clinical operations in the south and moved into one central and shared clinic space in Bethel Park.
- Drs. Dana Ascherman, Andreea Coca, and Amr Sawalha joined the Division. Dr. Ascherman is initiating a joint, multi-disciplinary clinic with the Division of Pulmonary, Allergy and Critical Care Medicine while Dr. Coca is initiating a joint, multi-disciplinary clinic with the Department of Ophthalmology.
- As part of the DOM Value Plan, a Prior Authorization Specialist position was created to reduce the turn-around time for prior authorizations. The position will be in place for a six-month trial. Initial data is very positive, showing a 50% reduction in the approval time for prior authorizations, and an increase in RN productivity (not spending time on prior authorizations as this task is solely on the Specialist).
- The Division of Rheumatology raised $1,030.00 for the Arthritis Foundation’s 2019 Walk to Cure Arthritis.

The Division’s faculty members assume a consultative and tertiary care role, as well as provide ongoing care to patients with all types of rheumatic diseases, with several subspecialists who serve as regional and national...
consultants for patients in the following clinical centers:

**UPMC Rheumatoid Arthritis Center**

Directed by Larry Moreland, MD, the UPMC Rheumatoid Arthritis Center is devoted to the management of rheumatoid arthritis (RA). The physicians use a multidisciplinary approach to diagnose and manage patients with RA. The center also participates in clinical and research trials to offer patients innovative therapies. Other academic physicians in the center include Yong Gil Hwang, MD; Kimberly Liang, MD; and Mandy McGeachy, PhD.

As part of the Accelerating Medicines Partnership (AMP)—a collaboration between the NIH, biopharmaceutical companies, and nonprofit organizations—patients undergoing a medical procedure involving the removal or collection of biological specimens, such as tissues from a joint, are asked as part of their medical care for permission to include samples of these specimens in the Arthritis and Autoimmunity Tissue Bank. Larry Moreland, MD, and Mandy McGeachy, PhD, serve as this study’s PIs.

The Division is also participating in other NIH-sponsored initiatives, including the Treatments Against RA and Effect on FDG PET-CT (TARGET) Trial, which examines the effect of RA disease modifying drugs (DMARDs) on vascular inflammation, and the Strategy to Prevent the Onset of Clinically-Apparent Rheumatoid Arthritis (StopRA), which uses blood tests to identify healthy individuals who may be at high risk for developing. Additional multi-disciplinary research studies are ongoing and involve metabolomics, Immunochip analysis, and microbiome using the RACER biorepository. A goal of the RA Center leadership is to understand/document the molecular signatures in patients who are in remission and/or low disease activity. Specific pilot projects are underway evaluating regulatory B cells and T helper follicular cells in these patients. Finally, preliminary data is being generated to explore mechanisms of how methotrexate prevents immunogenicity of biologics.

Dr. Kimberly Liang has ongoing NIH-funded research to better understand vascular abnormalities and novel therapies for patients with RA. Dr. Yong Hwang has funded research aimed at better defining chronic pain in patients with RA.

Since his arrival at the University of Pittsburgh in 2013, Yong Hwang, MD, has continued to develop a clinical research program in RA under the mentorship of Larry Moreland, MD. Dr. Hwang has been actively involved in research developed from the Rheumatoid Arthritis Comparative
Effectiveness Research (RACER) registry, as well as a published, peer-reviewed project examining differential response of serum amyloid A (SAA) to different therapies in RA and the value of SAA as a predictor of disease activity. Additionally, he studied the utility of Patient-Reported Outcomes Measurement Information System (PROMIS) for understanding interplay between patient-reported outcome measures and physician driven disease activity measures. Currently, his research is focused on understanding the complex interplay between RA disease activity, patient-reported outcomes and assessing mechanisms, and impact and management of pain in RA. An investigator-initiated study (funded by Pfizer, Inc.), titled as “Subgrouping of Patients with Rheumatoid Arthritis Based on Biophysical and Psychosocial Factors” is ongoing since September 2016. The objective of this study is to identify subgroups of RA patients with distinct pain, inflammation, and psychosocial factors and to investigate whether there are different treatment responses among subgroups.

**UPMC Lupus Center of Excellence**

The UPMC Lupus Center of Excellence, located in the Medical Arts Building on the UPMC/University of Pittsburgh's campus, is devoted to the diagnosis and management of systemic lupus erythematosus (SLE) and related systemic autoimmune diseases. The center's physicians use a multidisciplinary approach to diagnose and manage patients with chronic diseases.

**Dr. Amr Sawalha** was recruited from the University of Michigan as the Division of Rheumatology's Director of the Lupus Center of Excellence of UPMC and Chief of Pediatric Rheumatology at Children’s Hospital of Pittsburgh this past year. Dr. Sawalha brings with him 14 years of combined clinical and research experience and a particular interest in lupus and in elucidating the genetic and epigenetic basis of autoimmune diseases. **Dr. Andreea Coca** was appointed the Medical Director of the Lupus Center.

Other faculty members in the Lupus Center of Excellence include Kimberly Liang, MD, and Jeremy Tilstra, MD, PhD, both active in clinical, translational, and basic research activities. The Lupus Center physicians are working closely with Kelly Liang, MD, from the Renal-Electrolyte Division, to co-manage patients with lupus nephritis. Pediatric and adolescent lupus patients are typically evaluated and managed by a pediatric rheumatologist, Daniel Kietz, MD, who has a weekly clinic in the Lupus Center of Excellence. In addition, the UPMC Lupus Center of Excellence conducts clinical research trials and has a number of NIH-funded and industry-sponsored studies. **Dr. Coca** is principal investigator in a number of Sjögren’s syndrome and lupus clinical trials within the Lupus Center of Excellence.

Currently, there are two clinical trials actively recruiting, for which Dr. Coca is the principal investigator: 1) A Randomized, Double-Blind, Placebo-Controlled, Parallel-Group, Phase 3 Study of Baricitinib in Patients with Systemic Lupus Erythematosus (SLE). This is a multicenter study evaluating the efficacy and safety of baricitinib in patients with SLE receiving standard therapy, and 2) A Phase 2, Double-blind, Randomized, Placebo-controlled Multicenter Study to Evaluate Efficacy, Safety, and Tolerability of JBT-101 in Systemic Lupus Erythematosus. One hundred adults with SLE and active joint disease with at least moderate pain will be enrolled in this study to evaluate the safety, efficacy, and mechanisms of action of JBT-101 (cannabinoid derivative).

The UPMC Lupus Center of Excellence has also been maintaining a longitudinal Lupus Registry, which allows for rigorous data collection and storage of biological samples for research purposes. Utilizing resources made available from the registry, **Dr. Kimberly Liang**, in collaboration with Dr. Shanmugam Nagarajan at the University of North Carolina, is studying mechanisms of premature atherosclerosis in SLE. In addition, she has assisted with phone/mail follow-up for heart disease outcomes in UPMC SLE patients who were previous...
participants in the Systemic Lupus International Collaborating Clinics (SLICC) Registry. Along with Dr. Kelly Liang, she is also studying whether possible urine biomarkers predictive of classes of lupus nephritis.

**Dr. Jeremy Tilstra** has a research focus on SLE and discovering underlying causes of the disease. He is currently the lead for recruitment of SLE and Sjögren’s patients to the microbiome project, which aims to collect both blood and microbiome samples from patients with these autoimmune diseases. These samples will be compiled with a larger patient cohort collected by other researchers at UPMC. These samples will be used to identify similarities and differences of the microbiome between patient populations afflicted with varying diseases. Another research interest is to evaluate how immune cells change once they enter the target organ in the setting of autoimmunity. Dr. Tilstra’s future work will use blood, urine, and residual biopsy samples to determine which factors may be predictive of outcomes in lupus nephritis.

**Dr. Sawalha** has initiated the process to enhance organized recruitment of lupus patients in the Lupus Registry. He is working with 3 study coordinators involved in the registry to accurately link medical record information to samples already collected within the registry. Dr. Sawalha is also revisiting the type of samples to be collected longitudinally from new lupus patients in the registry, the process of recruitment, and the type of medical and disease activity information that needs to be recorded. He is also working with the Department of Medicine to use electronic medical records analysis resources to identify and systematically evaluate lupus patients within UPMC. The goal is to develop a large lupus cohort at UPMC for clinical, translational, and basic studies. Dr. Sawalha’s own research effort focuses on elucidating the genetic and epigenetic basis of lupus and other related autoimmune diseases. His team applies state-of-the-art genomic, epigenomic, and bioinformatics methodologies, and subsequent functional studies using both in vitro and in vivo systems to identify and characterize genetic loci and pathways involved in the pathogenesis of immune-mediated diseases. Using careful clinical phenotyping and extensive national and international collaborations, his team aims at discovering genomic and epigenomic markers for disease progression, specific organ involvement, and response to therapy in systemic autoimmunity. His vision for the Lupus Center at UPMC includes enhancing integrated care for lupus patients, providing a format for scientific discussion for lupus at UPMC, enhancing the interaction and collaboration between basic scientists and clinical researchers in lupus across the institution, and developing a funding mechanism to provide seed funds for lupus research at UPMC. He also envisions establishing an external advisory board composed of nationally and internationally renowned experts in lupus to help guide the direction of the Lupus Center of Excellence at UPMC.

Through FY 2019, **Dr. Ghaith Noaiseh** ran the UPMC Sjögren’s Clinic which was established in 2014. The goal is to provide state of the art care for patients with Sjögren’s syndrome with a focus on complex cases management. Dr. Noaiseh also actively recruits for several clinical trials in the field aiming at developing new therapies for the disease.

**University of Pittsburgh Myositis Center**

The University of Pittsburgh Myositis Center mission is to provide a state-of-the-art diagnosis and treatment center for all aspects of immune-mediated muscle disorders and related diseases and to lead the way in clinical and basic science research in the inflammatory myopathies. Our goal is to develop better therapies for the treatment of myositis and its complications and to aid in the cure of myositis. We strive to educate patients and providers regarding the diagnosis and management of these diseases.

**Chester V. Oddis, MD,** has been involved in myositis research for over 30 years with a longstanding interest in the epidemiology, clinical features, autoantibody correlations, and treatment of myositis. His research has contributed to a better understanding of inflammatory myopathy and the elucidation of the pathogenesis of
this rare autoimmune disease. He has investigated the pulmonary complications of myositis and the treatment of this common problem. As Director of the Myositis Center at the University of Pittsburgh, Dr. Oddis supervises and manages one of the world’s largest clinically and serologically-defined, longitudinal myositis databases which includes over 1000 patients with adult polymyositis, adult dermatomyositis, and overlap myositis disorders.

Rohit Aggarwal, MD, MS, Co-Director of the Myositis Center at the University of Pittsburgh, is an international expert in various forms of myositis and associated interstitial lung disease. His interests include clinical and translational research in myositis and associated interstitial lung disease, including outcome measures and clinical trials. Dr. Aggarwal is vice-chair of the medical board of The Myositis Association (TMA), a myositis patient organization, as well as chair of the scientific committee of the International Myositis Assessment and Clinical Studies (IMACS) Group, a consortium of myositis experts around the world. He is the current co-chair of the American College of Rheumatology (ACR) abstract review committee myopathy section. Along with Dr. Oddis, Dr. Aggarwal is instrumental in the development of one of the largest myositis repositories of clinical data and samples in the country with more than 1500 subjects.

Siamak Moghadam-Kia, MD, MPH, has specifically studied the clinical features of dermatomyositis patients possessing a novel autoantibody and its association with interstitial lung disease and survival. His research interests include clinical features and treatment of idiopathic inflammatory myopathies, autoantibodies and biomarkers in idiopathic inflammatory myopathies, and cutaneous manifestations of systemic rheumatic disease.

The Myositis Center has two investigator-initiated studies actively recruiting. The first, Abatacept for the Treatment of Myositis-associated Interstitial Lung Disease (ATtackMy-ILD), is an investigator-initiated proof of concept multi-center study that will evaluate the efficacy, safety and tolerability of abatacept (ABT) in anti-synthetase-associated interstitial lung disease (Syn-ILD) in a randomized, placebo-controlled 6-month (24-week) study. The primary objective is to evaluate the efficacy, safety and tolerability of ABT and standard of care (SOC) vs. SOC alone in patients with Syn-ILD. We will enroll 20 adult Syn-ILD subjects (a myositis-associated syndrome with a high incidence of ILD approaching 80%), using a 1:1 randomization scheme for active drug:placebo for 24 weeks, thus enrolling 10 subjects to receive SOC plus active Drug and 10 subjects to receive SOC plus placebo. All patients will then enter an optional open label follow-up after the 24-week randomized, controlled phase, during which all subjects receive 24 weeks of ABT in the same fashion as the initial study phase.

The second study, “A multi-center, double-blind, placebo controlled, proof of concept study to evaluate the efficacy and tolerability of tocilizumab in adults with refractory dermatomyositis and polymyositis” is a multi-center, double-blind, randomized placebo-controlled proof of concept pilot study is evaluating the efficacy and tolerability of tocilizumab (TCZ) in adult dermatomyositis (DM) and polymyositis (PM) patients. Participants must be 18 years of age or older with "definite" or "probable" DM or PM. 40 participants will be randomly assigned to TCZ or placebo in a 1:1 ratio (approximately 20 per arm). Participants will complete 10 study visits during this 48-week clinical trial.

UPMC Center for Vasculitis

Larry Moreland, MD, is the Director of the UPMC Center for Vasculitis. Other Rheumatology physicians at the Vasculitis Center include Kimberly Liang, MD; Douglas Lienesch, MD; and Niveditha Mohan, MD. The center focuses on providing the best possible care to patients, education and support for families, and access to new treatment options for those suffering from vasculitis, a disease characterized by the inflammation of
blood vessels. The University of Pittsburgh is one of 11 academic sites involved with the NIH-funded Vasculitis Clinical Research Consortium (VCRC). We offer innovative research studies for patients with these rare diseases.

**University of Pittsburgh and UPMC Center for Scleroderma**

The University of Pittsburgh and UPMC Center for Scleroderma supports clinical and basic science research, patient care, fellow training, and patient education on systemic sclerosis, localized scleroderma, related fibrosing conditions, and Raynaud phenomenon. **Robert Lafyatis, MD,** leads the Scleroderma Center. Patients from the United States and foreign countries are referred to the center for evaluation and multidisciplinary treatment of systemic sclerosis and other related disorders. Clinic patients are evaluated by **Robert Lafyatis, MD,** and **Robyn T. Domsic, MD, MPH.** Drs. Lafyatis and Domsic believe in multidisciplinary care for scleroderma patients. They collaborate extensively with clinicians and scientists in the pulmonary, gastroenterology, and vascular biology groups to help patients with specialized treatment of their complications, as well as to help learn more about pathogenesis of these complications.

Immune cell dysfunction is a major component of scleroderma (SSc) pathogenesis. Our research interests focus on understanding the role of T lymphocytes, the predominant cell-type in the affected tissues of patients, in disease pathogenesis. Patients have few therapeutic options, and a better understanding of the molecular and cellular mechanisms underlying loss of self-tolerance, activation of effector immune pathways, and of the interactions between the immune and stromal cells will lead to innovative therapies that selectively target the aberrant immune response, resulting in better efficacy and less toxicity.

**Patrizia Fuschiotti, PhD,** has research interests focused on the cellular and molecular mechanisms of pathogenesis by T cell and T cell-derived cytokines in inflammatory conditions. Particular emphasis is given to the roles played by cytokine IL-13 and its receptors (IL-13Ra1 and IL-13Ra2) in fibrosis, autoimmunity, and cancer. The context of this work is in human diseases primarily affecting the skin, namely SSc, an autoimmune connective tissue disease whose main clinical feature is fibrosis, and cutaneous T cell lymphoma (CTCL). She has shown that IL-13 and its molecular pathways are involved in both diseases, acting as a major pro-fibrotic factor in SSc and as an autocrine factor for CTCL. Recent work focused on studying the T cell-mediated immune responses in SSc skin disease, as well as the molecular mechanisms underlying IL-13 overproduction by specific skin-resident T cell subsets in SSc patients with active disease. Additional work focused on studying the role of IL-13 in CTCL development and progression, as well as in developing strategies aimed at targeting IL-13 and its molecular pathways for inhibiting proliferation of malignant lymphocytes. A new research direction in collaboration with Regeneron aims to test the efficacy of the Dupilumab antibody as a potential therapeutic for CTCL. She has also applied single-cell RNA-sequencing on CTCL skin tumor samples, aiming to obtain a better understanding of CTCL pathogenesis and to open avenues for innovative and more specific therapies in CTCL tailored to specific patients.

**Musculoskeletal Ultrasound in Rheumatology**

The Division of Rheumatology, under the leadership of **Dr. Niveditha Mohan** and **Dr. Rohit Aggarwal,** has developed a curriculum to train fellows in the use of Musculoskeletal Ultrasound (MSK USG) for both diagnostic and therapeutic purposes. An annual workshop is held every January, in collaboration with PM&R, to introduce the basics of MSK USG. Monthly USG procedure clinics are precepted by Dr. Mohan and Dr. Aggarwal to train fellows in using MSK USG for therapeutic interventions such as arthrocentesis. With the addition of new faculty members who are trained in MSK USG, there is a plan to increase this to twice a
month. A cadaver workshop with MSK USG was organized in June to train fellows in MSK USG procedures. Fellows are encouraged to enroll in certification programs such as US Sonar to improve their clinical skills. Research protocols using MSK USG are being planned for the upcoming academic year.

**Telemedicine**

The director of UPMC Rheumatology Telemedicine Services, Christine Peoples, MD, has provided tele-rheumatology services for nearly six years and has been recognized as one of the top providers of telehealth services in the country. She provides tele-rheumatology services throughout Pennsylvania at the following locations: UPMC Northwest, UPMC Bedford, UPMC Cole Memorial Hospital, and Guthrie Hospital (starting in August 2019). Through videoconferencing, our physicians can 1) identify rheumatologic diseases early; 2) manage chronic rheumatologic diseases; and 3) provide important follow-up care. From July 1, 2018 through June 30, 2019, there have been 621 total telemedicine visits at all UPMC Rheumatology Telemedicine Center locations (figure 3). Dr. Peoples also provides the rheumatology consultations for patients who are part of the Empower 3 Center for Health program, an innovative direct pay practice where patients pay one fee and receive unlimited health care.

The UPMC tele-rheumatology program continues to grow and be recognized nationally. The UPMC Bedford teleconsult center received an award from the AAMC for improving access to specialist physicians and part of the award included our tele-rheumatology program at UPMC Bedford that is directed by Dr. Peoples. Recently, AARP published a feature article about telemedicine and spotlighted our telemedicine rheumatology program at UPMC Northwest. The article included commentary from Dr. Peoples, the administrative staff at UPMC Northwest, and one of Dr. Peoples’ patients. Beginning in February 2018, Dr. Peoples provides tele-rheumatology services to the telemedicine program at UPMC Cole Memorial Hospital, fulfilling a great need for rheumatology care in the region. Additional coverage included an article from the National Psoriasis Foundation focused on the UPMC tele-rheumatology program; the article includes extensive commentary from Dr. Peoples along with a patient perspective of our tele-rheumatology program. Healio Rheumatology also published an article that included commentary and a spotlight on Dr. Peoples called “The Virtual Doctor is In: Advancing Care through Tele-Rheumatology.” Dr. Peoples was also featured in a recent Pittsburgh Business Times article, “The Telemedicine Tipping Point,” and is an invited speaker to the American College of Rheumatology’s annual meeting in November 2019 where she will lead the session titled “The Right Patients for Success in Telehealth.”
CLINICAL QUALITY IMPROVEMENTS

The Division’s focus on quality is evidenced by its work with rheumatic disease patients on parenteral biologic modifier therapies and other immunosuppressive medications.

Additionally, our physician-researchers have successfully developed methods of improving patient education and safety monitoring for those patients requiring immunosuppressive medications. Our practices consistently surpass quality standards set for the care of osteoarthritis, rheumatoid arthritis, and osteoporosis. We have also expanded our immunization initiative to include herpes zoster, influenza, and hepatitis B, as well as pneumococcal vaccination, influenza, and herpes zoster.

The Division participated in an HSD initiative to standardize the follow-up care plans for outpatients with chronic clinical problems. The goal of the initiative is to decrease the variability in the frequency and rationale to see return patients and to improve the use of specialists for the right patients and assure patient-focused access.

We reviewed the division’s top clinical conditions in the outpatient setting to create an evidence-based approach to how often patients with chronic medical conditions should be seen in “routine” specialty clinic visits. The interval between return appointments for non-acute, chronic clinical management was defined based on the peer-reviewed literature, professional guidelines, expert opinion, and consensus of the division’s physicians. The division was successful in defining appropriate follow-up care plans.

Following American College of Rheumatology guidelines, we have worked on a number of quality improvement projects, with the aim of improving physician efficacy, nursing work-flow, and patient satisfaction. So far, we have implemented a High Risk Medication Monitoring Protocol that will allow streamlining of adequate orders for medication monitoring. The other quality improvement process refers to Perioperative Management of High Risk Immunosuppressive Medication.
CLINICAL LOCATIONS—Central
1. **UPMC Arthritis and Autoimmunity Center**  
   Falk Medical Building  
   3601 Fifth Avenue, Suite 2B  
   Pittsburgh (Oakland), PA 15213

2. **UPMC Lupus Center of Excellence, Multispecialty Clinic & Pediatric Rheumatology**  
   Medical Arts Building  
   3708 Fifth Avenue, Suite 501  
   Pittsburgh (Oakland), PA 15213

3. **UPMC Arthritis and Internal Medicine**  
   Shadyside Place  
   580 South Aiken Avenue, Suite 430  
   Pittsburgh (Shadyside), PA 15232

4. **UPMC Arthritis and Autoimmunity Center—UPMC Mercy**  
   Douglas Lienesch, MD  
   1400 Locust Street, Suite 2100, Building D  
   Pittsburgh, PA 15219

5. **Margolis Rheumatology—UPMC**  
   Heinz 57 Center  
   339 Sixth Avenue, Fifth Floor  
   Pittsburgh, PA 15222
CLINICAL LOCATIONS—Peripheral
Margolis Rheumatology—UPMC St. Margaret
Medical Arts Building
200 Delafield Road, Suite 4040
Pittsburgh (Aspinwall), PA 15215

UPMC Bethel Park Rheumatology
2000 Oxford Drive, Suite 680
Bethel Park, PA 15102

UPMC Arthritis and Autoimmunity Center—Wexford
117 VIP Drive, Suite 120
Wexford, PA 15090

UPMC Rheumatology—Monroeville
600 Oxford Drive, Suite 210
Monroeville, PA 15146
RESEARCH AND OTHER SCHOLARLY ACTIVITIES

Major faculty areas of investigative interest in the Division include basic mechanisms of tissue injury and pathogenesis, as well as clinical features, natural history and therapy of systemic sclerosis, systemic lupus erythematosus, polymyositis-dermatomyositis, rheumatoid arthritis, vasculitis, and osteoarthritis. Extramural funding remained consistent during the past year.

Basic Science Mechanisms of Autoimmune Disease
A major focus of the Division is to define fundamental processes that underlie mechanisms of autoimmunity and ultimately how these may be harnessed for patient benefit. One major focus is how the IL-17/Th17 arm of the immune system drives pathogenesis in autoimmunity. Research in this area is conducted in the laboratories of Sarah Gaffen, PhD (Director of Basic Rheumatology Research), Mandy McGeachy, PhD, and Partha Biswas, PhD, whose laboratories work in a highly collaborative manner using tissue culture systems, mouse models, and human cell systems/samples. Dr. Gaffen’s main research emphases are on the molecular basis of IL-17 receptor-mediated signal transduction and the infectious disease susceptibility in the context of IL-17 deficiency (as occurs in patients taking biologic drugs that block this pathway). Her group also assesses skin manifestations of autoimmunity, such as psoriasis. Dr. Biswas’s group is interested in IL-17 immune responses in the kidney, using mouse models of glomerulonephritis (a model of lupus nephritis and Goodpasture syndrome) and cells from patients with kidney diseases. Dr. McGeachy’s group focuses on how Th17 cells are generated in both mice and humans and how immune pathology is induced during autoimmune conditions.

The Scleroderma Center also has a very active research program. Robert Lafyatis, MD, and Robyn T. Domsic, MD, MPH conduct clinical trials to find new treatments for systemic sclerosis and its complications, including skin...
fibrosis, Raynaud phenomenon, digital ulcers, interstitial lung disease, and pulmonary arterial hypertension. In translational studies, Dr. Lafyatis investigates fibroblast and macrophage biology in the pathogenesis of systemic sclerosis, working closely with Patrizia Fuschiotti, PhD, who conducts research into the role of T cells in systemic sclerosis. Dr. Domsic leads the Pittsburgh observational study of patients with systemic sclerosis, which over the years has contributed greatly to the medical literature regarding the clinical manifestations of systemic sclerosis. Dr. Domsic’s research focuses on creating risk prediction models to help manage patients, improving outcome measures and clinical trial design.

Research highlights include:

- **Dana Ascherman, MD**, was recruited to the Division of Rheumatology after several years at the University of Miami. Dr. Ascherman studies animal model research on myositis, pulmonary complications of anti-synthetase syndrome and rheumatoid arthritis, and connective tissue diseases related to pulmonary complications and interstitial lung disease. He is developing collaborative efforts with Pulmonary to continue research on these rare diseases.

- **Dana Ascherman, MD**, has teamed with Dr. Daniel Kass from the Division of Pulmonary, Allergy and Critical Care Medicine to initiate the interdisciplinary Autoimmune Interstitial Lung Disease Clinic, which will promote the care of patients with inflammatory lung disease and facilitate clinical/translational research efforts in this arena.

- **Robyn Domsic, MD, MPH**, secured funding from the Department of Defense as the Principal Investigator of an international, multicenter observational trial to develop and validate new trial outcomes in Raynaud phenomenon.

- **Rohit Aggarwal, MD, MS**, was awarded an American College of Rheumatology (ACR)/ European League Against Rheumatism (EULAR) grant for development and validation for anti-synthetase syndrome classification criteria.

- **Rohit Aggarwal, MD, MS**, received the Award for Commitment and Excellence in Service (ACES) from UPMC and the Distinguished Mentor Award from the Institute of Clinical Research Education (ICRE), University of Pittsburgh.


- **Mehret Birru-Talabi, MD, PhD**, received a four-year career development award from the Robert Wood Johnson Harold Amos Medical Faculty Development Program.

- **Mehret Birru-Talabi, MD, PhD**, and Larry Moreland, MD, published “Contraception Use Among Reproductive-Age Women with Rheumatic Diseases” in Arthritis Care & Research.

- **Partha Biswas, PhD**, published the review, “IL-17 in Renal Immunity and Autoimmunity,” in the Journal of Immunology.

- **Patrizia Fuschiotti, PhD**, published an article: “Single-cell lymphocyte heterogeneity in advanced Cutaneous T-Cell Lymphoma skin tumors” in Clinical Cancer Research, 2019 Jul 15;25(14):4443-4454. The article was featured on the cover. Single-cell RNA sequencing (scRNA-seq) technology was used to profile the transcriptomes of thousands of individual cells from advanced-stage Cutaneous T-cell Lymphoma (CTCL) skin tumors.

- **Patrizia Fuschiotti, PhD**, has an investigator-initiated research grant with Regeneron to perform preclinical studies on the use of Dupilumab in cutaneous T cell lymphomas.
• Sarah Gaffen, PhD, was elected a Councilor of the International Cytokine and Interferon Society.
• Sarah Gaffen, PhD, was the recipient of a 2-year Rheumatology Research Foundation Innovative Research Award and a joint R21 grant with Partha Biswas, PhD, to analyze RNA metabolism in autoimmune glomerulonephritis (“Regulation of renal IL-17 signaling in antibody-mediated kidney disease”).
• Dr. Gaffen’s group published “IL-17 integrates multiple self-reinforcing, feed-forward mechanisms through the RNA-binding protein Arid5a” in Science Signaling, which was further highlighted with an accompanying featured commentary.
• Sarah Gaffen, PhD, published a senior author paper, “Combined Blockade of TNF-α and IL-17A Alleviates Progression of Collagen-Induced Arthritis without Causing Serious Infections in Mice,” in Journal of Immunology this spring. The article, which was featured on the cover, investigated the impact of combined antibody blockade of IL-17 and TNF in autoimmunity.
• Sarah Gaffen, PhD, and Mandy McGeachy, PhD, co-authored a review article, “The IL-17 Family of Cytokines in Health and Disease,” in the 25th Anniversary Edition of Immunity on IL-17 signaling and function.
• Dr. Robert Lafyatis’s Single Cell Core was administratively opened as a fully functioning Core under the Dean’s Office, offering sc-RNA-seq, Cite-seq, 5’scRNA-seq and sc-ATAC-seq.
• Dr. Robert Lafyatis’s P50 Center of Research Translation published several manuscripts as part of Project 1 including articles in European Respiratory Journal, Annals of Rheumatic Diseases, Nature Communications, and Frontiers in Immunology.
• Kimberly Liang, MD, MS, has recently become the site principal investigator (PI) for the Lupus Clinical Investigators Network (LuCIN). She is now recruiting for a phase II clinical trial protocol (PAISLEY study), sponsored by Bristol-Myers Squibb.
• Kimberly Liang, MD, MS, continues to lead an R21-funded clinical trial investigating whether sildenafil improves endothelial dysfunction in rheumatoid arthritis.
• Siamak Moghadam-Kia, MD, MPH, was elected as one of the new members of the International Myositis Assessment and Clinical Studies Group (IMACS) meeting committee in February 2019.
• Mandy McGeachy, PhD, published a senior author paper, “IL-17 metabolically reprograms activated fibroblastic reticular cells for proliferation and survival,” in Nature Immunology on the role of IL-17-driven metabolism in fibroblast reticular cells with Drs. Sarah Gaffen and Partha Biswas as co-authors. The paper was also highlighted in a News and Views commentary in Nature Immunology and in Nature Reviews Immunology.
• Dr. Larry Moreland published “Defining inflammatory cell states in rheumatoid arthritis joint synovial tissues by integrating single-cell transcriptomics and mass cytometry” in Nature Immunology.
• Jeremy Tilstra, MD, PhD, was awarded a K08 on his first submission. Other grants funded last academic year include an LRA novel research award (3 year), Department of Defense concept award (fundable score), and PACER award.
• Jeremy Tilstra, MD, PhD, published “Kidney-infiltrating T cells in murine lupus nephritis are metabolically and functionally exhausted” in Journal of Clinical Investigation.
Faculty Research Interests and Activities

Larry W. Moreland, MD  Division Chief

Dr. Moreland engages in translational research on diseases such as rheumatoid arthritis, vasculitis, lupus, and seronegative spondyloarthopathies. He has extensive experience in clinical trials and long-term registries for patients with autoimmune diseases. Specific areas of interest are pathogenesis, biomarkers, and outcomes research. He has many ongoing collaborations with colleagues at the University of Pittsburgh, as well as numerous investigators at other academic institutions. In addition to being the Rheumatology Division Chief, he is Director of the University of Pittsburgh and UPMC Rheumatoid Arthritis Center and Vasculitis Center.

Advisory Committee Memberships and Leadership Positions

- Member, Arthritis Foundation Rheumatoid Arthritis Working Group, 2007-2019
- Member, Vasculitis Clinical Research Consortium, 2008-2019
- Member, ACR/EULAR Task Force for Development of Criteria for Early Rheumatoid Arthritis, 2008-2019
- Member, Institutional Advisory Board, Pitt Clinical and Translational Science Institute (CTSI), 2008-2019
- Member, Arthritis Foundation Peer Review Council for Training Awards, 2008-2019
- Member, Steering Committee, Physical Therapy/Occupational Therapy T32 Grant, 2009-2019
- Member, International Advisory Committee, Japan College of Rheumatology, 2009-2019
- Member, University of Pittsburgh School of Medicine Ambassadors Program, 2009-2019
- Member, University of Pittsburgh Comparative Effectiveness Research Clinical Trials Working Group, 2010-2019
- Director, FOCIS (Federation of Clinical Immunology Societies), University of Pittsburgh, 2010-2019
- Member, University of Pittsburgh Rehabilitation and Research Training Center Program for a Center on Enhancing the Health and Wellness of Individuals with Arthritis, 2010-2019
- Member, University of Pittsburgh Comparative Effectiveness Research Clinical Trials Working Group, 2010-2019

Editorships

- Section Editor, Rheumatoid Arthritis Section, Current Rheumatology Reports, 1998-2019
- Editorial Board, American Journal of Medicine, 2001-2019
- Contributor, Rheumatoid Arthritis, Up to Date, 2010-2019

Honors and Awards

- Member, American Society of Clinical Investigation, 2000-2019
- Honoree, Best Doctors, Pittsburgh Magazine, 2019
- Honoree, Best Doctors in America, 2019

Rohit Aggarwal, MD, MS

Dr. Aggarwal’s research interests center on myopathies, including polymyositis, dermatomyositis, and inclusion body myositis. He is also interested in autoimmune or connective tissue disease-related interstitial lung disease or pulmonary fibrosis.

Advisory Committee Memberships and Leadership Positions

- Medical Director, UPMC Falk Arthritis & Autoimmunity Center, 2010-2019
as well as extra-muscular tissues that include skin, joints, lung, and the vascular system. While this

Dr. Ascherman’s research has investigated the role of cell-mediated immunity in the pathogenesis of idiopathic inflammatory myopathy, a systemic autoimmune disorder resulting in damage to muscle as well as extra-muscular tissues that include skin, joints, lung, and the vascular system. While this
As well as extra-muscular tissues that include skin, joints, lung, and the vascular system. While this is characteristic of idiopathic inflammatory myopathy, a systemic autoimmune disorder resulting in damage to muscle and extramuscular connective tissue. Dana P. Ascherman, MD

Division of Rheumatology and Clinical Immunology

2019 Annual Report

Department of Medicine

Major Lectureships and Seminars

• Lecturer, Georgia Society of Rheumatology, Greensboro, GA, May 2019
• Lecturer, Medicine Grand Rounds, University of Nebraska Medical Center, Omaha, NE, May 2019
• Lecturer, American College of Rheumatology, State of the Art Clinical Symposium, Chicago, IL, April 2019
• Lecturer, World Rheumatology Forum, Rheumatology Summit 2019, April 2019
• Lecturer, 3rd Global Conference on Myositis, Berlin, Germany, March 2019
• Lecturer, 2019 Annual Meeting of State of Texas Association of Rheumatologists, February 2019
• Lecturer, Rheumatology Grand Rounds, New York University, New York, NY, January 2019
• Lecturer, Parent Project Muscular Dystrophy and NIH meeting, Arlington, VA, December 2018
• Lecturer, American College of Rheumatology Annual Meeting 2018, October 2018
• Lecturer, The Virginia Society of Rheumatology 32nd Annual, Glen Allen, VA, September 2018
• Lecturer, West Virginia State Rheumatology Class, August 2018
• Section Editor, Current Rheumatology Reports, 2014-2018
• Editorial Board, Rheumatology: Current Research, 2013-2018
• Editorial Board, Seminars in Arthritis and Rheumatism, 2011-2018
• Member, Scientific Committee, The Myositis Association, 2018-present
• Member, Scientific Committee, Global Conference on Myositis, 2018-present
• Chair, Scientific Planning Committee, International Myositis Assessment & Clinical Studies Group, 2017-2018
• Vice-Chair, Medical Advisory Board, The Myositis Association, 2017-present
• Member, Professional Relationship Committee, The Myositis Association, 2016-2018
• Member, International Myositis Phase II/III Clinical Trials Double-blind RCT Steering Committee
• Member, Professional Relationship Committee, The Myositis Association, 2016-present
• Abstract Reviewer, American College of Rheumatology, April 2014-present
• Member, Medical Advisory Board, The Myositis Association, 2014-present
• Co-Chair, Abstract Committee, Myopathy Section, American College of Rheumatology, 2014-2018
• Member, Scientific Committee, International Myositis Assessment & Clinical Studies Group, 2012-2018

The research focus in the Biswas laboratory centers on understanding the impact of Interleukin-17 receptor.
signaling in renal immunity and autoimmunity by combining basic and translation research. The kidney is often subject to irreversible damage caused by infections and auto-inflammatory conditions. The incidence of end-stage kidney damage is increasing worldwide and represents a major clinical and economic burden. Currently, there are no effective treatments for this fatal condition. The complex inflammatory cytokine network and renal inflammatory events that drive the progression of kidney injury to irreversible damage is poorly understood. The research program in the Biswas laboratory is divided into several areas focused around IL-17 receptor signaling in the kidney: 1) Determining how IL-17 drives irreversible kidney damage, with the ultimate goal of revealing effective therapeutic approaches to block IL-17 signaling in chronic kidney diseases, including lupus nephritis; 2) Defining the mechanisms of IL-17-mediated renal immunity against disseminated candidiasis and uropathogenic E. coli infection; and 3) Understanding the role of IL-17 receptor signaling in renal fibrosis, the final outcome of acute or chronic kidney diseases leading to kidney dysfunction.

**Study Sections**
- Study Section Member, Congressionally Directed Medical Research Program, Department of Defense-Autoimmune Diseases Panel, 2019

**Advisory Committee Memberships and Leadership Positions**
- Member, Pediatric Rheumatology Fellow Advisory Committee, 2014-2019
- Member, Faculty Advisory Committee, 2015-2019
- Member, Rheumatology Fellow Advisory Committee, 2015-2019

**Editorships**
- Editorial Board Member, *Journal of Scleroderma and Related Disorders*, 2016-present
- Editorial Board Member, *Journal of Immunology, Infections and Inflammatory Disease*, 2016-present
- PACER grant reviews, 2019

**Andreea Coca, MD, MPH**
Dr. Coca’s research interests stem from her exposure to the field of public health during her master’s years. She is very interested in the epidemiology of rheumatic diseases, outcome research, and quality improvement projects. In addition, she enjoys providing patients with access to latest advancements in treatment, through enrollment in clinical trials in systemic lupus erythematosus and Sjögren’s syndrome. She also works closely with uveitis specialists for database development and an inception cohort of uveitis and inflammatory eye disease patients.

**Advisory Committee Memberships and Leadership Positions**
- Co-Director, Rheumatology-Ophthalmology Inflammatory Eye Disease clinic, 2015-2019
- Medical Director, Lupus Center of Excellence, 2019-present

**Robyn T. Domsic, MD, MPH**
Dr. Domsic’s research focuses on improving the care of patients with scleroderma. Her research to date has focused on creating and testing risk stratification strategies for scleroderma patients. These tools can be used to improve both patient care and clinical trial design. Her second main area of research interest is Raynaud’s phenomenon and the vascular manifestations of scleroderma. Specifically, she is interested in novel imaging techniques for vascular involvement in scleroderma and in assessing new outcome measures for testing therapies that treat Raynaud’s phenomenon.

Dr. Domsic continues to be actively involved in several multi-center clinical trials investigating potential
Dr. Domsic continues to be actively involved in several multi-center clinical trials investigating potential therapies for the management of scleroderma and Raynaud's phenomenon. She has current funding for an investigator-initiated trial examining the effect of atorvastatin on Raynaud's phenomenon that will be completed only at the University of Pittsburgh.

**Editorships**
- Editorial Board, *Journal of Scleroderma and Related Disorders*, 2016-present

**Patrizia Fuschiotti, PhD**
Dr. Fuschiotti’s research interests include the cellular and molecular mechanisms of pathogenesis by T cell and T cell-derived cytokines in chronic inflammatory conditions, with particular emphasis is given to the roles played by cytokine IL-13 and its receptors (IL-13Ra1 and IL-13Ra2) in fibrosis, autoimmunity, and cancer. The context of this work has been in human diseases primarily affecting the skin, namely systemic sclerosis (SSc), an autoimmune connective tissue disease whose main clinical feature is fibrosis, and cutaneous T cell lymphoma (CTCL). Dr. Fuschiotti has shown that IL-13 and its molecular pathways are involved in both diseases, acting as a major pro-fibrotic factor in SSc and as an autocrine factor for CTCL. In addition to understanding the underlying mechanisms of pathogenesis, Dr. Fuschiotti has also been developing strategies aimed at targeting IL-13 and its molecular pathways for therapeutic relief. Recent work includes single-cell transcriptome analysis of CTCL skin tumors to investigate tumor heterogeneity with the aim to develop therapeutic strategies tailored to specific patients.

**Sarah L. Gaffin, PhD**
The immune system strikes a remarkably tight balance between controlling infections and limiting immunity to self. T cell-derived cytokines are a case in point: while critical for protecting against infectious disease, they also mediate pathology in autoimmunity. The Gaffen lab studies a cytokine called IL-17, which links innate and adaptive immunity through regulation of neutrophils and innate antimicrobial proteins. IL-17 and its receptor are unique in structure and sequence from other known cytokine families, and the Gaffen lab was among the first to study signaling mechanisms mediated by this novel protein. Dr. Gaffen’s group takes a variety of biochemical, molecular, and in vivo approaches to defining IL-17 biology. In terms of infections, the Gaffen lab was the first to demonstrate that IL-17 is critical for immunity to mucosal fungal infection with the commensal fungus, *Candida albicans*, causative agent of oral and vaginal thrush and also of systemic candidiasis, a serious hospital-acquired infection with >50% mortality. Research in the Gaffen lab is heavily focused on defining the biological function of IL-17 and its receptor in the context of the oral mucosa. Treatment of autoimmune diseases has been revolutionized by biologic drugs that neutralize cytokines, such as etanercept (a TNF receptor antagonist) and tocilizumab (an IL-6 receptor antagonist). Many of these drugs target the Th17/IL-17 pathway, and antibodies to IL-17 were approved in 2016 for psoriasis. Dr. Gaffen’s group aims to understand the physiological impact of cytokine blockade in humans, particularly with respect to the IL-17 signaling pathway.

**Study Sections**
- Chair, Immunity & Host Defense (IHD) study section, NIDCR Board of Scientific Counselors, 2018
- Chair, Immunity & Host Defense (IHD) study section, University of Pittsburgh School of Medicine PACER grant reviews, 2019

**Advisory Committee Memberships and Leadership Positions**
- Member, Training Grant External Advisory Board, University at Buffalo, State University of New York, 2010-2018
- Advisory Board, Science Advisory Board for the FEBS Advanced Lecture Course on Human Fungal
Pathogens, Nice, France, 2019
- Co-Chair, Gordon Research Conference on Fungal Immunology, Galveston, TX, 2019

Editors
- Editorial Board, *Immunological Investigations*, 2001-2018
- Associate Editor, *Cytokine*, 2006-2018
- Editorial Board, *Cytokine and Growth Factor Reviews*, 2010-2018
- Associate Editor, *PLoS Pathogens*, 2014-2018
- Section Editor, *Journal of Immunology*, 2014-2018
- Reviewing Editor, *Journal of Biological Chemistry*, 2015-2018

Major Lectureships and Seminars
- Lecturer, Molecular Mycology Course: Current Approaches to Fungal Pathogenesis, Marine Biological Laboratory at Woods Hole, MA, 2019
- Speaker, International Cytokine & Interferon Society Meeting, Vienna, Austria, 2019
- Speaker, University of Toledo Graduate Research Symposium, Toledo, OH, 2019
- Speaker, Mt Lebanon High School AP Biology, 2019

Honors and Awards
- Awardee, Chancellor’s Distinguished Senior Scholar Research Award, 2018

**Yong G. Hwang, MD**
Rheumatoid arthritis (RA) is a common immune-mediated disease. Patients with established RA indicate that 47% of patients continue to have widespread pain despite relatively low levels of inflammation. Dr. Hwang’s current research interest is to identify subgroups of RA patients with distinct pain, inflammation, and psychosocial factors and to investigate whether there are different treatment responses among subgroups.

**Robert A. Lafyatis, MD**
Dr. Lafyatis’ laboratory effort is focused on understanding scleroderma (systemic sclerosis), and developing novel therapeutic approaches based on identifying biomarkers of the disease process and utilizing biomarkers in clinical trials. The lab has utilized a biomarker approach in a clinical trial of fresolimumab (anti-TGF-beta) to show a role for TGF-beta in skin fibrosis associated with systemic sclerosis. The lab is also applying its pharmacodynamic biomarker of skin disease to trials of tocilizumab (trial completed), and C-82 and rilonacept (ongoing). The research group has particular interest in understanding the mechanisms stimulating immune response in systemic sclerosis, focusing on innate immune responses leading to fibrosis and vascular injury. The lab’s data show increased expression of interferon responsive genes in circulating monocytes of scleroderma patients, prompting current investigations into the stimulus for this pattern of gene expression and the effect of interferon on fibrosis and vascular injury. Most recently, we have been examining the transcriptome of single cells in the skin and lungs of patients with systemic sclerosis to better understand changes in gene expression in different immune and connective tissue cell types that lead to disease.

To aid in developing new therapies for systemic sclerosis, we are studying the pathogenesis through existing murine models, particularly bleomycin-induced skin and lung fibrosis, testing novel therapeutics to clarify the relationship between innate immunity and fibrosis. Our goal is to gain insight from these models that will enable us to propose more informative early phase clinical trials, utilizing biomarkers to show target engagement and as a surrogate clinical response.
**Advisory Committee Memberships and Leadership Positions**
- Co-Chair, International Workshop for Scleroderma, 2005-2018
- Member, Global Fibrosis Foundation Medical Advisory Council, 2009-2018

**Editorships**
- Associate Editor, Journal of Cell Communication and Signaling, 2006-2018

**Kimberly P. Liang, MD**
Dr. Liang’s interests lie in the heterogeneity of rheumatic diseases and their link pathologically to atherosclerosis and vascular disease. Her current research focus is on the evaluation of risks, determinants, and management strategies of premature cardiovascular disease (CVD) in RA patients, through the use of novel noninvasive vascular studies that serve as measures of subclinical atherosclerosis and surrogate markers of future CVD events. Her NIH-funded R21 proposal investigates whether sildenafil use in RA patients improves endothelial dysfunction (as assessed by brachial artery flow-mediated dilation and peripheral arterial tone) and improves serum biomarkers of atherosclerosis and inflammation. Her NIH-funded K23 proposal investigated whether RA patients are more likely to develop vulnerable, atherosclerotic plaques than non-RA patients, as assessed by novel microbubble contrast-enhanced carotid ultrasound (CU) imaging techniques. Dr. Liang’s Vasculitis Foundation-funded proposal investigates whether CU can differentiate between active disease vs. atherosclerotic damage in large-vessel vasculitis. She is interested in developing expertise in novel vascular techniques and applying this technology to the diagnosis and follow-up of rheumatic disease patients with vascular diseases. She is also actively engaged in multiple clinical trials and observational studies of patients with SLE, vasculitis, and RA.

**Editorships**
- Ad hoc Reviewer, Multiple journals (Arthritis and Rheumatology, Arthritis Care and Research, The Journal of Rheumatology), 2015-2018

**Douglas W. Lienesch, MD***
Dr. Lienesch supports the clinical research efforts within the Division of Rheumatology through the Vasculitis and Rheumatoid Arthritis Centers.

**Advisory Committee Memberships and Leadership Positions**
- Member, UPMC Health Plan Pharmacy and Therapeutics Committee, 2011-2018

**Honors and Awards**
- Honoree, Best Doctors, Pittsburgh Magazine, 2019

**Mandy J. McGeachy, PhD**
Th17 cells cause chronic tissue inflammation in autoimmune diseases like psoriasis, multiple sclerosis, and Crohn’s disease. However, Th17 cells and other ‘type-17’ cells provide vital protection against commensals and opportunistic pathogens at barrier surfaces and also aid in wound repair. Many of these effects are achieved through IL-17. Perhaps due to these dual functions of Th17 cells, therapies targeted towards the IL-17 pathway are highly efficacious in some diseases, but have had mixed results in others. The McGeachy lab studies how inflammatory Th17 cells are generated and regulated and and how they mediate their effects...
through IL-17 in different tissues. The goal of this research is to determine the best approaches to modulate Th17-driven pathology while conserving the beneficial protective roles of Th17 cells.

Key questions being addressed include 1) Molecular mechanisms that regulate Th17 differentiation in humans, with a focus on the interplay between costimulatory and cytokine signaling; 2) Functional regulators of in vivo Th17 effector cell pathogenicity; 3) Regulation of Th17 migration in different tissues; and 4) Th17:tissue interactions that lead to stromal cell remodeling during chronic inflammation.

**Study Sections**
- Ad hoc Reviewer, NIH HAI Study Section, 2019

**Editorships**
- Ad hoc Reviewer, *Journal of Experimental Medicine*, 2012-present
- Ad hoc Reviewer, *PLOS One*, 2012-present
- Ad hoc Reviewer, Multiple journals (*Journal of Immunology, Blood, European Journal of Immunology, Arthritis and Rheumatology, Immunity, Nature Immunology, and Journal of Experimental Medicine*), 2012-present
- Editorial Board, *Cytokine*, 2014-present
- Editorial Board, *Scientific Reports*, 2015-present
- Editorial Board, *Frontiers in Multiple Sclerosis and Neuroimmunology*, 2017-2019

**Major Lectureships and Seminars**
- Lecturer, Immunology Seminar, University of Alabama at Birmingham, Birmingham, AL, 2018
- Lecturer, American Association of Immunologists National Meeting, Austin, TX, 2018
- Lecturer, Investigators Meeting, Rheumatology Research Foundation, San Francisco, CA, 2018

**Siamak Moghadam-Kia, MD, MPH**
Dr. Moghadam-Kia's interests are inflammatory myopathies and biomarker clinical studies.

**Professional Affiliations and Society Memberships**
- Member, American College of Rheumatology, 2015-2018

**Niveditha Mohan, MD**
Dr. Mohan’s research centers on clinical trials in vasculitis.

**Advisory Committee Memberships and Leadership Positions**
- Member, Interviewing Committee, University of Pittsburgh School of Medicine Admissions, 2000-2018

**Ghaith Noaiseh, MD**
Dr. Noaiseh is the site principal investigator for several randomized clinical trials assessing efficacy of different novel biological therapies in the management of Sjögren’s Syndrome and Systemic Lupus Erythematosus. His interest is in studying how the overlap of autoimmune rheumatic diseases affects the clinical phenotype, disease course and response to therapy; specifically, the overlap of Sjögren’s Syndrome with other autoimmune diseases, such as Systemic Lupus Erythematosus, myositis, and Scleroderma.

Since 2014, Dr. Noaiseh has collected data and blood samples of patients with Sjögren’s syndrome as part of the UPMC Sjögren’s Registry to facilitate research and collaboration with other institutions in this field.

**Advisory Committee Memberships and Leadership Positions**
Dr. Ghaith Noaiseh is the site principal investigator for several randomized clinical trials assessing efficacy of different agents such as tacrolimus.

Dr. Oddis has been involved in myositis research for over 30 years with a longstanding interest in the epidemiology, clinical features, autoantibody correlations, and treatment of myositis. As Director of the Myositis Center at the University of Pittsburgh, he supervises and manages one of the world’s largest clinically and serologically defined, longitudinal myositis databases with more than 1,000 patients who have adult polymyositis, adult dermatomyositis, and overlap myositis disorders. He was the Principal Investigator on the RIM (Ritubimab in Myositis) Trial, the first multicenter clinical trial in myositis funded by the National Institutes of Health (N01 AR042273) and the largest clinical trial ever completed in myositis. It enrolled 200 subjects from 20 adult and 11 pediatric national and international centers. He collaborates with many national and international myositis investigators and has been involved with task forces developing clinical trial guidelines for both myositis as well as connective tissue disease associated interstitial lung disease (ILD).

In 2008, he developed the Rheumatic Disease Data Management System (RDMS) enabling myositis investigators to link disease activity and damage measures with clinical, laboratory, serologic, and experimental data over time. RDMS is web-based, enabling real-time entry of clinical data, and it includes a robust specimen tracking system leading to a valuable specimen repository. Dr. Oddis has written extensively on the diagnosis and management of patients with myositis, including use of novel immunosuppressive agents such as tacrolimus.
Lupus nephritis is the most common serious complication of lupus. Lupus nephritis can be seen in up to 40% of lupus patients and is more common in pediatric and minority populations. Dr. Tilstra’s research focus is to understand basic signaling mechanisms leading to lupus nephritis. The need for further basic understanding of lupus nephritis is exemplified by the fact that only one new medication has been approved for lupus in the last 50 years and is not indicated for lupus nephritis. Therefore, his work focuses on two distinct pathways to better define this complex disease state. The first is to evaluate the MyD88 signaling pathways in murine lupus through the assessment of several upstream receptors using a reductionist approach and genetic manipulation to determine the roles of TL9, TLR7, and IL-1 signaling on lupus pathogenesis and lupus nephritis. In a secondary project, Dr. Tilstra is evaluating the interaction between the renal parenchyma and cellular infiltrates to better understand tissue specific effects of autoimmunity in the setting of lupus nephritis.

**Major Lectureships and Seminars**
- Presenter, ACR Atlanta Session, November 2018
- Presenter, Senior Vice Chancellor Talk, University of Pittsburgh, November 2018

* Faculty who left the division over the course of FY 2019.
TEACHING ACTIVITIES

Division faculty members have extensive teaching responsibilities, both in the Department of Medicine and in the School of Medicine. Faculty members are involved at all levels of the educational process, from directing first-year courses to having medical students participate in a four-week Rheumatology elective. Interns and more senior Internal Medicine residents rotate on the Rheumatology Service for two to four weeks, and faculty and fellows teach residents in the Rheumatology Clinics during their ambulatory medicine block. Rheumatology faculty are also engaged in more formal teaching in the medical school. For instance, Dr. Chester Oddis directs two medical student courses. The first year course, “Immunology in Health and Disease,” encompasses an overview of basic immunology, as well as several lectures given by the Division of Rheumatology and Clinical Immunology faculty. These lectures cover all of the autoimmune diseases commonly encountered by rheumatologists in their clinical practice. The second year course, “Skin and Musculoskeletal Diseases,” includes a 3-hour workshop led by the rheumatology faculty during which they formally teach and lead a discussion with a small group of medical students. Many cases are presented to the medical students in a PowerPoint format, and the students are instructed on the differential diagnosis, assessment, and management of common rheumatic diseases. Effective July 1, 2019, Dr. Mehret Birru-Talabi replaced Dr. Oddis as Associate Director of the Rheumatology Fellowship Training Program.

The Division of Rheumatology also places a special emphasis on resident teaching. Dr. Rohit Aggarwal is the division’s Subspecialty Education Coordinator, who coordinates all resident education in rheumatology. Residents do their inpatient and outpatient electives in rheumatology on a routine basis. Rheumatology fellows and faculty lead the residents’ twice-a-week educational sessions under the Rheumatology Clinical Review Course (RCRC). Residents can opt for a research elective in rheumatology, where they work with specific mentors on a well-defined research project with the aim of an abstract and presentation at the annual American College of Rheumatology (ACR) meeting. Rheumatology fellows and faculty also teach during residents’ musculoskeletal rotation and ambulatory medicine blocks, where residents get hands-on experience and teaching on musculoskeletal examination on patients seen in rheumatology clinic. Faculty members also lecture at the noon conferences every year, as well as the annual Department of Medicine “Update in Internal Medicine” conference series. Moreover, the Division invites outside speakers to give medicine Grand Rounds every year. During the annual Fellows Competition, fellows give a short annual lecture to residents on “Rheumatology Made Ridiculously Simple.” Rheumatology faculty also participate in annual resident luncheon interactions to help residents learn more about the subspecialty. As of July 1, 2019,
Dr. Jeremy Tilstra has replaced Dr. Aggarwal as Subspecialty Education Coordinator.

The University of Pittsburgh Rheumatology Division has one of the largest rheumatology training programs in the country. The UPMC Rheumatology Fellowship training program, under the direction of Dr. Douglas Lienesch, has a total of seven fellows in clinical training. Our clinical training for fellows includes a comprehensive didactic curriculum involving the Summer Didactic Lecture Series, Immunology Lecture Series, monthly Journal Club, monthly radiology conferences, and weekly Grand Rounds. All of these activities have direct faculty supervision and thus, encourage contact between fellows in training and academic faculty. Fellows also have the option to continue on for a third year as trainees on a NIH-funded T32 Research Training Grant co-directed by Dr. Sarah Gaffen in collaboration with the Department of Immunology. Rheumatology faculty are intrinsically involved in all aspects of the rheumatology fellows’ education, including formal didactic lectures, small group problem based learning, scholarly activity mentoring, precepting of clinical activities in the office and inpatient setting, and various other activities. Fellows completing this program routinely elect to enter academic medicine with focus on primary research, education, or clinical care. Effective July 1, 2019, Dr. Niveditha Mohan takes over from Dr. Lienesch as Director of the Rheumatology Fellowship Training Program.

Clinical Fellows, FY2019

Current Fellows
Nicole Hunt, MD
Medical School: University of the West Indies, Jamaica
Residency: Howard University Hospital, Washington, DC

Reshad Mahmud, MD, MS
Medical School: Albany Medical College, Albany, NY
Residency: University of Pittsburgh Medical Center

Nicholas Vaughn, MD, MBA
Medical School: Saint Louis University School of Medicine
Residency: Medical College of Wisconsin

Departing Fellows
Adam Elisha, MD
Medical School: Arizona College of Osteopathic Medicine of Midwestern University
Residency: Providence Internal Medicine Residency, Spokane, WA
Current Position: Rheumatologist, Duluth, MN

Kanchana Herath, MD
Medical School: Pennsylvania State University College of Medicine
Residency: Medical College of Wisconsin Affiliated Hospitals
Current Position: Rheumatologist, Penn Medicine Lancaster General Health, Lancaster, PA

Erika Joyce, DO
Medical School: Lake Erie College of Osteopathic Medicine
Residency: Allegheny General Hospital
Current Position: Rheumatology and Clinical Immunology Fellow

Anna Papazoglou, MD
Medical School: University of Athens School of Health Sciences
Residency: Albert Einstein Medical Center, Philadelphia, PA, and Sahlgrenska University Hospital, Gothenburg, Sweden
Current Position: T32 Postdoctoral Scholar, Division of Rheumatology and Clinical Immunology, University of Pittsburgh

Fellow Activities

Presentations and Abstracts

Adam Elisha, DO
• The Masquerading Swollen Ankle, Pennsylvania Rheumatology Society Annual Meeting 2018, Hershey, PA, September 2018
• Optimizing Recruitment Using Social Media in Rare Disease Research, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019

Kanchana Herath, MD
• Evaluation of Fracture Risk and Osteoporosis in Males with Rheumatoid Arthritis, American College of Rheumatology Annual Meeting 2018, Chicago, IL, October 2018

Nicole Hunt, MD
Publications

Erika Joyce, DO
Presentations and Abstracts
• Examining Potential Biomarkers in Early Diffuse Scleroderma Patients Treated with Statins, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019

Anna Papazoglou, MD
Presentations and Abstracts
• Susac Syndrome, Poster Presentation, Pennsylvania Rheumatology Society Annual Meeting 2018, Hershey, PA, September 2018
• The role of TNFSF18 in Systemic Sclerosis, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019
Dr. Jeremy Tilstra has replaced Dr. Aggarwal as Subspecialty Education Coordinator.

The University of Pittsburgh Rheumatology Division has one of the largest rheumatology training programs in the country. The UPMC Rheumatology Fellowship training program, under the direction of Dr. Douglas Lienesch, has a total of seven fellows in clinical training. Our clinical training for fellows includes a comprehensive didactic curriculum involving the Summer Didactic Lecture Series, Immunology Lecture Series, monthly Journal Club, monthly radiology conferences, and weekly Grand Rounds. All of these activities have direct faculty supervision and thus, encourage contact between fellows in training and academic faculty. Fellows also have the option to continue on for a third year as trainees on a NIH-funded T32 Research Training Grant co-directed by Dr. Sarah Gaffen in collaboration with the Department of Immunology. Rheumatology faculty are intrinsically involved in all aspects of the rheumatology fellows' education, including formal didactic lectures, small group problem based learning, scholarly activity mentoring, precepting of clinical activities in the office and inpatient setting, and various other activities. Fellows completing this program routinely elect to enter academic medicine with focus on primary research, education, or clinical care. Effective July 1, 2019, Dr. Niveditha Mohan takes over from Dr. Lienesch as Director of the Rheumatology Fellowship Training Program.

### Fellow Activities

#### Adam Elisha, DO

**Presentations and Abstracts**
- The Masquerading Swollen Ankle, Pennsylvania Rheumatology Society Annual Meeting 2018, Hershey, PA, September 2018
- Optimizing Recruitment Using Social Media in Rare Disease Research, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019

#### Kanchana Herath, MD

**Presentations and Abstracts**
- Evaluation of Fracture Risk and Osteoporosis in Males with Rheumatoid Arthritis, American College of Rheumatology Annual Meeting 2018, Chicago, IL, October 2018

#### Nicole Hunt, MD

**Publications**

#### Erika Joyce, DO

**Presentations and Abstracts**
- Examining Potential Biomarkers in Early Diffuse Scleroderma Patients Treated with Statins, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019

#### Anna Papazoglou, MD

**Presentations and Abstracts**
- Susac Syndrome, Poster Presentation, Pennsylvania Rheumatology Society Annual Meeting 2018 Hershey, PA, September 2018
- The role of TNFSF18 in Systemic Sclerosis, Department of Medicine Research Day, University of Pittsburgh, Pittsburgh, PA, April 2019
Postdoctoral Fellows, FY2019

Rami R. Bechara, PhD  
Mentor: Sarah L. Gaffen, PhD  
Dr. Bechara’s research focuses on understanding IL-17 driven autoimmune diseases.

Chetan V. Jawale, PhD  
Mentor: Partha S. Biswas, PhD  
Dr. Jawale is working to define mechanisms of defect in antifungal activity of neutrophils in kidney disease.

Yang Li, PhD  
Mentor: Sarah L. Gaffen, PhD  
Dr. Li is studying the role of Arid5a in IL17 signal pathway.

Saikat Majumder, PhD  
Mentor: Mandy J. McGeachy, PhD  
Dr. Majumder’s research is focused on mechanisms of activation and regulation of fibroblastic reticular cells during Th17 autoimmune inflammation.

Shankar K. Revu, PhD  
Mentor: Mandy J. McGeachy, PhD  
Dr. Revu is studying the underlying molecular mechanism and activation of human Th17 development. He is also researching the role of CD28 costimulation in Th17 differentiation and preceding restimulation responses of pathogenic Th17 cells.

Jamie L. Tweedle, PhD  
Mentor: Sarah L. Gaffen, PhD  
Dr. Tweedle studies IL-36 in candidiasis.

Akash Verma, PhD  
Mentor: Sarah L. Gaffen, PhD  
Dr. Akash’s research focus is IL-17 in fungal immunity.
THREE-YEAR BIBLIOGRAPHY

Larry W. Moreland, MD  Division Chief


Rohit Aggarwal, MD, MS


Aggarwal R, Oddis CV, Goudeau D, Koontz D, Qi Z, Reed AM, Ascherman DP, Levesque MC. Autoantibody levels in myositis patients correlate with clinical response during B cell depletion with rituximab.

Dana P. Ascherman, MD


Mehret Birru-Talabi, MD, PhD


Partha S. Biswas, MVSc, PhD


Ramani K, Jawale CV, Verma AH, Coleman BM, Kolls JK, Biswas PS. Unexpected kidney-restricted role for IL-17 receptor signaling in defense against systemic Candida albicans infection. JCI Insight. 2018 May 3;3(9).


Andreea Coca, MD, MPH


Robyn T. Domsic, MD, MPH


Pauling JD, Domsic RT, Saketkoo LA, Almeida C, Withey J, Jay H, Frech TM, Ingegnoli F, Dures E, Robson J,


**Patrizia Fuschiotti, PhD**


**Sarah L. Gaffen, PhD**


**Yong G. Hwang, MD**


**Robert A. Lafyatis, MD**


Cascio S, Medsger TA Jr, Hawse WF, Watkins SC, Milcarek C, Moreland LW, Lafyatis RA, Fuschiotti P. 14-3-3z sequesters cytosolic T-bet, upregulating IL-13 levels in TC2 and CD8+ lymphocytes from patients with


Taroni JN, Greene CS, Martyanov V, Wood TA, Christmann RB, Farber HW, Lafyatis RA, Denton CP, Hinchcliff


Mandy J. McGeachy, PhD


Thomas A. Medsger Jr., MD


Siamak Moghadam-Kia, MD, MPH


Ghaith Noaiseh, MD*


Chester V. Oddis, MD


Christine Peoples, MD


Jeremy Tilstra, MD, PhD


* Faculty who left the division over the course of FY 2019.
ACKNOWLEDGMENTS

This report was produced by the Office of Academic Affairs in the Department of Medicine.

EXECUTIVE EDITOR
Nichole Radulovich, MEd, CRA
Executive Administrator

SENIOR EDITOR, FACT-CHECKER, AND GRAPHIC DESIGN
Katie Nauman
Academic Affairs Administrator

PROJECT COORDINATORS
Kristen Bagwell
Web Producer

Jane-Ellen Robinet
Communications Coordinator

RHEUMATOLOGY CONTENT MANAGERS
Lauren Zufall
Administrative Manager, Rheumatology

Linda Sadej
Administrative Assistant

DATABASE DEVELOPMENT AND SUPPORT
Nemanja Tomic
Database Developer

Photo credits:
Front and back covers: Gaffen lab; page 1: Head shots courtesy of UPMC/University of Pittsburgh Department of Medicine; pages 3-4: Department of Medicine, Gaffen lab, Biswas lab, and “Rheumatoid arthritis finger xray pathology,” Igokapil, Dreamstime stock photo ID 88864214; page 5: “Rheumatoid arthritis finger xray pathology,” Igokapil, Dreamstime stock photo ID 88864214; pages 13 and 15: Google maps, “Rheumatology clinic locations,” accessed October 2019; page 17: “Rheumatoid arthritis,” 7active Studio, Dreamstime stock photo ID: 84225297; page 36: Gaffen lab; page 39: Biswas lab.