



**Stanford**  
MEDICINE

Sean N. Parker Center  
for Allergy & Asthma Research



# 2020

**ALLERGY AND ASTHMA UPDATE**

**Transforming Lives** with Innovative  
Science and Compassionate Care





# Together, We Are Fulfilling Our Promise

Thanks to our generous philanthropic community and brave patients, we are discovering new treatments and diagnostics for allergy and asthma, treating more people than ever, and shaping policies around climate change.



## Table of Contents

Introduction.....	1
<b>1</b> Scientific Advances and Program Achievements.....	2
<b>2</b> Philanthropic Impact.....	16
<b>3</b> Community Connections.....	24
<b>4</b> Clinical Impact.....	30
<b>5</b> Training the Next Generation.....	38
<b>6</b> Global Vision.....	42
<b>7</b> Funding Needs.....	46



## All Thanks to You, We Are Delivering on Our Promise



**Thank you.** None of the work we have done this year would be possible without you—our donors, our friends, our patients.

And what a year it has been! In January 2020, the Food and Drug Administration approved the first oral immunotherapy medication for peanut allergy—thanks in great part to research at the Sean N. Parker Center for Allergy & Asthma Research. We performed the first two vaccine studies in food allergy. We received national attention in the media and the scientific community for studies on oral immunotherapy maintenance dosing and the effects of wildfires on health. We opened a new clinic on the Stanford campus and secured laboratory space in the Biomedical Innovations Building, which will allow us to expand our research and patient care.

### All thanks to you.

While we do receive support from the National Institutes of Health and other non-profit organizations, the vast majority of our funding comes from philanthropy, often from families affected by allergies and asthma. Your generosity and leadership have allowed us to advance the science, improve care, and expand our outreach to underserved, low-income communities to get them access to information and treatment for allergies and asthma.

**Just six years after our Center was founded, we are delivering on the promise we made then to improve the health of children and adults with allergies and asthma. All thanks to you.**

I hope you enjoy reading about the many achievements you have made possible at our Center in 2019. And I hope you take pride in all you are making possible for years to come as we continue to create innovative science and deliver compassionate care for all people living with allergies and asthma. **We can't do it without you.**

All the best,

*Kari C Nadeau*

Kari C. Nadeau, MD, PhD, FAAAAI

Director, Sean N. Parker Center for Allergy & Asthma Research at Stanford University  
*Naddisy Foundation Professor of Pediatric Food Allergy, Immunology, and Asthma*  
Professor of Medicine and Pediatrics and, by courtesy, Otolaryngology at Stanford  
Section Chief, Asthma and Allergy  
Division of Pulmonary & Critical Care  
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# Scientific Advances and Program Achievements

The Sean N. Parker Center for Allergy & Asthma Research is bringing innovative, life-changing progress and hope to people with allergies and asthma worldwide.



In 2019, our Center made tremendous progress in identifying and understanding the molecular pathways underlying allergic disease, enabling us to get closer to causes and cures for allergy, asthma, and inflammation. More than 400 patients addressed their sensitivity to peanuts and other foods through oral immunotherapy trials we conducted. Food allergy immunotherapy involves having patients ingest tiny doses of an allergen, such as a peanut protein, to desensitize their immune system to the food. **A milestone was reached in January 2020 when the Food and Drug Administration (FDA) approved the first oral immunotherapy medication for peanut allergy**—Palforzia from Aimmune Therapeutics. The FDA gave it a green light because of Palforzia’s effectiveness in reducing allergic reactions and the high unmet need for treating peanut allergy. Our Center was one of the sites that evaluated this drug in patients. Having the first immunotherapy drug for food allergy approved by the FDA is a monumental achievement, heralding a new era of safe and effective treatments. None of this important work could have been done without our generous donors and brave patients.

We look forward to using rigorous science and compassionate care to develop life-changing treatments and find preventions and cures for allergy and asthma.

## Here are Some Highlights from the Past Year:

### Advancing Clinical Trials

In 2019, we continued to expand clinical research, conducting more than 25 trials. We launched seven new studies and continued working on more than 20 ongoing studies. Research topics included allergic rhinitis, atopic dermatitis, asthma, eosinophilic esophagitis (EoE, or allergic inflammation of the esophagus), and allergies to peanuts, milk, cashew, shrimp, and multiple foods. We had 1,744 clinical visits, including visits with 191 patients tested for allergy for the first time, and 40 adults and children enrolled in new studies. Our biobank of specimens, which are used in our research, increased from about 72,000 to nearly 75,000.

It was exciting to start a Phase 2 trial for peanut allergy with dupilumab, a promising biologic drug (meaning it is produced from or contains components of living organisms) that was previously approved for eczema and asthma. We also began a Phase 2 trial for multi-food allergies that combined dupilumab with another drug, omalizumab.

In addition, we started a Phase 1 trial of a novel vaccine, ASP0892 (formerly ARA-LAMP-Vax). It contains DNA that produces peanut proteins when injected into the body. The vaccine is designed to desensitize a patient to three major allergenic proteins in peanuts. Other new trials started in 2019 included oral immunotherapy for shrimp or cashew and a study of omalizumab as the principal therapy and as an adjunct therapy in people with multiple allergies.

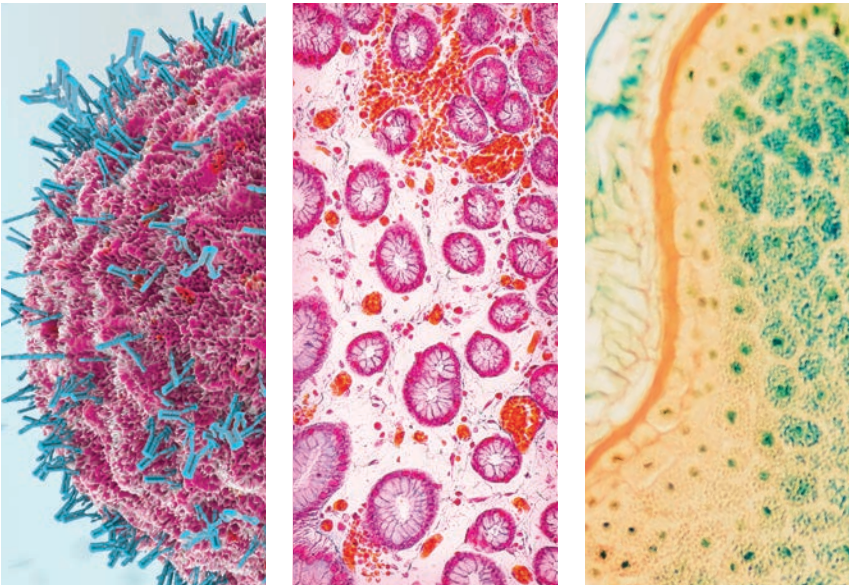
In addition to food allergy, we continue to work on other allergic diseases. Allergic diseases often show up first as atopic dermatitis, or eczema, and then progress to food allergy, allergic rhinitis that affects the nose, and, subsequently, asthma. This is known as the “atopic march,” which can start with defects in the skin barrier. We evaluated the effectiveness of two types of emollients, or moisturizers, one that is paraffin- or petroleum-based and the other a trilipid cream mimicking the skin’s natural lipid composition and pH. Based on trans-epidermal water loss, a measure of skin barrier integrity, the trilipid cream was superior to paraffin- or petroleum-based emollients at restoring the skin barrier.

*For a list of clinical trials, see pages 34–37 in the Clinical Impact section of this update.*

### Making Progress with Food Allergies

In 2019, we completed a large Phase 2 trial of peanut immunotherapy, called POISED. This study shed light on important questions about life after peanut immunotherapy. Current research suggests that patients need to continue a maintenance dose to stay desensitized, but there is little information on how large that dose needs to be. This study found that although immunotherapy could desensitize individuals to up to four grams of peanut protein (about 16 peanuts), stopping the intake of peanut protein, or even decreasing it to 300 milligrams daily, could increase a person’s risk of becoming sensitive to peanuts again.

## SCIENTIFIC ADVANCES AND PROGRAM ACHIEVEMENTS



The POISED study received a Top 10 Clinical Research Achievement Award for 2020 from the Clinical Research Forum, a nonprofit that promotes clinical research. Dr. Sharon Chinthrajah, clinical associate professor, director of the Clinical Translational Research Unit of our Center, and a *Carell Family Endowed Faculty Scholar for Food Allergy and Immunology Research*, was honored at a virtual award event for leading the POISED research.

We have long studied B cells in blood, which produce immunoglobulin E (IgE), an antibody underlying food allergy. In one 2019 study, we obtained blood samples as well as biopsies from the stomach, duodenum, and esophagus from people with peanut allergy. Using DNA sequencing, we determined that IgE-producing B cells are found not only in the blood, but also in the gastrointestinal tract, a finding that may assist in discovering new ways to treat food allergy.

However, some individuals with peanut-specific IgE can eat peanuts without allergic reactions (known as sensitized tolerance). Using mass cytometry, in which antibodies are used to label proteins to determine a cell’s properties, we found cellular and molecular indicators that may help us differentiate people who are allergic to peanuts and those who have peanut-specific IgE but do not have an allergic reaction.

In addition to peanut allergy, we continued developing immunotherapy for other allergies and multiple food allergies. We participated in a multicenter study on wheat oral immunotherapy and found that immunotherapy with high-protein wheat flour was safe and effective in desensitizing most participants within a year. More importantly, 13 percent of participants continued to be desensitized after two years, even if they discontinued immunotherapy for eight to 10 weeks.



Testing New Drugs

With our deep understanding of the molecular mechanisms underlying food allergy, our Center is well-positioned to test novel biologic drugs that have been developed. For example, we conducted trials of a peanut allergy drug called etokimab that inhibits interleukin-33, a key molecule that initiates a cascade of reactions leading to the symptoms of allergy. In a Phase 2 study, we evaluated the effectiveness of a single injection of etokimab in those with severe peanut allergy. We found that 15 and 45 days after treatment, 73 percent and 57 percent, respectively, could consume 375 milligrams of peanut protein (about one to 1½ peanuts). In contrast, all participants who received the placebo had an allergic reaction upon eating peanut protein. The drug was also found to be safe, and none of the participants experienced severe side effects.

Current therapies for peanut allergy require daily intake of peanut allergens, making it difficult to follow the regimen. Etokimab could be used as a single therapy and would not require that patients consume the allergen regularly for desensitization.

Assisting the Underserved

We are working toward ensuring proper and timely diagnosis for the poor and the uninsured. Often, the medically underserved must go to the emergency room for treatment, where they might be undertreated. For example, only 33 percent receive epinephrine at some point in their care, just 10 percent are seen by an allergist, and a mere 30 percent get referred to an allergist for further treatment.

Our Center is in discussions with the pediatric and adult emergency rooms at Stanford Hospital and Lucile Packard Children’s Hospital Stanford to create a process where people with allergic reactions who do not get evaluated by an allergist are directed to our Center for free food allergy testing. This will assist with proper diagnosis and care.

Shaping Policy

We rely on robust scientific data as we help advance treatments toward FDA approval. Our research has shown that the long-term benefits of desensitization with peanut oral immunotherapy outweigh the short-term risks of allergic reactions during immunotherapy. However, on July 10, 2019, the Institute for Clinical and Economic Review (ICER) reported that the clinical evidence for peanut oral immunotherapy is insufficient and that current evidence does not yet demonstrate that long-term benefits outweigh short-term risks.

ICER’s conclusion contrasted with compelling data from our Center and other research institutions. Many patients undergoing immunotherapy for food allergies report major improvements in their quality of life. We believe that the risks of allergic reaction are minimal if immunotherapy is conducted at sites that are trained and equipped to immediately treat upon the first signs of an allergic reaction. Risks also are minimized when patients are educated on how to recognize an allergic reaction, when to get medical help, and when and how to use epinephrine auto-injectors.

Dr. Nadeau led more than two dozen researchers in the U.S., Canada, and Europe to write an article voicing strong support for oral immunotherapy for peanut allergy, which appeared in November in *the Journal of Allergy and Clinical Immunology*. This advocacy assisted with getting support from the FDA’s Allergenic Products Advisory Committee and approval from the FDA for Palforzia to treat peanut allergy.

Advancing New Technologies

Increasingly, bioinformatics—the computerized analysis of large volumes of biological data—is playing a central role in allergy research. Bioinformatics is becoming more important in our investigation of immune changes in people undergoing peanut immunotherapy. For example, we are using RNA sequencing on gastrointestinal samples from patients in immunotherapy to investigate the genetic makeup of those who benefit from immunotherapy. We are also evaluating biomolecules that can help predict who can maintain desensitization to peanut allergens after successful immunotherapy.

Our Center is also continuing to innovate in making food allergy and aeroallergen diagnosis more accurate, specific, and easy. Our patents include two diagnostic tests for allergy. Both detect certain proteins on basophils, white blood cells in the immune system, which are activated when stimulated by allergens. One uses a technique called flow cytometry, which uses a laser beam to separate cells based on associated biomarkers. The other is a microfluidic device, which we have developed in collaboration with Dr. Sindy Tang, associate professor of mechanical engineering at Stanford. The device uses only a tiny drop of blood to detect proteins present on basophils during activation. The device can quickly and easily diagnose multiple allergies simultaneously. One of our other patents is for a mixture of allergens that is designed to promote and support the immune system and a healthy gut microbiome.

Investigating Wildfires and Pollution

In recent years, California has seen increases in the frequency, length, and magnitude of wildfires. Our Center is investigating the long-term health effects of these fires on the heart, lungs, and immune system. For example, Mary Prunicki, MD, PhD, *Barakett Endowed Faculty Scholar for Expanded Access*, has been studying the molecular changes associated with prolonged exposure to wildfires. In addition to changes in immune cells, she has found that wildfire leads to increased expression of the PDL2 protein, which has been associated with airway inflammation and cancer. Our work on wildfires has been cited in *the Washington Post*, *the New York Times*, and *Nature*.



In one study, we compared people who were and were not exposed to smoke from the 2014 El Portal wildfire near Yosemite National Park and found that exposed individuals had significant increases in IL-beta and c-reactive proteins, both indicators of inflammation. As the people tested lived 62 miles away from the fire, the findings indicate that wildfire impact may affect the health of even those living at a distance.

Dr. Prunicki has also started a study on the effect of wildfire exposure in firefighters by examining their blood biomarkers associated with smoke exposure. In another study conducted near Fresno, California, a region with high levels of air pollution, she has completed a study on adolescents that looked at the effect of pollutants on inflammatory markers and blood pressure. She has also completed research in young children to evaluate the effect of air pollution on monocytes, immune cells that are predominant in plaque, which can build up and clog arteries.

Much of our research is done through partnerships that make us stronger. The Center has formed collaborations with the Woods Institute for the Environment and The Bill Lane Center for the American West, both at Stanford, to conduct wildfire research. In 2019, Dr. Nadeau was appointed a senior fellow at the Woods Institute and is part of the FIRE team there, which aims to deliver comprehensive recommendations based on sound science to support local, state, and federal agencies. We are also developing curriculum on pollution, climate change, and human health to foster education and awareness of these issues.

We could not have accomplished all that we did without you!

## Planting Seeds for Discovery

Seed grants fund the exploration of ideas that can benefit scientific knowledge and medical treatment of patients with allergies, asthma, and respiratory problems. This research lets physicians and scientists plant the seeds for medical breakthroughs and develop new technologies and methods. Your philanthropy is important in supporting this innovative research.

**Our Center Awarded Seed Grants to the Following Researchers in 2019:**

**Michele Barry, MD, FACP**, professor of medicine, **Susanne Sokolow, PhD, DVM**, senior research scientist, and **Giulio De Leo, PhD**, professor of biology, all at Stanford. They lead a group that is assessing a 10-year program for people living near tropical rainforests in West Kalimantan, Borneo, from Health in Harmony, a nonprofit. Health in Harmony developed a health clinic and provided medical services, while also offering incentives for reducing illegal logging and providing sustainable agriculture training. The group led by the Stanford researchers will examine data on child

mortality, infectious diseases, and economic measures while looking at data on vegetation coverage in forests and carbon storage of trees. The review will test the hypothesis that providing affordable healthcare to poor communities improves well-being and reduces practices that harm the environment.

**Stephanie Eisenbarth, MD, PhD**, associate professor of laboratory medicine at Yale University School of Medicine. She will test whether the presence and level of food-specific immunoglobulin A (IgA), an antibody of the immune system, in human stool is a good marker for tolerance of specific foods. Using stool samples and clinical data from patients in peanut oral immunotherapy trials at Stanford, she will look at whether peanut-specific IgA increased in patients who were successfully desensitized to peanuts. She developed a test that quantifies peanut-specific IgA and plans to create tests for eggs and milk. Eventually, she will examine how levels of IgA correspond to how tolerant people are of peanuts, eggs, and milk. Food-specific IgA potentially could be used to stratify people by degree of risk for anaphylaxis.



## Expanding Our Scientific Talent

The Center continues to expand by bringing in new talent to work alongside the best and the brightest minds dedicated to allergy research. In 2019, our team grew to include the following people:



**Shu Cao, MS**, biostatistician.

She performs statistical analysis to explore the clinical and molecular risks associated with severe allergic symptoms. She obtained a dual bachelor's degree in biological international economics and business university of Science and Technology, and a statistics at West Virginia University.



**Maya Kasowski, MD, PhD**, clinical instructor of pathology and *Sean Parker Faculty Scholar*. Her research focuses on how noncoding genetic variation influences gene regulation and disease risk. Her lab will dissect

the genetics that underlie allergy. She obtained her MD/PhD from Yale University, completed her residency in pathology, and served as a postdoctoral fellow in genetics at Stanford University.



**Meng Chen, MD**, clinical assistant professor of allergy and immunology. Dr. Chen is an active investigator in food allergy trials. She also evaluates the impact of climate change on pollen patterns. She received her medical

degree from the University of California, San Francisco, and completed her internal medicine residency at the University of California, Los Angeles. She completed a fellowship in allergy and immunology at the University of California, San Diego, and Rady Children's Hospital.



**Rachel Moericke, MA**, director of clinical trial operations & regulatory affairs. She oversees clinical trial operations and regulatory matters for our clinical research team and our team working with Stanford's Good

Manufacturing Practices facility. She received her master's degree in clinical and research health psychology and studied the impact of biopsychosocial factors on patients receiving medical care.



**William J. Collins, MD**, clinical assistant professor of internal medicine and faculty fellow. He works as a hospitalist at Stanford Hospital and does clinical research at our Center. In addition to work in

food allergy, he also has research interests in asthma and drug allergies. He completed his residency at the University of California, San Diego, and received his medical training at the University of California, San Francisco.



**Lisa Patel, MD**, clinical assistant professor of pediatrics. She is the advocacy and policy lead at our Center, where she is focusing on a strategy to address climate change. She earned her bachelor's degree in biological

sciences at Stanford University, obtained her master's degree in environmental sciences at the Yale School of Forestry, and was a Presidential Management Fellow at the Environmental Protection Agency. She obtained her medical degree from Johns Hopkins University and completed her residency in pediatrics at the University of California, San Francisco.

## Our 2019 Scientific Advisors

Our Center's Scientific Advisory Committee brings together the best minds in allergy and asthma science. These scientists and physicians from different specialties contribute their insights to improve diagnostics, prognostics, and therapies.

**Kari Nadeau, MD, PhD**, director of the Sean N. Parker Center for Allergy & Asthma Research, Stanford

**Sean Parker**, philanthropist,  
entrepreneur, founder and president  
of the Parker Foundation

**Cezmi Akdis, MD, PhD,**  
director, Swiss Institute of Allergy  
and Asthma Research

**Mübeccel Akdis, MD, PhD**, head of dermatology, Swiss Institute of Allergy and Asthma Research

**Michele Barry, MD**, senior associate dean, global health; director, Center for Innovation in Global Health, Stanford

**Scott Boyd, MD, PhD**, associate professor of pathology, Stanford

**Carlos Carmago, Jr., MD, DrPH,**  
*Conn Chair in Emergency Medicine,*  
Massachusetts General Hospital

**Howard Chang, MD, PhD,**  
director, Center for Personal  
Dynamic Regulomes, Stanford

**Yueh-hsiu Chien, PhD,**  
professor of microbiology and  
immunology, Stanford

**R. Sharon Chinthrajah, MD**, director,  
Clinical Translational Research Unit of  
the Sean N. Parker Center for Allergy  
& Asthma Research, Stanford

**Mark Davis, PhD**, director,  
Stanford Institute for Immunity,  
Transplantation, and Infection

**Manisha Desai, PhD**, director,  
Quantitative Sciences Unit, Stanford

**Andrew Fire, PhD**, George D. Smith  
Professor in Molecular and Genetic  
Medicine, Stanford

**Stephen Galli, MD,** *Mary Hewitt Loveless, MD, Professor and professor of pathology, Stanford*

**Christopher Gardner, PhD**, *Rehnborg  
Farquhar Professor of medicine,  
Stanford Prevention Research Center*

**Ruchi Gupta, MD, MPH**, director of Science and Outcomes of Allergy and Asthma Research, Northwestern University and Ann & Robert H. Lurie Children's Hospital of Chicago

**Theodore Jardetsky, PhD**, professor of structural biology, Stanford

**Purvesh Khatri, PhD**, associate professor, Stanford Institute for Immunity, Transplantation, and Infection

**Chaitin Khosla, PhD**, director of Stanford Chemistry, Engineering, and Medicine for Human Health (ChEM-H) and *Wells H. Rauser and Harold M. Petiprin Professor*, Stanford Engineering

**Gideon Lack, MD**, professor of pediatric allergy, King's College London

**Donald Leung, MD, PhD**, head of pediatric allergy and immunology, National Jewish Health, Denver

**David Lewis, MD**, chief of pediatric allergy, immunology, and rheumatology, Stanford

**Holden Maecker, PhD**, director,  
Human Immune Monitoring  
Center, Stanford

**Lloyd Minor, MD**, *Carl and Elizabeth Naumann Dean*, Stanford Medicine

**Cathryn Nagler, PhD**, *Bunning Food Allergy Professor, University of Chicago*

**Mark Nicolls, MD**, chief of pulmonary and critical care medicine, Stanford

**Garry Nolan, PhD**, *Rachford and Carlota A. Harris Professor of microbiology and immunology, Stanford*

**Julie Parsonnet, MD**, *George DeForest Barnett Professor in Medicine* and professor of health research and policy, Stanford

**Bali Pulendran, PhD**, *Violetta L. Horton Professor of pathology, and professor of microbiology and immunology, Stanford*

**Stephen Quake, MS, PhD,**  
Lee Otterson Professor, Stanford  
Engineering, and professor of  
bioengineering, Stanford Medicine

**Michael Snyder, PhD**, chair of genetics and director of the Center for Genomics and Personalized Medicine, Stanford

**Justin Sonnenburg, PhD**, associate professor of microbiology and immunology, Stanford

**Sindy Tang, PhD**, associate professor of mechanical engineering, Stanford

**Steven Ziegler, PhD**, director of immunology research, Benaroya Research Institute



## 2019 JOURNAL PUBLICATIONS

**Development of multiple features of antigen-induced asthma pathology in a new strain of mast cell deficient BALB/c-Kit (W-sh/W-sh) mice.**

Hernandez JD, Yu M, Sibilano R, Tsai M, Galli SJ.  
LABORATORY INVESTIGATION.  
2019 Dec 19. [Epub ahead of print].

**Sustained successful peanut oral immunotherapy associated with low basophil activation and peanut-specific IgE.**

Tsai M, Mukai K, Chinthrajah RS, Nadeau KC, Galli SJ.  
THE JOURNAL OF ALLERGY AND CLINICAL  
IMMUNOLOGY.  
2019 Dec 2. [Epub ahead of print].

**The future of omics for clinical practice.**

Long A, Bunning B, Borro M, Sampath V,  
Nadeau, KC.  
**ANNALS OF ALLERGY, ASTHMA & IMMUNOLOGY.**  
2019 Dec; 123(6): 535-536.

## Transcriptomic and methylomic features in asthmatic and non-asthmatic twins.

Dhondalay GKR, Bunning B, Bauer RN, Barnathan ES, Maniscalco C, Baribaud F, Nadeau KC, Andorf S. **ALLERGY.** 2019 Nov 22. [Epub ahead of print].

## Global metabolic profiling to model biological processes of aging in twins.

Bunning BJ, Contrepois K, Lee-McMullen B, Dhondalay GKR, Zhang W, Tupa D, Raeber O, Desai M, Nadeau KC, Snyder MP, Andorf S.

## Can food allergy be cured? What are the future prospects?

*SamPATH V, Sindher SB, Alvarez Pinzon AM, Nadeau KC.*  
**ALLERGY.**  
 2019 Nov 16. [Epub ahead of print].

**Phase 2a randomized, placebo-controlled study of anti-IL-33 in peanut allergy.**

Chinthrajah S, Cao S, Liu C, Lyu SC, Sindher SB, Long A, Sampath V, Petroni D, Londei M, Nadeau KC. **JCI INSIGHT.** 2019 Nov 14; 4(22).

### Trends in egg specific immunoglobulin levels during natural tolerance and oral immunotherapy.

Andorf S, Bunning B, Tupa D, Cao S, Long A, Borres MP, Galli SJ, Chinthrajah RS, Nadeau KC. **ALLERGY.** Accepted November 14, 2019. [Epub ahead of print].

**Blockade of TIM-1 on the donor graft ameliorates graft-versus-host disease following hematopoietic cell transplantation.**

Iliopoulou BP, Hsu K, Pérez-Cruz M, Tang SW,  
 Pang WW, Erkers T, Kambham N, Freeman GJ,  
 Dekruyff RH, Meyer EH.  
**BLOOD ADVANCES.**  
 2019 Nov 12; 3(21): 3419-3431.

## Conflicting verdicts on peanut OIT from the ICER and FDA Advisory Committee; where do we go from here?

Eiwegger T, Anagnostou K, Arasi S, Bégin P, Ben-Shoshan M, Beyer K, Blumchen K, Brough H, Caubet JC, Chan ES, Chen M, Chinthrajah S, Davis CM, Roches AD, Du Toit G, Elizur A, Galli SJ, Håland G, Hoffmann-Sommergruber K, Kim H, Leung DYM, Long A, Muraro A, Nurmatov UB, Pajno GB, Sampath V, Saxena J, Sindher S, Upton J, Worm M, Nadeau K. **THE JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY.** 2019 Nov 1. [Epub ahead of print].

## Genetic and environmental susceptibility to food allergy in a registry of twins.

Kivistö JE, Clarke A, Dery A, De Schryver S, Shand G, Huhtala H, Mäkelä MJ, Asai Y, Nadeau K, Harada L, Chan ES, Ben-Shoshan M.  
**THE JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY: IN PRACTICE.**  
 2019 Nov - Dec; 7(8): 2916-2918.

**Cow's milk and vitamin D supplementation in infants—timing is everything.**

Du Toit G, Elizur A, Nadeau KC.  
JAMA PEDIATRICS.  
2019 Oct 21. [Epub ahead of print].

**Sustained outcomes in oral immunotherapy for peanut allergy (POISED study): a large, randomised, double-blind, placebo-controlled, phase 2 study.**

Chinthrajan RS, Purington N, Andorf S, Long A, O’Laughlin KL, Lyu SC, Manohar M, Boyd SD, Tibshirani R, Maecker H, Plaut M, Mukai K, Tsai M, Desai M, Galli SJ, Nadeau KC.

**THE LANCET.**

2019 Oct 19; 394(10207): 1437-1449.

**Epithelial RABGEF1 deficiency promotes intestinal inflammation by dysregulating intrinsic MYD88-dependent innate signaling.**

El Abbas S, Kadermecker C, Bai Q, Beguin C, Schyns J, Meunier M, Pirotin D, Desmet CJ, Meuwis MA, Art T, Louis E, Tam SY, Tsai M, Bureau F, Galli SJ, Marichal T. **MUCOSAL IMMUNOLOGY.** 2019 Oct 18. [Epub ahead of print].

**Natural Tr1-like cells do not confer long-term tolerogenic memory.**

Yadava K, Medina CO, Ishak H, Gurevich I, Kuipers H, Shamskhou EA, Koliesnik IO, Moon JJ, Weaver C, Nadeau KC, Bollyky PL.  
**ELIFE.**  
 2019 Oct 11; 8.

**House dust mites activate nociceptor-mast cell clusters to drive type 2 skin inflammation.**

Serhan N, Basso L, Sibilano R, Petitfils C, Meixiong J, Bonnart C, Reber LL, Marichal T, Starkl P, Cenac N, Dong X, Tsai M, Galli SJ, Gaudenzio N.  
**NATURE IMMUNOLOGY.**  
 2019 Oct 7. [Epub ahead of print].

## The impact of prescribed fire versus wildfire on the immune and cardiovascular systems of children.

Prunicki M, Kelsey R, Lee J, Zhou X, Smith E, Haddad F, Wu J, Nadeau K.  
**ALLERGY.**  
2019 Oct; 74(10): 1989-1991.



## 2019 JOURNAL PUBLICATIONS

## ICER report for peanut OIT comes up short.

Eiwegger T, Anagnostou K, Arasi S, Bégin P, Ben-Shoshan M, Beyer K, Blumchen K, Brough H, Caubet JC, Chan ES, Chinthrajah S, Davis CM, Roches AD, Du Toit G, Elizur A, Galli SJ, Håland G, Hoffmann-Sommergruber K, Kim H, Leung DYM, Muraro A, Nurmatov UB, Pajno GB, Sindher S, Szepefalusi Z, Torres MJ, Upton J, Worm M, Nadeau K.

ANNALS OF ALLERGY, ASTHMA &amp; IMMUNOLOGY.

2019 Sep 9.

**Almond (*prunus dulcis*) allergen pru du 8, the first member of a new family of food allergens.**

Che H, Zhang Y, Jiang S, Jin T, Lyu SC, Nadeau KC, McHugh T.

JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY.

2019 Aug 7; 67(31): 8626-8631.

## Recent progress in the analysis of $\alpha\beta$ T cell and B cell receptor repertoires.

Davis MM, Boyd SD.

**CURRENT OPINION IN IMMUNOLOGY.**

2019 Jul 17; 59: 109-114.

**Blockade of repulsive guidance molecule b (RGMb) inhibits allergen-induced airways disease.**

Yu S, Leung KM, Kim HY, Umetsu SE, Xiao Y, Albacker LA, Lee HJ, Umetsu DT, Freeman GJ, DeKruyff RH.

THE JOURNAL OF ALLERGY AND CLINICAL

**IMMUNOLOGY.**

2019 Jul; 144(1): 94-108.e11.

### Proteasome-dependent regulation of distinct metabolic states during long-term culture of human iPSC-derived cardiomyocytes.

Ebert A, Joshi AU, Andorf S, Dai Y, Sampathkumar S, Chen H, Li Y, Garg P, Toischer K, Hasenfuss G, Mochly-Rosen D, Wu JC.

**CIRCULATION RESEARCH.**

2019 Jun 21; 125(1): 90-103.

### Modeling cardiovascular risks of e-cigarettes with human induced pluripotent stem cell-derived endothelial cells.

Lee WH, Ong SG, Zhou Y, Tian L, Bae HR, Baker N, Whitlatch A, Mohammadi L, Guo H, Nadeau KC, Springer ML, Schick SF, Bhatnagar A, Wu JC.

**JOURNAL OF THE AMERICAN COLLEGE OF  
CARDIOLOGY.**

2019 Jun 4; 73(21): 2722-2737.

**A perspective on the pediatric death from oral food challenge reported from the Allergy Vigilance Network.**

*Upton J, Montserrat A, Nadeau K.*

## ALLERGY.

2019 Jun; 74(6): 1035-1036.

### Changing patient mindsets about non-life-threatening symptoms during oral immunotherapy: A randomized clinical trial.

Howe LC, Leibowitz KA, Perry MA, Block W, Kaptchuk TJ, Nadeau KC, Alia J, Crum AJ.

**THE JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY: IN PRACTICE.**

2019 May - Jun; 7(5): 1550-1559.

## Genetic and environmental susceptibility to food allergy in a registry of twins.

Kivistö JE, Clarke A, Dery A, De Schryver S, Shand G, Huhtala H, Mäkelä MJ, Asai Y, Nadeau K, Harada L, Chan ES, Ben-Shoshan M.

**THE JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY: IN PRACTICE.**

2019 May 23. [Epub ahead of print].





## Philanthropic Impact

Your dedication to our Center's compassionate care and innovative science drives us together toward a cure for allergies and asthma.

# 2



Our Center runs on philanthropic support. The vision and leadership of donors like you have allowed us to prove the effectiveness of immunotherapy, create a device to diagnose allergies, and bring new tools and education to families in underserved areas. Fueled by your commitment, we expect to make many more discoveries, develop better treatments, and help more people around the world. Thank you!



**These philanthropic partners played a leading role in new research and expanded care in 2019:**

The [Friend family](#) provided a gift to study wheat epitopes to determine the best ways to block the molecular pathways involved in wheat allergies.

The [Barakett family](#) and an [anonymous donor](#) are making possible the next phase of a trial of a new vaccine for peanut allergies and a study of skin lubricants for children with eczema. (See pages 2 and 3 for more information.) Also, thanks to the [Barakett family](#), we are able to offer Saturday hours at our research clinic, allowing more families to participate in our clinical trials. (See page 25.)



Very generous gifts from [two anonymous donors](#) have made possible two important research projects. One is a collaboration with Mayo Clinic, Arizona, on a study of whether the drug dupilumab will improve the safety and effectiveness of oral immunotherapy for milk allergies. The other is for the development of a prognostic device that will indicate how well immunotherapy will work for food allergy patients and tell whether they need to keep taking a maintenance dose of the allergen.

We also thank [The Safe + Fair Food Company](#), [End Allergies Together \(EAT\)](#), [Food Allergy Research and Education \(FARE\)](#), and the [National Institutes of Health \(NIH\)](#) for their important contributions to our research and care.

## Helping Others Find Peace of Mind

Inspiring stories from some of our courageous and generous donor families, in their own words.



From left, Carter, David, Gavin, Kori, and Keegan

### Shaw Family

Our daughter Keegan was a toddler when we first discovered she had a severe peanut allergy. As we moved from Maryland to California, we saw doctor after doctor. They all told us the same thing: our only option was food avoidance. During this process, we also discovered our 6-month-old son Carter was allergic to nuts and eggs.

When we moved to Palo Alto, a friend told us about Dr. Nadeau and her food allergy oral immunotherapy clinical trials at Stanford University. We were able to get both Keegan and Carter enrolled in the first multiple food allergy trial using omalizumab (Xolair), which tested oral immunotherapy for up to five allergens at once.

After that trial, we saw our children’s lives change. Today, Keegan and Carter are thriving and playing sports as active teenagers. Keegan can eat up to 16 peanuts—at the start of the trial even trace amounts caused her to have an allergic reaction—and Carter can eat many more foods without fear of a serious reaction. Our children’s participation in the trial has been life-changing for our family. Now we can travel freely and live without fear.

As a “founding family,” our kids were the research. We were one of the first to try the protocols to help other families dealing with food allergies.

We’re thankful that we’ve been able to work closely with Dr. Nadeau, from planning community events to donating and fundraising for trials to spreading awareness in schools and groups. Together we are letting the world know that food allergies are very scary and a real health crisis. And that food avoidance is not the only option.

*“We are working to find a cure for allergies and asthma, increase choices of therapy, and fight this global epidemic with prevention, early detection, and best care. We do this because of patients and families who inspire us to improve lives throughout the world.” — Kari Nadeau, MD, PhD*



Back, from left: Ken, Andrew, and Pansy; front, from left: Audrey, Alex, and Luke

### Andrew Yang

When I was 6 months old, my face turned bright red after I ate some walnut crumbs. I was diagnosed with a nut allergy. Since that time, most of my life has been one of infinite caution. Because I had anaphylactic reactions to all nuts, eating in

restaurants was a risk. Traveling and eating in foreign countries was dangerous. Even at home and school we had to be extremely careful about everything I ate.

Then, several years ago, my mom read an article in *the New York Times* about Dr. Nadeau and her amazing work. My mom knew immediately that participating in one of Dr. Nadeau’s trials would be a life-altering experience for me and my family. We were able to be part of a study using omalizumab, or Xolair, which helps speed up the desensitization process.

In the beginning, it was definitely hard. After the Xolair shot, my reaction to nuts was non-lethal but still very uncomfortable and painful. But as time went on and my dosage increased, nuts became easier to tolerate. All the discomfort was worth it!

I owe my life to this program! I never thought I would be able to do what I can now, which is eat 12 nuts a day. I know I am safe from accidental ingestion of nuts, and that I won’t have to go to the emergency room as I did before. I can enjoy eating out with my family and travel without fear. I feel safer in any environment.

My family and I support Dr. Nadeau and her team at the Center because we want other kids to have the same opportunity I had—the chance to live without a sword hanging by a thread over their heads. I think allergy research is one of the worthiest causes to support.



### Ariella Nelson

When I was 4 years old, I bit into a chocolate chip cookie at my grandmother’s house. Later that night, I started coughing, felt nauseous, and vomited. My parents took me to an allergist who diagnosed my allergy to tree nuts.

My life changed dramatically. As I got older, I quizzed servers in restaurants, parents at friends’ homes, and even relatives who knew about my allergy but didn’t understand the seriousness of it. At school, I sat at the “no nut” table, which I called the “no fun” table. There were never a lot of kids there and I felt like an outsider. People meant well but mistakes were made, and occasionally I had to use my EpiPen and ended up in the ER.

Three years ago, a friend told me about a clinical study at Stanford. My friend connected me with Dr. Nadeau and I began oral immunotherapy. Eating real nuts—even in powder form—was scary. But I knew that if this worked even a little, it would be worth it. Today, I am on a maintenance dose of

four nuts a day. Though I still carry EpiPens, I no longer worry if a lone pistachio makes its way into my vanilla ice cream, or if my cinnamon roll was keeping company with an almond croissant.

My family and I are strong supporters of the Sean N. Parker Center because the groundbreaking research being done there is already having a positive impact on kids throughout the country, if not the world.

I will be going off to college next year. Thanks to oral immunotherapy, I no longer live in a constant state of anxiety and fear. While I still won’t be getting the takeout cashew chicken to eat with my dormmates, I will be able to enjoy a more typical college life. And that means everything.

# Gifts that Last a Lifetime and Beyond

By endowing our brightest researchers and providing continued support for our programs and research, you are enriching so many lives. Thank you for your commitment and leadership.



## Bringing the Best Care to the Most Vulnerable

The generosity of the [Canfield, Barakett, Freidheim, and Giorgi families](#) is making it possible for people in underserved areas of Chicago, New York, and San Francisco to get support in dealing with the often-overwhelming challenges of allergies and asthma. (Read about this amazing work on page 26.)

## Driving the Science that Drives the Care

The [Bunning family](#) has generously supported our research into the molecular causes of allergies and asthma.

A gift from the [Hill family](#) is providing computational work for our clinical trials, allowing us to sort through and categorize huge amounts of data necessary for breakthrough discoveries.

Generous donations from the [Lubetzky](#) and [Hartman families](#) laid the groundwork for our peanut allergy vaccine trial. [Many dedicated families in Southern California](#) supported a collaboration with the University of California, Los Angeles, on a peanut oral immunotherapy dosing trial. The [Orzak, Kepner, and Englander families](#) joined [an anonymous donor](#) to fund development of a diagnostic microchip to more accurately and safely diagnose allergies.

## Providing Wings for Top Talent to Soar

Faculty endowments guaranteeing support for our talented Center scientists provide the backbone for our research. The [Gies family](#) has endowed Sayantani (Tina) Sindher, MD, one of our top clinicians. With support from the [Barakett family](#), Mary Prunicki, MD, PhD, and her team have made national headlines with their findings on the adverse health effects of wildfire exposure. (For details on this important research, see page 5.) The [Carell family's](#) endowment for Dr. Chinthrajah, our clinical director, has been instrumental in making her one of the leading allergy and asthma clinical researchers in the world.

Philanthropy also supports our basic scientists, including Bali Pulendran, PhD, endowed by the [Soffer family](#); and Scott Boyd, MD, PhD, who is endowed by [an anonymous donor](#).

Dr. Pulendran is studying how the immune system responds to allergens and infections. Dr. Boyd's work examines the role of B cells in allergic reactions.

Research in the “wet” lab—where tissue samples are studied using powerful microscopes and advanced cell-sorting technology—requires the powerful computing of the “dry” lab to create discoveries. The [Li family](#) supports Manisha Desai, PhD, our Center's new computational director. Computer scientist Bibek Paudel, PhD, who is using machine learning to study the impact of environmental and lifestyle changes on the health of vulnerable people, is supported by the [Bravo family](#).

Dr. Nadeau's professorship, which gives her the freedom to design and share new research and create exciting collaborations, is supported by the [Lainovic family](#) and many others, including the [Li, Carell, Sandberg, Orzak, Kepner, Staggs, Bates, Limaye, Arrillaga, and Yun families](#).



# Space to Grow

Thanks to the generosity of the [Koch family](#), we have a new clinic on the Stanford campus—the David and Julia Koch Clinic. It is located steps away from our new laboratory in the Biomedical Innovations Building, made possible by [Sean N. Parker](#) and [an anonymous donor](#). These exciting new spaces are allowing us to bring our innovative science and compassionate care to more people with allergies and asthma, and we look forward to moving ahead with our philanthropic community toward finding cures for these diseases.



Photos by Matthew Anderson Photography



From top: Sharon Chinthrajah, MD, in the David and Julia Koch Clinic on the Stanford campus; Jamie Saxena, MS, FNP-C, research nurse practitioner, checks the vital signs of Ayden Chou, a clinical trial participant, during his visit to the Koch Clinic; Medical equipment cabinet in the clinic.



## Community Connections

Outreach programs, events, and a book! These are just some of the ways our Center brought education and compassionate care to people with allergies and asthma this year.

# 3



## COMMUNITY CONNECTIONS

Thanks to the generosity of our wonderful donors, we have been able to partner with other organizations and sponsor projects around the country that aim to improve the health of children in underserved communities.

### Opening Doors

A busy schedule shouldn't be an obstacle to getting a person's food allergy under control. Thanks to the incredible support of our donor community, our Center added early and late hours on weekdays and started opening its doors one Saturday a month.

Extended clinic hours have been particularly helpful to Robin Fletcher, a high school student from San Francisco, and her mother, Jacqueline Lisa Fletcher. Robin is enrolled in our COMBINE study for treating multiple allergies, and she needs to come in every two weeks. "Our main goal of coming to Saturday clinic is to make sure she misses school as little as possible," says Jacqueline.

Jamie Saxena, MS, FNP-C, a research nurse practitioner who coordinates staffing at the clinic, has seen a real uptick in enrollment as a result of

the expanded time. "These are long studies that require patients to come in for two or three hours every two weeks. The missed school can really add up," she says. The extra hours also help working parents fit their children's appointments into their schedules.

Donor funds make it possible to underwrite the cost of staffing a nurse practitioner or doctor and lab specialist during these added hours.

### Toxic Stress

Children who have experienced toxic stress due to physical and emotional abuse or neglect have a higher risk of developing allergies and asthma. To address this issue, our Center has been working with the Center for Youth Wellness, a San Francisco non-profit dedicated to improving the health of children exposed to toxic stressors.

With the help of donor funds, we have built a select committee of pediatric nurses, doctors, asthma and allergy experts, psychiatrists, psychologists, and other scientists. The team has gathered evidence that demonstrates the link between toxic stress and disease. They are now working on a set of guidelines that health workers can use to help them recognize the signs of toxic stress in patients and better manage their care.

Next, we are involving nurses, social workers, and community members in the committee, ensuring the guidelines work for the people on the front lines. Once the guidelines are finished, we'll develop a pilot study to measure their effectiveness, collect feedback from health workers, and optimize them so they can be adopted by national health agencies.



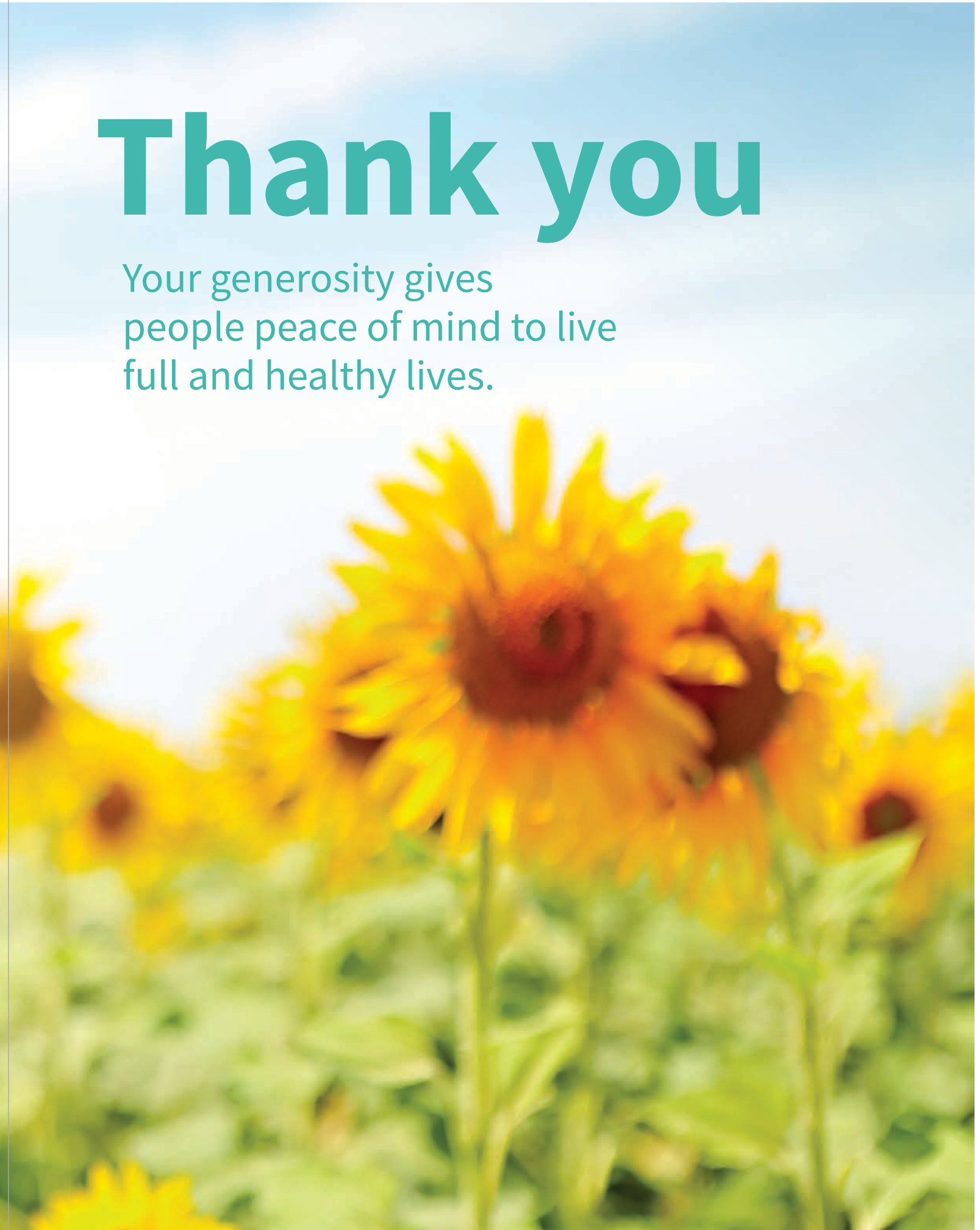
Left, Sayantani (Tina) Sindher, MD, works with our Center's clinical research coordinator, Debjani Ghoshal, to treat patient Robin Fletcher at her Saturday oral immunotherapy appointment. Right, Dr. Sindher works closely with Andrew Long, PharmD, a pharmacist who manages the many medications for the Center's clinical trials.





# Thank you

Your generosity gives  
people peace of mind to live  
full and healthy lives.

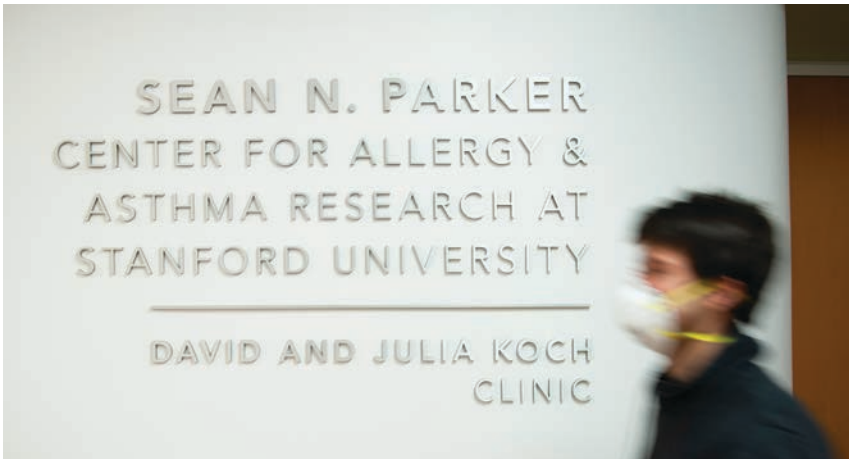




# Clinical Impact

Thanks to your amazing support, more and more patients are getting the most advanced treatments in our clinical trials—and living life to the fullest!

4



We are excited to report that we opened the David and Julia Koch Clinic at Stanford in 2019. This new clinic allows us to see more patients with allergies and asthma and enroll them in our trials. The location on the Stanford campus means we are close to our laboratory team and other departments on campus, and better able to coordinate research and care.

Off-campus clinics and collaborations are expanding, too. We are reaching more patients through our partnership with the Allergy, Asthma, and Immunology Clinic in Atherton, California, a clinic for adults. We now have an allergy clinic in San Francisco through the California Pacific Medical Center—Sutter Health California Pacific Medical Center. Dr. Nadeau and other providers from our clinic see patients there, which has been a great way for us to recruit patients into our allergy trials from across the San Francisco Bay Area.

For our patients with eosinophilic esophagitis (EoE), Dr. Sindher has joined a clinic that combines EoE and gastroenterology specialists. By bringing together gastroenterologists, allergists, and dieticians under one roof, they can treat patients holistically for a full range of symptoms. The clinic is so popular it has increased its hours from every other week to once a week to meet patient demand.

What makes working at the Center so special? Let's hear from three of our clinicians. (Featured, right.)



Rachel Moericke, MA

Director, Clinical Trial Operations & Regulatory Affairs

I oversee clinical trial operations and regulatory affairs for our clinical research team and good manufacturing practice (GMP) facility, including our team's work with the National Institutes of Health and industry sponsors. I help ensure research is conducted within regulatory guidelines and good clinical practices.

**One of the greatest things about working at our Center is the team.** We have an incredibly dedicated group of research and GMP staff dedicated to making a difference in the field and with patients and their families.

Personally, I know many people struggling with food allergy and asthma. There are often many fears and restrictions placed on the child, parent, family, and community. **Working together we can help build a brighter future.**



Divya Kumar, PhD, ACRP-CP

Clinical Life Science Research Scientist

Over the last five years at our Center, I've enjoyed working at the research lab and manufacturing facility as well as interacting with trial participants. I am currently in charge of oral and epicutaneous (patch) immunotherapies for food allergies. As a coordinator, I screen potential candidates for trials and ensure enrolled participants follow the protocol. As a researcher, I get to analyze data for manuscripts. **Being a mother of a child with food allergies, I understand how these therapies can change a whole family's lifestyle for the better. It is rewarding to be able to make a positive change—not every clinical trial can do that.**



Jamie Saxena, MS, FNP-C

Research Nurse Practitioner

As a nurse practitioner at our Center, I assess the health of the patients who participate in our trials, as well as take steps to ensure their safety.

**I love the relationships that we build with our participants. Since they come into our Center frequently, we get to know them and their families well, and it is fun to be part of their journey.** I also love that we are involved with groundbreaking scientific discoveries. It is thrilling to be part of a team that has such a positive impact on the world!



Our Center participated in or sponsored more than 25 clinical trials in 2019, including the following:

STUDY TOPIC	Date Started/Status	Purpose
PEANUT ALLERGY		
<b>Omalizumab (Xolair), a biologic drug approved for treating asthma</b>	<i>2013, ongoing</i>	Study efficacy of omalizumab at four centers to safely and rapidly desensitize patients with severe peanut allergy. Determine if pretreatment with anti-IgE mAb (omalizumab) can greatly reduce allergic reactions and allow for faster and safer desensitization.
<b>OIT with peanut flour follow-up</b>	<i>2016, completed</i>	Demonstrate the safety, tolerability, and efficacy of AR101 peanut flour through a characterized oral desensitization immunotherapy (CODIT) in peanut-allergic children and adults who have completed a previous AR101 OIT study.
<b>Skin patch</b>	<i>2016, ongoing</i>	Evaluate the safety of Viaskin Peanut, a skin patch, to induce desensitization to peanuts in children 4 to 11 years old.
<b>OIT with peanut flour follow-up</b>	<i>2017, completed</i>	Study the long-term safety, tolerability, and efficacy of AR101 peanut flour in children who have completed a previous AR101 OIT study.
<b>Skin patch follow-up</b>	<i>2017, ongoing</i>	Follow patients who completed a Viaskin Peanut skin patch study for two to three more years.
<b>Skin patch</b>	<i>2017, ongoing</i>	Assess the safety and efficacy of Viaskin Peanut skin patch to induce desensitization to peanuts in peanut-allergic children 1 to 3 years old.
<b>OIT with peanut flour, long-term study</b>	<i>2017, ongoing</i>	Assess AR101 peanut flour's safety and tolerability over an extended dosing period.
<b>Skin patch, long-term assessment</b>	<i>2018, ongoing</i>	Assess the long-term safety and therapeutic benefit of Viaskin Peanut skin patch in peanut-allergic children.
<b>OIT with peanut flour in young children</b>	<i>2018, ongoing</i>	Study the efficacy and safety of AR101 peanut flour in a characterized desensitization OIT regimen in peanut-allergic children 1 to 4 years old, using escalating doses over six months.

STUDY TOPIC	Date Started/Status	Purpose
PEANUT ALLERGY (CONT.)		
OIT with dupilumab added to peanut flour	2018, ongoing	Study the safety of combining dupilumab, a monoclonal antibody approved for treatment of eczema, with AR101 peanut flour and assess improvement of desensitization to peanuts over 28 weeks.
Sublingual (under the tongue) therapy with SAR439794, which combines a synthetic TLR4 agonist (a drug that targets a transmembrane protein involved in inflammation and immune response) with a peanut extract	2018, ongoing	Investigate the safety, tolerability, and effects of repeated daily sublingual doses of SAR439794 in peanut-allergic adolescents and adults.
OIT with dupilumab monotherapy	2019, ongoing	Assess tolerability in a peanut protein food challenge in children 6 to 17 years old after being treated only with dupilumab over 24 weeks.
Vaccine	2019, ongoing	Evaluate safety, tolerability, and immune response in peanut-allergic adolescents receiving a protein DNA plasmid injection.
Skin patch follow-up	2019, ongoing	Study the long-term benefits and safety of Viaskin Peanut skin patch in children 1 to 3 years old.
OIT with peanut flour	2019, ongoing	To determine the safety, efficacy, and tolerability of the drug AR101 in peanut allergic children 1 to 4 years old.
EOSINOPHILIC ESOPHAGITIS (EOE)		
Fluticasone propionate, a corticosteroid used in nasal sprays	2017, ongoing	Compare the efficacy and safety of fluticasone propionate in a tablet form with placebo in adults with EoE.
Injectable dupilumab, a biologic medication used to treat allergic diseases such as eczema	2018, ongoing	Investigate the efficacy and safety of injectable dupilumab in adult and adolescent patients with EoE.





# Training the Next Generation

Your philanthropy has allowed our Center to provide a pathway for future leaders to continue our important work.

Through mentorships, research opportunities, and networking, we provide our trainees opportunities in the field of allergy and asthma that they can't get anywhere else. We engage with young researchers at every level: Our trainees include undergraduates, graduate students, and post-doctoral scholars. Our goal is to strengthen the community of allergy and asthma researchers and physicians committed to helping patients. We are confident that our cultivation of these young researchers will bring us that much closer to finding better treatments and cures.

5



**Cade Cannedy**

Cade is an undergraduate research assistant who joined our Center in the summer of 2019. He is working on studies on the effectiveness of

home air purifiers and the health consequences of wildfires in California. Cade has a deep interest in social and environmental justice and the economic conditions that exacerbate health problems. He graduated from Stanford in June 2020, after majoring in political science and writing a senior thesis on air quality, regulation, and local governance in California's Central Valley. He hopes to pursue a career in environmental law or public health.



**Ziyuan He, PhD**

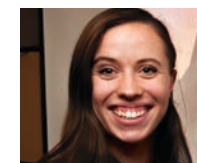
Dr. He joined the Nadeau Lab at our Center in the summer of 2019. His research focuses on using computational and bioinformatic

methods to analyze immunology-related data. His current work includes analyzing gut microbiota of patients in the oral immunotherapy clinical trials. He received his PhD in microbiology and immunology from Tulane University. Before joining the Nadeau lab, he studied white blood cells and aging in Rhesus macaque monkeys at UC Davis and the Tulane University Primate Center.



**Christopher Warren, PhD**

Dr. Warren is a postdoctoral scholar who joined our Center's clinical research team in the fall of 2019 after receiving his PhD from the University of Southern California's Department of Preventive Medicine. In recent years, his epidemiological studies have characterized the prevalence, distribution, and causes of food allergies in the United States. By elucidating the burden of allergic disease—both physical and psychosocial—his work informs ongoing efforts to understand disease origins as well as evaluate the effectiveness of emerging immunotherapies and prevention strategies. In addition to this population-level epidemiological work, his research also focuses on developing and validating ways to measure patient-reported changes in health in hopes of advancing food allergy surveillance efforts in the U.S. and beyond.



**Emily O'Neal, MA**

Emily is a virtual reality (VR) experience designer particularly interested in medical and educational applications of the technology. For her master's thesis with Stanford's Virtual Human Interaction Lab, Emily partnered with our Center to design and develop a VR application to reduce patient anxiety during the food challenge procedure. The application immerses patients in a fantastical forest and each bite they take fuels magic powers. Emily's work is motivated by a passion for user-centered design and improving patient experience. Emily graduated from Stanford University in March of 2020 with a bachelor's degree in human biology and a master's degree in communications and media studies.



**Hesam Movassagh, PhD**

Dr. Movassagh is a postdoctoral scholar at our Center. He obtained his PhD in immunology from the University of Manitoba, Canada.

During his PhD program, Dr. Movassagh discovered a novel immune regulatory axis, Semaphorin 3E-PlexinD1, which may lead to new diagnosis and treatment options for asthma. His current project focuses on the impact of exposure to air pollution on dysregulation of the immune system in children and its consequence on pediatric asthma. Dr. Movassagh believes understanding the mechanisms underlying this dysregulation is the key step to developing innovative strategies to control illness and death associated with air pollution.

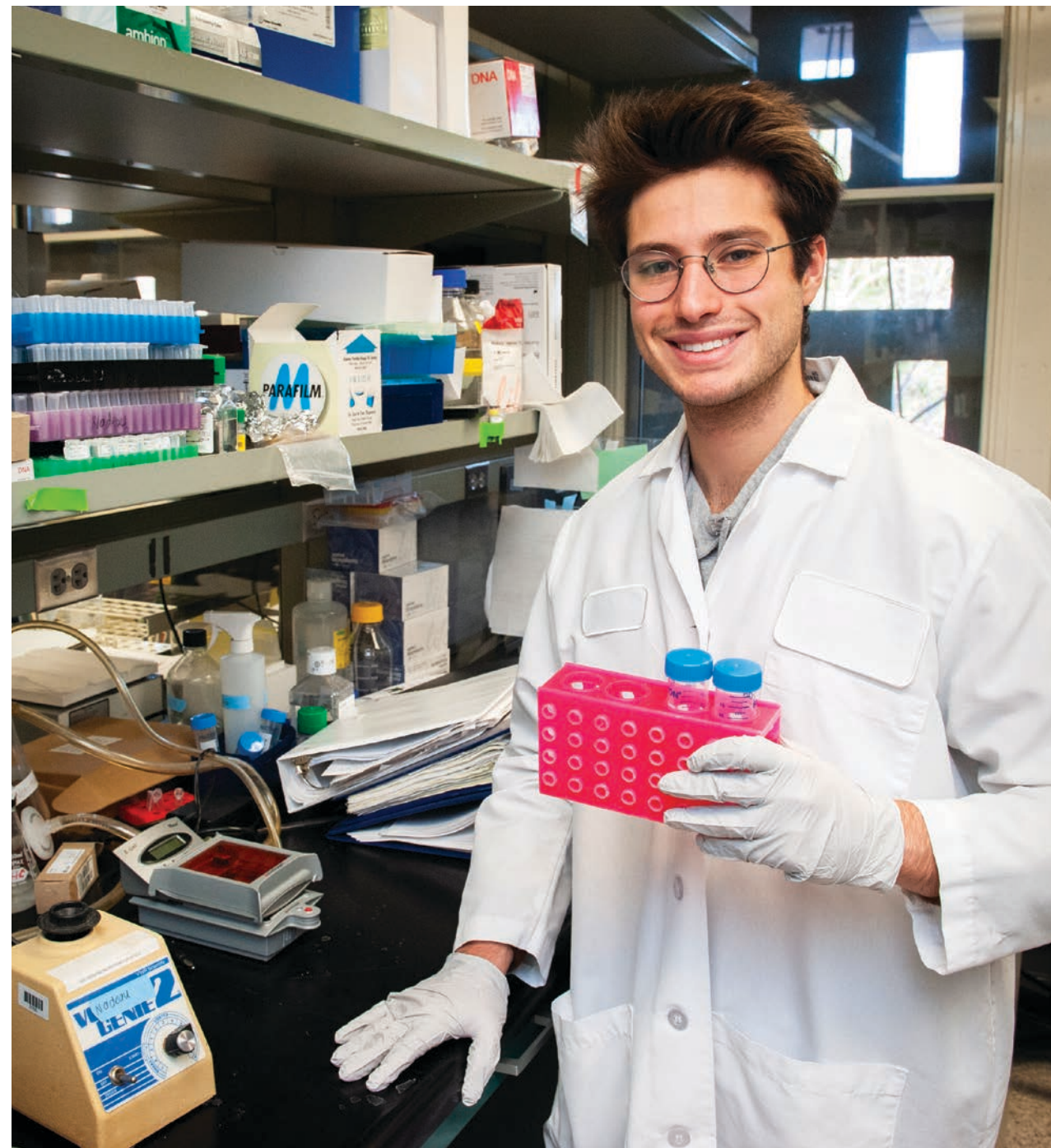


**Andrea Nadosy Bunt, MBA**

Andrea joined our Center as a graduate student intern in the fall of 2019. She holds an undergraduate degree from Harvard College and an MBA from Harvard Business School. After business school, she ran a company that designed and produced stylish tech accessories that were sold online and in Apple stores. In 2011, after the birth of her first child, her focus shifted entirely to the importance of prenatal and childhood health. She is currently a master's student in the Community Health and Prevention Research Program at Stanford Medical School and is interested in the "why" of disease, particularly the epigenetic mechanisms that could be at the root of certain diseases.

## Tomorrow's Leaders Searching for Answers Today

Every year, in the lab and in the clinic, our Center's interns and postdocs—the next generation of researchers—focus on finding ways to improve the lives of allergy and asthma patients everywhere.



### From Top Clockwise:

A wildfire study participant gets a blood pressure check.

Emily O'Neal, VR/AR experience designer, demonstrates how VR technology helps ease fear in clinical trial participants.

Shifaa Alkotob, MD, postdoctoral clinical research fellow, uses a swab to collect biological specimens of a wildfire study participant during a clinic visit.

Eric Smith, one of our undergraduate interns, works in the lab.

An experiment testing a white blood cell sample is conducted under a biofume hood.

Biological specimens from clinical trial participants are preserved and stored for food allergy research.

Christopher Warren, PhD, a postdoctoral research fellow at our Center, works out a problem on the whiteboard.





# Global Vision

Our dedicated donors enable our Center to connect with organizations around the world to solve allergy- and asthma-related health challenges.

6



## Leading the Charge to Prevent Disease

Due to climate change, wildfires are expected to increase 50 percent by 2050. Meanwhile, fires caused by agricultural practices are on the rise. The increased level of smoke can lead to cardiovascular and chronic lung diseases as well as cancer and diabetes. Last year, these non-communicable diseases accounted for 71 percent of deaths worldwide and this number is expected to increase to 80 percent by 2045. The economic impact is predicted to be in the trillions of dollars.

Using its expertise in allergic diseases, our Center team is leading the charge to improve the air we breathe and mitigate the effects of pollution.

### Building Coalitions

To address this widescale problem, Dr. Nadeau organized a wildfire-specific section of panelists at the Planetary Health Alliance Annual Meeting held last September at Stanford in partnership with the Stanford Center for Innovation in Global Health, Stanford Woods Institute for the Environment, and the Wellcome Trust. The event brought together leading experts from around the world and across all disciplines—from scientists to policy makers and community groups—to form connections and propose solutions.

Speaking at a panel discussion exploring the impact of fire pollution on human health, Dr. Nadeau made an urgent call to action: “We need to act together to preserve forest ecology and protect our health.”



Panelists spoke about the direct correlation between smoke from wildfires or fires caused by agricultural practices and the dramatic increase in respiratory disease and even premature death. Proposed solutions included changing slash-and-burn agricultural practices and developing digital mapping tools to track which populations will be hit hardest by air pollution caused by fires.

Last year, a global health fellow at Stanford, Herb Riband, launched a new Stanford Global Non-Communicable Disease Innovation Initiative, with support from our Center, Stanford faculty across multiple departments, as well as external partners. He now works for the World Health Organization in Geneva, Switzerland, where he continues to work with Stanford to improve outcomes for people with cardiovascular, respiratory, and other chronic diseases.

### Finding Solutions Through Science

Better air quality is crucial to preventing not only severe asthma attacks and strokes but also changes to the immune system that could be irreversible. In a first-of-its-kind study

currently underway, Dr. Nadeau and Mary Prunicki, MD, PhD, director of air pollution and wildfire research in the Nadeau laboratory, have been looking at the long-term health effects of wildfire smoke on the immune system.

During last year’s rampage of infernos in Northern California, Drs. Nadeau and Prunicki, with a team of students and postdocs, raced to begin collecting samples from hundreds of people in the Bay Area who had already signed up to participate in a study on the long-lasting effects of wildfire smoke. Their team will conduct tests on blood samples to assess subjects’ circulatory, respiratory, and immune systems through 2037. Our Center hopes to enroll as many as 2,000 participants. According to an article in the top British scientific journal *Nature*, it will be the most diverse group of people enrolled in a wildfire pollution study occurring over a long period of time. Results could potentially lead to guidelines on ways to reduce health risks through prediction, mitigation, and air filtering.





## Funding Needs

Your generosity is the engine that fuels our Center. It allows us to conduct the research that is having a direct impact on how we diagnose and treat allergies and asthma.



# 7

Please consider funding the following projects—we need philanthropic support to launch and grow these exciting areas of research:

### Disrupting the Field

We have the researchers, tools, and technology in place to create highly personalized treatments for food allergy, including determining who can and cannot be cured through oral immunotherapy. This work involves improving diagnostics; finding new biomarkers to predict when allergic reactions will happen and when an allergy disappears; and creating the ideal dosing strategy for each patient—including when, if ever, the patient can stop oral immunotherapy. We are looking for medications that can do in a single pill what would take weeks of oral immunotherapy. We are looking for ways to predict and measure allergic reaction that are so accurate they may eventually replace stressful and burdensome food challenges. This research is happening, but slowly and in pieces as we look to fund each stage separately through philanthropy or grants.

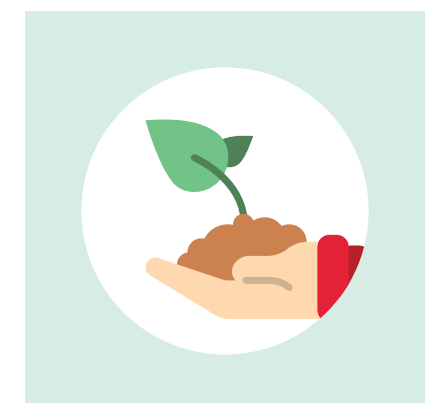
Your support would accelerate this research and bring it to the hands of doctors who could help more children.

### Innovating for Tomorrow

In keeping with the innovation that Stanford and Silicon Valley are known for, we are quickly bringing potentially life-changing laboratory discoveries directly to patients through clinical trials. This type of research—with the potential to produce breakthroughs that will change the field—is almost impossible to fund through government grants or industry sponsors. We need philanthropic investment to start key projects and keep others progressing. Funds for clinical trials go toward recruiting participants, collecting biospecimens and other information for laboratory studies, and mechanistic studies in the laboratory to identify and isolate allergen-specific cells for further study. We have a pipeline of exciting new clinical trials designed and ready to go once funds are in place. These include a first-of-its-kind study to desensitize people allergic to shrimp and look at immune cells involved in those allergies; an oral immunotherapy trial using a new combination of drugs we believe will desensitize people to food allergies faster and without some of the side effects of basic oral immunotherapy; a trial of a single-dose pill to successfully and safely stop peanut allergies in adults; and a study to determine whether air filters in homes will protect children from the detrimental health effects of wildfire smoke.

### Addressing Climate Change

The impact of pollution and global warming on human health is one of the biggest and most complex problems for medical science. It requires creative and far-reaching solutions. Our Center is up for the challenge. We are working with partners at Stanford and around the world to document how pollution and wildfires damage the immune system at the molecular level and develop and test strategies to limit damage, as well as advocating for policies to halt root causes of climate change. An endowed research fund—a fund that continues to pay out in perpetuity—would give us leeway to greatly expand our studies related to global climate change, planetary health, and wildfires, and help provide evidence to shape public health policies with a solid basis in science.



## Building Our Data Capabilities

The bottleneck for new discoveries is no longer the generation of biological and clinical data, but managing, analyzing, and interpreting large and complex data sets. This work, so key to developing algorithms or identifying trends that lead to important treatments, is extremely labor intensive. To tackle the challenges of Big Data in biology and medicine, we need computational scientists who not only have deep data analysis knowledge but also a working understanding of the underlying biological and medical questions—and the ability to bridge the two. We need biostatisticians and data scientists to help analyze the data we receive continuously and put this into a form we can use for our studies. Your support would allow us to hire and retain biostatisticians who can expand our ability to extrapolate and interpret the enormous amounts of information we generate from our studies, allowing researchers to more accurately predict response to treatment, determine the most promising treatments, and design future studies.



## Attracting World-Class Talent

## Senior Faculty Scholars

Whether they are investigating a link between air pollution and asthma or using data from clinical trials to determine the best treatment for food allergy, our Center's senior faculty scholars are paving the road to breakthrough discoveries and better therapies. Philanthropic support makes it possible for these academic stars to perform the groundbreaking research that leads to national funding, clinical trials, and cures.

### Junior Faculty Scholars

Junior faculty scholars at our Center run the engine of our research by gathering and analyzing the data that reveal the underlying mechanisms of disease. In our clinics, they provide compassionate care and outreach to all patients, including those from underserved areas. With your funding, we can inspire promising scientists to start and continue their careers at Stanford.

## Internship Fund

It is crucial to nurture young talent at the high school and college levels. Our Center's summer interns have made important contributions to investigations and are inspired to pursue careers in scientific research. Support of this program will allow students from underserved communities to receive a stipend for their participation, which will help them compete for admission to top universities and medical schools.

## Software Development: The Promise of Technology

## Telehealth

Using our location in Silicon Valley as a springboard, we aim to organize a Health Hackathon, in which we challenge Stanford students to create a mobile app that puts medical assistance at our patients' fingertips. Seed funding for this project will help bring the expertise and treatments of our Center to patients who live far away.

## Virtual Reality

Virtual reality programs specific to food allergy can alleviate anxiety for children in our oral immunotherapy trials by distracting them during blood draws and encouraging them to eat food they've been conditioned to avoid. This fund would underwrite software development, cost of headsets and computer hardware, and administration of a study measuring the impact of virtual reality programming on allergy patients' quality of life.




# Thank you



From all of us at the Sean N. Parker Center for Allergy & Asthma Research at Stanford University, our patients, and people everywhere who benefit from your generosity, thank you. 🍷





We are dedicated to finding causes, treatments, and cures for allergic diseases, bringing greater peace of mind to children, adults, and families locally and globally.

For more information about our Center or how to participate in this important work, please contact:



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