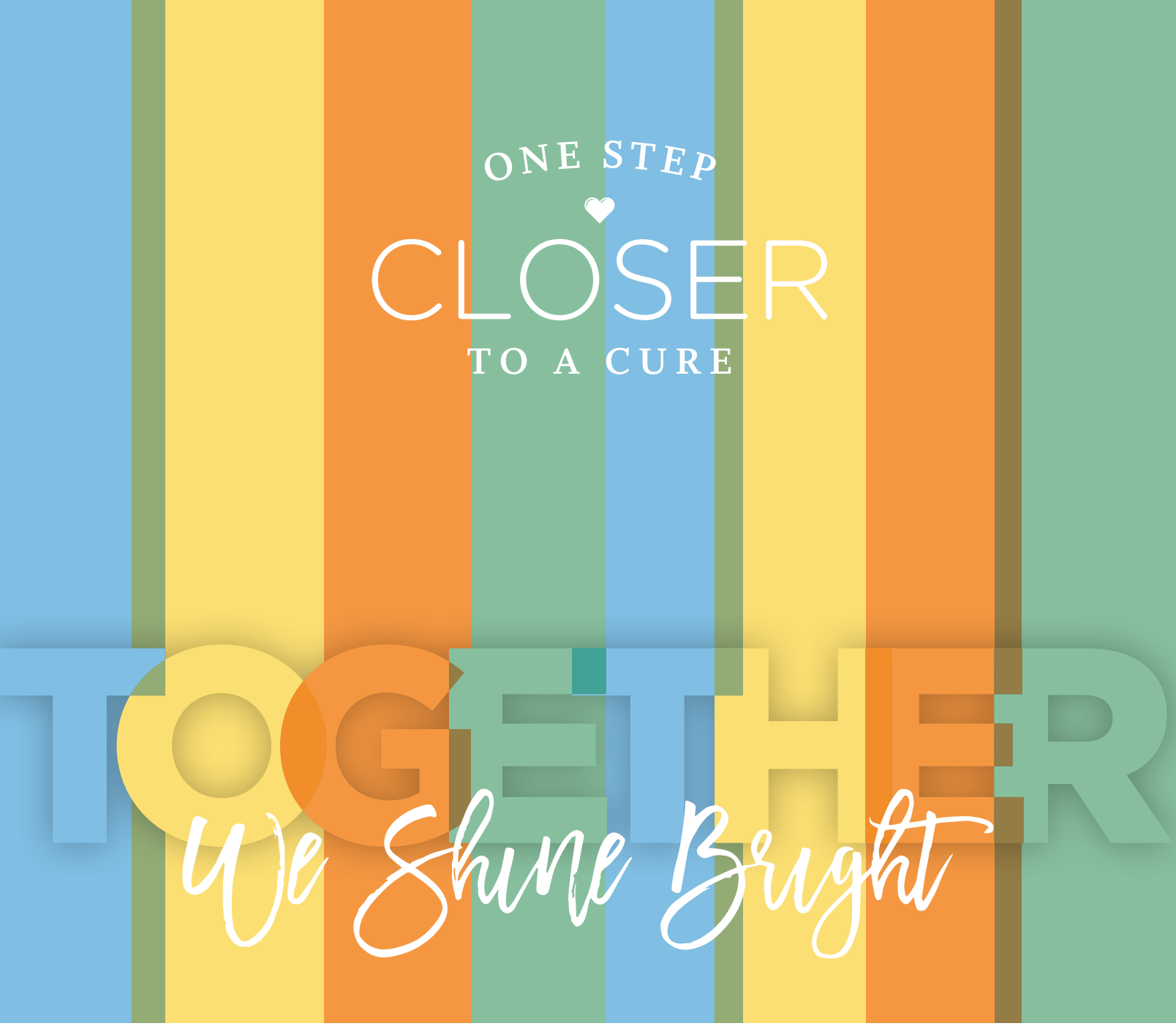
cystinosis magazine

WE ARE ONE STEP CLOSER TO A CURE

TOGETHER We Shine Bright

FOR FRIENDS AND SUPPORTERS OF THE CYSTINOSIS RESEARCH FOUNDATION

SPRING 2019



We are one step closer to a cure!

The Cystinosis Research Foundation is proud to announce FDA approval of the first stem cell and gene therapy clinical trial for cystinosis. We thank Stéphanie Cherqui, PhD, for her unwavering commitment to our children and for never giving up.

We have partnered together in our pursuit of a cure for cystinosis. Now our time has come; we will test this new therapy and will hope and pray that it is the cure. There is a palpable energy in the CRF community that drives research. We are a family and we shine bright together in our quest for a cure.

CONTACT US:
Please send suggestions and comments regarding *Cystinosis Magazine* to *nstack@cystinosisresearch.org.*

To receive our e-newsletter, *Star Facts*, send your email address to *zsolsby@cystinosisresearch.org.*

The entire cost of *Cystinosis Magazine* is underwritten by friends of the Cystinosis Research Foundation.

Art Direction and Printing: Idea Hall

SPRING 2019

cystinosis magazine

CYSTINOSISRESEARCH.ORG

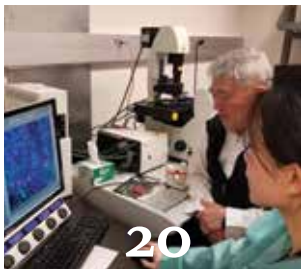
19200 Von Karmen Avenue
Suite 920
Irvine, California 92612

949 223 7610

The mission of the Cystinosis Research Foundation is to find better treatments and a cure for cystinosis by supporting bench, clinical and translational research. Since 2003, CRF has raised over $50 million for cystinosis research in an effort to find a cure.

cystinosis RESEARCH FOUNDATION | RESEARCH HOPE CURE

WELCOME



RESEARCH BREAKTHROUGHS

RESEARCH HIGHLIGHTS

ANNOUNCEMENTS

FAMILY STORIES

CYSTINOSIS MAGAZINE IS A PUBLICATION OF THE CYSTINOSIS RESEARCH FOUNDATION

SPRING 2019

Dear FAMILY AND FRIENDS

What a year it has been, and we are only half-way through! Ever since CRF was established in 2003, we have been focused on funding research that would result in better treatments and a cure for cystinosis. Jeff and I launched the foundation after our beloved Natalie made a wish for her twelfth birthday, "to have my disease go away forever." It is often hard to believe that it has been 16 years since that day, a day that changed our lives forever, but the years have flown by, and this year we reap the benefits of the research seeds we planted many years ago.

Although we started the foundation as just one family, we were quickly joined by all of you. Natalie's birthday wish became the rallying cry for so many of you. You have taught us the true meaning of community. Fate brought us together, but fate has been transcended by a deep level of love, support and friendship that unites us in a more powerful and everlasting way.

THE STEM CELL AND GENE THERAPY TRIAL WAS APPROVED BY THE FDA!

I will not forget the day that I received a call from Stéphanie Cherqui, PhD at UC San Diego. We knew that she had submitted the Investigational New Drug (IND) application to the FDA thirty days earlier seeking approval of a clinical trial to test a stem cell and gene therapy treatment for cystinosis. We were on pins and needles waiting for the FDA's reply. When she told me that the FDA had approved the treatment, I was speechless but then overcome with emotion. We had done it! We had persevered! As the weight of this historical and life-changing news set in, it became very real, very quickly, that our children, our loved ones with cystinosis, might be cured of this dreadful disease.

We are elated about the news. We began funding Dr. Cherqui in 2006 and have issued grants totaling over $4.3 million. Since that time, the seed money we provided has been leveraged by other funding agencies. Although there were challenges along the way – we stayed focused on our mission to find a cure. It was easy to stay focused because we had Dr. Stéphanie Cherqui, leading the charge!

Stéphanie has dedicated her career to the cystinosis community; there are no words to adequately thank her for the impact she has had on our community. She has given us the gift of hope and the promise that our children will outlive us. We thank all of you, our family and friends, who have never stopped believing that we could accomplish this historical and monumental feat.

The recruitment for the clinical trial is underway. We have received dozens of calls from adults with cystinosis who are interested in volunteering. The FDA approved Dr. Cherqui

and her consortium of experts to conduct a Phase I and II trial of genetically-modified autologous stem cell transplants in six adults with cystinosis. Hematopoietic stem cells are taken from the patient and genetically modified with a lentivirus vector to insert a correct copy of the cystinosin gene. These stem cells are then transplanted back into the patient. We hope that this one-time treatment will stop the progression of cystinosis and might even repair some of the damage already done. We expect results from the first patients by the end of this year.

NEED FOR FUNDING CONTINUES

Cystinosis affects all of the cells in the body which makes it a challenging disease to study. CRF has strategically focused research on the kidneys, eyes, muscles and bones, brain and thyroid which are the areas affected most severely by cystinosis. It is essential that we know more about the pathogenesis of cystinosis in order to unlock the mysteries of this disease. Even as we begin the stem cell and gene therapy clinical trial, we must keep funding current and future research. Until we know that the stem cell trial is a cure, we must remain vigilant.

SHINING A LIGHT ON IMPROVED THERAPIES, NEW TREATMENTS AND NEW IDEAS

CORNEAL CYSTINOSIS

Corneal cystinosis is the build-up of cystine crystals in the eyes that causes photophobia, severe eye pain, and sometimes, blindness. There is an existing eye drop treatment, but the drops must be taken every waking hour and are painful for many patients. CRF is funding two very important studies that could revolutionize eye treatment for cystinosis.

NanoWafer, Inc., a CRF-owned company, led by Ron Bache, CEO, is making excellent progress. Our team of qualified and experienced experts is currently working to finalize the nanowafer technology so that we can begin the required FDA pre-clinical testing. NanoWafer, Inc. is finalizing the formulation, manufacturing and testing methods, clinical attributes, and preparing for production scale up. Additionally, NanoWafer, Inc. is actively fundraising to allow the company to take the technology to the FDA for approval. The nanowafer can be loaded with medication, placed in the eye where it quickly dissolves but leaves medication in the eye for hours, maybe even for a day. This would be a superior treatment to the current hourly eye drops.

There has been tremendous progress, yet risks still remain. If successful, our plans call for us to start the FDA clinical trial in early 2020.

Eye Gel Drop - Morgan Fedorchak, PhD of University of Pittsburgh has another promising potential eye treatment in the works. CRF has been funding Dr. Fedorchak since 2016. Her aim has been to develop an eye drop with a controlled release formulation that provides a full day of cysteamine therapy in a single drop. Dr. Fedorchak and her team at Pitt have developed a thermosresponsive hydrogel that contains spray-dried, cysteamine-loaded microspheres. Her progress has been remarkable, already moving toward preclinical safety and efficacy studies. We are pleased to report that CRF has entered into an Option Agreement with the University of Pittsburgh to potentially acquire an exclusive license to the technology for use in developing a new FDA approved treatment for corneal cystinosis.

NEW TREATMENT IDEAS

Novel Drug Treatment - Francesco Emma, MD of Bambino Children's Hospital in Rome, Italy has screened over 1,200 compounds from a drug library and found two compounds which are safe and beneficial in cystinosis knockout mice. He is doing additional studies to determine whether they will be safe for humans. If successful, patients might be able to reduce their current medications. A clinical study is planned for later this year.

Muscle Wasting - Robert Mak, MD of UCSD is studying the relationship of cystinosis and inflammation and how this affects bone and muscle health. They have found two compounds, one of which is already an FDA-approved medication, that target inflammation and appear to

increase muscle mass and strength in cystinosis knockout mice. This could be a particularly exciting therapy for muscle wasting, a devastating late complication of cystinosis.

Bone and Muscle Treatment – Richard Reimer, MD of Stanford School of Medicine is building on the earlier work done by Dr. Mary Leonard and Dr. Paul Grimm who sought to better understand the issues of myopathy, a debilitating complication of cystinosis that causes limb weakness, swallowing difficulties and respiratory insufficiency. Dr. Richard Reimer is studying the effects of resistance exercise on bone and muscle dysfunction in cystinosis. He is currently recruiting patients for the clinical trial.

Novel Treatment - Nonsense Mutation. Paul Goodyer, MD, funded by CRF since 2010, is working with Eloxx Pharmaceuticals to bring a novel therapy to patients with the nonsense mutation in cystinosis. Eloxx has applied to the FDA for approval. Eloxx developed an injectable drug that promotes the synthesis of a functioning cystinosin protein, despite a mutation that would normally result in premature termination of protein synthesis. Clinical trials are anticipated to start this year.

FIFTEEN NEW GRANTS ISSUED IN FIVE COUNTRIES TOTALING $3,009,180

We are pleased to announce that in 2018 we issued 15 new grants totaling over $3.0 million for cystinosis research. The grants were awarded to researchers in the United States, Belgium, France, Italy and Switzerland. The five recipients of the Fall 2018 grants are listed on page 10 with a lay abstract of their studies starting on page 22.

Since 2003, CRF has funded 180 multi-year research studies in 12 countries. Our researchers have published 76 articles in prestigious journals as a result of CRF funding. CRF is the largest private fund provider of cystinosis research in the world.

We have built a strong, research-driven foundation that has accomplished major milestones, including two FDA approvals. We have many more life-changing possibilities and treatments on the horizon. You have been with us every step of the way, supporting us and encouraging us. We could not do this without you.

THE RIPPLE EFFECT OF CYSTINOSIS RESEARCH

The work we have funded on cystinosis has also resulted in new discoveries in other diseases and disorders. Dr. Cherqui's work has resulted in the successful treatment of two other disorders in the mouse models of Friedreich's Ataxia and Danon disease. Dr. Fedorchak's work could help others with inherited corneal dystrophies. There are so many more discoveries made by CRF researchers that have resulted from CRF funding, including other corneal diseases, kidney diseases and genetic and systemic diseases similar to cystinosis.

Your support of cystinosis research has had a ripple effect on other diseases and disorders. A cure for cystinosis will help find cures for other diseases, potentially helping millions of people. We are changing lives together; you are giving hope to thousands and possibly even millions who will benefit from our research discoveries.

WE ARE FOREVER GRATEFUL

We are incredibly grateful to all of you who have supported our efforts to find better treatments and a cure for cystinosis. With the FDA approval of the stem cell and gene therapy trial, a whole new world has opened up. As the first patients are treated, we will remain cautious and hopeful that the treatment will be the cure. We thank the first six patients who will undergo the treatment – they are pioneering a path for others in our community.

We have remained steady and focused and as a result, we are on the brink of a cure. The path to this moment has had many twists and turns; it has taken many years of hard work and dedication; but we have never given up hope that we would succeed. We have faced every obstacle together with you, our family and friends, our community of supporters. Your commitment has kept us going and renewed our determination.

We have so much to be grateful for: your unwavering support, your commitment to research and your compassion and love for our community. We have made extraordinary progress and with your continued support, generosity and love, we will cure cystinosis.

With heartfelt thanks and gratitude,

Nancy & Jeff

TOGETHER *We Shine Bright*

DEAR FAMILY AND FRIENDS,

Wow! 2018 has been a year full of promise, hope and happiness. I continue to live in Irvine and have welcomed a furry cat friend into my life named Henry. From starting a new job at CASA (Court Appointed Special Advocates), to finding out that the FDA approved the stem cell clinical trial for cystinosis- I feel incredibly blessed to be where I am today.

My new job as a case supervisor at CASA has truly been amazing. I finally found a job that connects me with my passion and desire to advocate for children in the foster care system. In my position, I support, recruit and retain volunteers who work with foster children as mentors and advocates. There is such a great need for these children to have stability in their lives, and I am honored to help provide that for them in some small way.

The recent FDA approval of the stem cell and gene therapy clinical trial for cystinosis has been surreal for me. It almost seems too good to be true. In some way it feels like only yesterday that I made my wish, "to have my disease go away forever." It is incredible to think how far we have come since then. We have been so fortunate to have Stéphanie Cherqui, PhD dedicated to our community and to finding a cure. I am thankful for her commitment to the research and for her tireless effort that has resulted in FDA approval.

Cystinosis is a horrible and terrifying disease. Nothing you say or do will make it go away. It is always there. But, being surrounded by an incredible community has given me the hope and faith that cystinosis will not be my forever. As a community, we lift each other up and help each other through the tough times. We are brave, we are resilient and we are hopeful. It is the determination, passion and love of this community that keeps me strong every day. Words cannot express how thankful I am to my parents, doctors, researchers and the entire cystinosis community for making my wish a reality.

Knowing that the cure is so close, I look forward to living the rest of my life and pursuing all of my dreams. I look forward to the day where I don't wake up feeling sick to my stomach or feel like the smell of my medicine is oozing out of my pores. I can't wait for the day where I don't have to worry about taking my medication in front of people at work or accidentally forgetting a dose. I look forward to the day when I can get home from work and not have to deal with my side effects from my medication or worry about extreme fatigue. I can't wait for the day when I don't have to worry that maybe this is the day I go blind. I can't wait for the day where I can just be me, Natalie, without cystinosis.

I take comfort knowing that cystinosis will never prevent me from reaching milestones that I thought I might not reach because of cystinosis – like excelling in a career, growing old with a partner and starting a family.

I know that I will live longer now, and because of that, I am extremely grateful for what Dr. Cherqui, my mom and the rest of this community has done for not only me, but for all the other patients with cystinosis. I am truly blessed to know each and every one of you and hope that one day soon we will be free of cystinosis. Thank you for never giving up on making my wish come true.

Natalie

WHAT IS CYSTINOSIS?

Cystinosis is a rare, inherited, metabolic disease that is characterized by the abnormal accumulation of the amino acid cystine in every cell in the body. Build-up of cystine in the cells eventually destroys all major organs of the body including the kidneys, liver, eyes, muscles, bone marrow, thyroid and brain.

Medication is available to control some of the symptoms of this terrible disease, but cystinosis remains incurable. Cystinosis affects approximately 500 people, mostly children, in North America, and about 2,000 worldwide.

It is one of the 7,000 rare or "orphan" diseases in the United States that collectively impacts approximately 30 million Americans.

Federal funding for research on cystinosis and other rare diseases is virtually non-existent and most pharmaceutical companies remain uninterested because financial rewards are too small. Yet, while there are only a small number of patients who suffer from any given "orphan" disease, **knowledge gained by studying one disease often leads to advancements in other rare diseases and more prevalent and well-known disorders.**

OUR STORY

In 2003, Natalie Stack made a wish on the eve of her 12th birthday, "to have my disease go away forever." That same year, the Cystinosis Research Foundation was established with the sole purpose of raising funds to find better treatments and a cure for cystinosis.

TODAY, CRF IS THE LARGEST FUND PROVIDER OF GRANTS FOR CYSTINOSIS RESEARCH IN THE WORLD, ISSUING 180 GRANTS IN 12 COUNTRIES.

CRF has raised over $50 million with 100% of your donations going to support cystinosis research. CRF's efforts have changed the course of cystinosis and given new energy to its investigators and scientists. CRF's commitment to research has given hope and promise to the global community of cystinosis patients and their families.

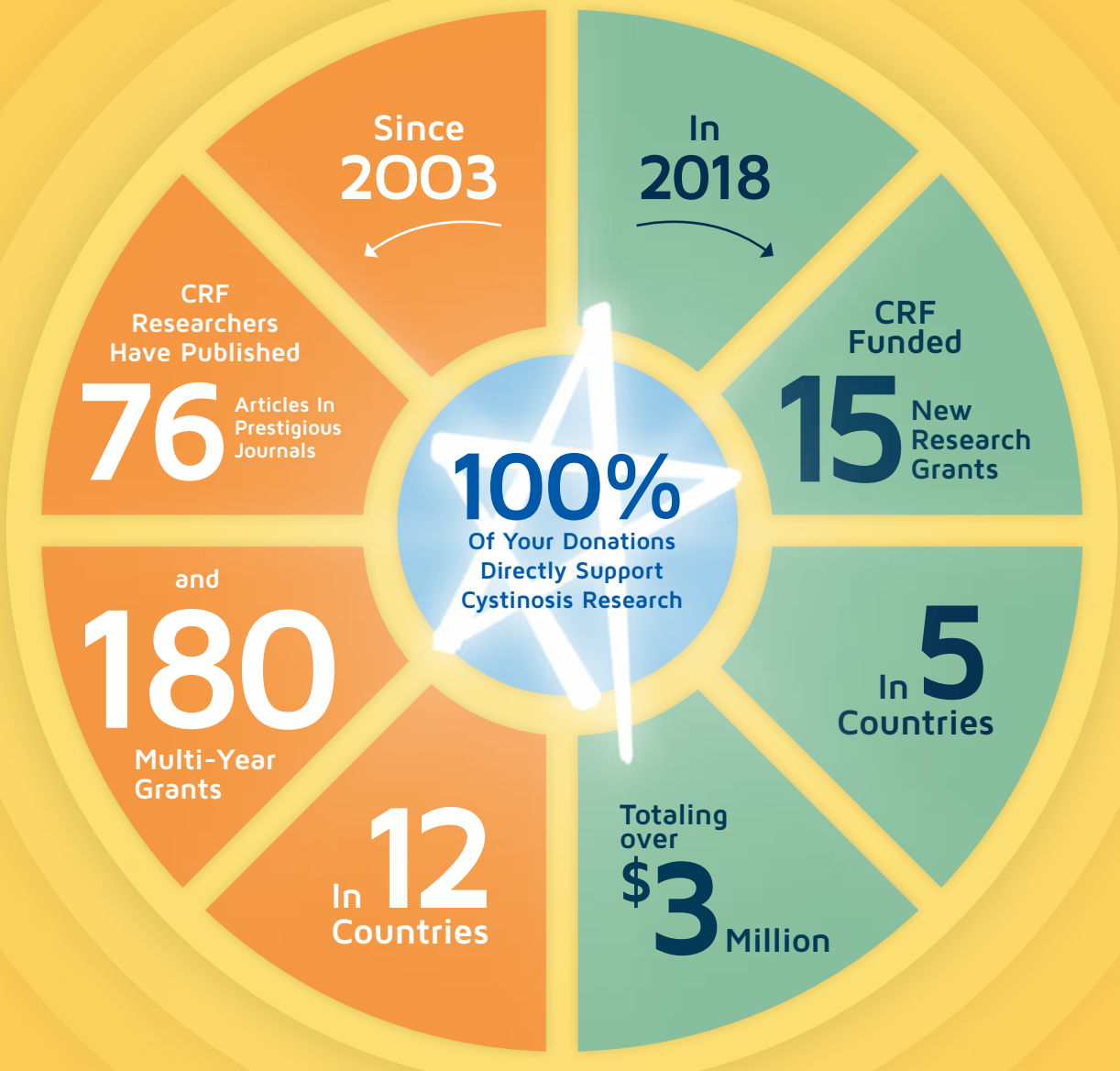
cystinosis RESEARCH FOUNDATION | RESEARCH HOPE CURE

CHARITY NAVIGATOR ★★★★ Four Star Charity

THANK YOU! TOGETHER,

WE HAVE CHANGED THE COURSE OF CYSTINOSIS.

We celebrate our CRF community and are grateful every day for our families, friends and donors who have remained steadfast in their commitment to finding better treatments and a cure. Thank you to the cystinosis researchers and scientists who are working around the clock on behalf of our children and adults with cystinosis.



We navigate by the light of a guiding star and have set our course closer to the cure with more new clinical trials than ever before. It is because of you that CRF has been able to fund extraordinary researchers across the globe.

THE IMPACT OF CRF RESEARCH

Stem Cells and Gene Therapy: Bone Marrow Stem Cells, Induced Pluripotent Stem Cells, Gene Therapy and Gene Editing

30 GRANTS

Stéphanie Cherqui, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Alan Davidson, PhD
THE UNIVERSITY OF AUCKLAND, GRAFTON, AUCKLAND, NEW ZEALAND

Paul Goodyer, MD
MONTRÉAL CHILDREN'S HOSPITAL, QUÉBEC, CANADA

Patrick Harrison, PhD
UNIVERSITY COLLEGE CORK, CORK, IRELAND

Vasiliki Kalatzis, PhD
INSTITUTE GÉNÉTIQUE MOLÉCULAIRE MONTPELLIER, MONTPELLIER, FRANCE

Winston Kao, PhD
Hassane Amlal, PhD
NEW
UNIVERSITY OF CINCINNATI, CINCINNATI, OHIO

Daniel Salomon, MD
THE SCRIPPS RESEARCH INSTITUTE, LA JOLLA, CALIFORNIA

Holger Willenbring, MD
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO, SAN FRANCISCO, CALIFORNIA

Molecular Study of Cystinosis in the Yeast Model

3 GRANTS

Bruno André, PhD
UNIVERSITÉ LIBRE DE BRUXELLES, GOSSELIES, BELGIUM

Anand Bachhawat, PhD
IISER MOHALI, MANAULI, PUNJAB, INDIA

David Pearce, PhD
UNIVERSITY OF ROCHESTER MEDICAL CENTER, ROCHESTER, NEW YORK

Skin, Muscle and Bone

11 GRANTS

Justine Bacchetta, MD, PhD
Irma Machuca-Gayet, PhD
HOSPICES CIVILS DE LYON
UNIVERSITÉ DE LYON, LYON, FRANCE

Robert Ballotti, PhD
Christine Chiaverini, MD, PhD
FACULTÉ DE MÉDECINE, NICE, FRANCE

Paul Grimm, MD
STANFORD UNIVERSITY SCHOOL OF MEDICINE, PALO ALTO, CALIFORNIA

Mary Leonard, MD, MSCE
STANFORD UNIVERSITY, PALO ALTO, CALIFORNIA

Robert Mak, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Richard Reimer, MD
Jacinda Sampson, MD, PhD
Mary Leonard, MD, MSCE
Paul Grimm, MD
Trinh Tina Duong, MPT
Feliks Kogan, PhD
STANFORD UNIVERSITY, PALO ALTO, CALIFORNIA

Genetic Analysis of Cystinosis

5 GRANTS

Katy Freed, PhD
TEXAS BIOMEDICAL RESEARCH INSTITUTE, SAN ANTONIO, TEXAS

Sihoun Hahn, MD, PhD
SEATTLE CHILDREN'S HOSPITAL, SEATTLE, WASHINGTON

Elena Levtchenko, MD, PhD
UNIVERSITY HOSPITAL, LEUVEN, BELGIUM

Eric Moses, PhD
TEXAS BIOMEDICAL RESEARCH INSTITUTE, SAN ANTONIO, TEXAS

Minnie Sarwal, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO, SAN FRANCISCO, CALIFORNIA

New Drug Discovery Cysteamine, New Medications and Devices

25 GRANTS

Ghanashyam Acharya, PhD
BAYLOR COLLEGE OF MEDICINE, HOUSTON, TEXAS

Pierre Courtoy, MD, PhD
DE DUVE INSTITUTE, UNIVERSITÉ CATHOLIQUE DE LOUVAIN, BRUSSELS, BELGIUM

Antonella De Matteis, MD
TELETHON INSTITUTE OF GENETICS AND MEDICINE, NAPLES, ITALY

Ranjan Dohil, MD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Francesco Emma, MD
Laura Rega, PhD
BAMBINO GESÙ CHILDREN'S HOSPITAL, ROME, ITALY

Paul Goodyer, MD
MONTRÉAL CHILDREN'S HOSPITAL, QUÉBEC, CANADA

Vincent Stanton, Jr., MD
Patrice Rioux, MD, PhD
THIOGENESIS THERAPEUTICS, INC., SAN DIEGO, CALIFORNIA

Eye-Corneal Cystinosis Research

9 GRANTS

Ghanashyam Acharya, PhD
BAYLOR COLLEGE OF MEDICINE, HOUSTON, TEXAS

Stéphanie Cherqui, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Morgan Fedorchak, PhD
Kanwal Nischal, MD, FRCO
UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE, PITTSBURGH, PENNSYLVANIA

Jennifer Simpson, MD
UNIVERSITY OF CALIFORNIA, IRVINE, IRVINE, CALIFORNIA

Kang Zhang, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Thyroid

1 GRANT

Pierre Courtoy, MD, PhD
DE DUVE INSTITUTE, UNIVERSITÉ CATHOLIQUE DE LOUVAIN, BRUSSELS, BELGIUM

Neurological

15 GRANTS

Angela Ballantyne, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Miriam Britt Sach, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Rita Ceponiene, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Florian Eichler, MD
MASSACHUSETTS GENERAL HOSPITAL, BOSTON, MASSACHUSETTS

Aude Servais, MD, PhD
NECKER HOSPITAL, PARIS, FRANCE

Amy Spilkin, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Doris Trauner, MD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Rat Model for Cystinosis

1 GRANT

Francesco Emma, MD
BAMBINO GESÙ CHILDREN'S HOSPITAL, ROME, ITALY

Olivier Devuyst, MD, PhD
UNIVERSITY OF ZÜRICH, ZÜRICH, SWITZERLAND

Lab Equipment for Cystinosis

3 GRANTS

Ghanashyam Acharya, PhD
BAYLOR COLLEGE OF MEDICINE, HOUSTON, TEXAS

Stéphanie Cherqui, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Sergio Catz, PhD
THE SCRIPPS RESEARCH INSTITUTE, LA JOLLA, CALIFORNIA

Cure Cystinosis International Registry (CCIR)

1 GRANT

Ranjan Dohil, MD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Kidney Research

20 GRANTS

Robert Chevalier, MD
UNIVERSITY OF VIRGINIA, CHARLOTTESVILLE, VIRGINIA

Pierre Courtoy, MD, PhD
Christopher Pierreux, PhD
DE DUVE INSTITUTE, UNIVERSITÉ CATHOLIQUE DE LOUVAIN, BRUSSELS, BELGIUM

Olivier Devuyst, MD, PhD
UNIVERSITY OF ZÜRICH, INSTITUTE OF PHYSIOLOGY, ZÜRICH, SWITZERLAND

Allison Eddy, MD
BC CHILDREN'S HOSPITAL, VANCOUVER, BRITISH COLUMBIA, CANADA

Benjamin Freedman, PhD NEW
UNIVERSITY OF WASHINGTON, SEATTLE, WASHINGTON

Elena Levtchenko, MD, PhD
UNIVERSITY HOSPITAL, LEUVEN, BELGIUM

Robert Mak, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Tara McMorrow, MD
UNIVERSITY COLLEGE DUBLIN, BELFIELD, DUBLIN, IRELAND

Philip Newsholme, PhD
CURTIN UNIVERSITY, PERTH, WESTERN AUSTRALIA

Daryl Okamura, MD
SEATTLE CHILDREN'S RESEARCH INSTITUTE, SEATTLE, WASHINGTON

Mary Taub, PhD
UNIVERSITY AT BUFFALO, THE STATE UNIVERSITY OF NEW YORK, BUFFALO, NEW YORK

Cystine Measurement and Cysteamine Toxicity Study

9 GRANTS

Bruce Barshop, MD, PhD
UNIVERSITY OF CALIFORNIA, SAN DIEGO, LA JOLLA, CALIFORNIA

Thomas Jeitner, PhD
NEW YORK MEDICAL COLLEGE, VALHALLA, NEW YORK

Elena Levtchenko, MD, PhD
UNIVERSITY HOSPITAL, LEUVEN, BELGIUM

Cellular and/or Molecular Studies of the Pathogenesis of Cystinosis

48 GRANTS

Corinne Antignac, MD, PhD NEW
IMAGINE INSTITUTE (INSERM U1163), PARIS, FRANCE

Francesco Bellomo, PhD
BAMBINO GESÙ CHILDREN'S HOSPITAL, ROME, ITALY

Sergio Catz, PhD
THE SCRIPPS RESEARCH INSTITUTE, LA JOLLA, CALIFORNIA

Antonella De Matteis, MD
TELETHON INSTITUTE OF GENETICS AND MEDICINE, NAPLES, ITALY

Olivier Devuyst, MD, PhD NEW
Zhiyog Chen, PhD
UNIVERSITY OF ZÜRICH, ZÜRICH, SWITZERLAND

Liang Feng, PhD
STANFORD UNIVERSITY, PALO ALTO, CALIFORNIA

Bruno Gasnier, PhD
Rossella Conti, PhD
PARIS DESCARTES UNIVERSITY, PARIS, FRANCE

Taosheng Huang, MD, PhD
UNIVERSITY OF CALIFORNIA, IRVINE, IRVINE, CALIFORNIA

Elena Levtchenko, MD, PhD
UNIVERSITY HOSPITAL, LEUVEN, BELGIUM

Ming Li, PhD NEW
Jacob Kitzman, PhD
UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

Alessandro Luciani, PhD
UNIVERSITY OF ZÜRICH, ZÜRICH, SWITZERLAND

Gennaro Napolitano, PhD
THE SCRIPPS RESEARCH INSTITUTE, LA JOLLA, CALIFORNIA

Norbert Perrimon, PhD
HARVARD MEDICAL SCHOOL, BOSTON, MASSACHUSETTS

Giusi Prencipe, PhD
BAMBINO GESÙ CHILDREN'S HOSPITAL, ROME, ITALY

Matias Simons, MD
IMAGINE INSTITUTE, PARIS, FRANCE

Jess Thoene, MD
TULANE UNIVERSITY SCHOOL OF MEDICINE, NEW ORLEANS, LOUISIANA

2018 CRF RESEARCH GRANTS FUNDED

* *5 New Grants in Fall 2018*

Characterization of mTORC1 Signaling in Early Pathogenesis of Cystinosis

* $336,400.00

TWO-YEAR GRANT

(February 1, 2019 – January 31, 2021)

Corinne Antignac, MD, PhD, Principal Investigator
IMAGINE Institute, Paris, France

Cysteamine Toxicity on Bone: The CYSTEA-BONE Project

$126,000.00

TWO-YEAR GRANT

(November 1, 2018 – October 31, 2020)

Justine Bacchetta, MD, PhD, Principal Investigator
Irma Machuca-Gayet, PhD, Co-Principal Investigator
Hospices Civils de Lyon et Université de Lyon, France

EnVision XCite Plate Reader Equipment

$62,233.18

EQUIPMENT GRANT

Sergio Catz, PhD
The Scripps Research Institute, La Jolla, California

Novel Mechanistic and Translational Studies of Neutrophil-Mediated Inflammation in Cystinosis

$150,000.00

TWO-YEAR GRANT

(September 1, 2018 – August 31, 2020)

Sergio Catz, PhD, Research Mentor
Raquel Carvalho Gontijo, PhD, Research Fellow
The Scripps Research Institute, La Jolla, California

Evaluation of Ctns-/- Mice Protection by Oral Supplementation with Basic Amino-Acids: Focus on Kidneys – Extension to Another Colony

$165,045.00

TWO-YEAR GRANT

(September 1, 2018 – August 31, 2020)

Pierre Courtoy, MD, PhD, Principal Investigator
Christophe Pierreux, PhD, Co-Principal Investigator
De Duve Institute AISBL, Brussels, Belgium

Pathogenesis of Cystinosis: Studies Using Transgenic Zebrafish Models

* $225,000.00

THREE-YEAR GRANT

(February 1, 2019 – January 31, 2022)

Olivier Devuyst, MD, PhD, Research Mentor
Zhiyog Chen, PhD, Research Fellow
University of Zürich, Zürich, Switzerland

Development and Characterization of a Rat Model of Cystinosis

$133,430.00

ONE-YEAR GRANT

(September 1, 2018 – August 31, 2019)

Francesco Emma, MD, Principal Investigator
Olivier Devuyst, MD, PhD Co-Principal Investigator
Bambino Gesù Children's Hospital, IRCCS, Rome, Italy
University of Zürich, Zürich, Switzerland

Molecular Mechanism of Cystinosis

$150,000.00

TWO-YEAR GRANT

(September 1, 2018 – August 31, 2020)

Liang Feng, PhD, Research Mentor
Xue Guo, PhD, Research Fellow
Stanford University, Palo Alto, California

Total 2018 Grants Awarded: **$3,009,180**

Developing a Therapeutic Strategy for Cystinotic Nephropathy with iPS Cells

$392,316.00

TWO-YEAR GRANT

(February 1, 2019 – January 31, 2021)

Benjamin "Beno" Freedman, PhD, Principal Investigator
University of Washington, Seattle, Washington

Cell Therapy and Gene Editing for Cystinosis

$179,834.00

ONE-YEAR GRANT

(February 1, 2019 – January 31, 2020)

Winston Kao, PhD, Principal Investigator
Hassane Amlal, PhD, Co-Principal Investigator
University of Cincinnati, Cincinnati, Ohio

Dissect the Protein Turnover Mechanism of Cystinosis Mutants

$285,648.00

TWO-YEAR GRANT

(February 1, 2019 – January 31, 2021)

Ming Li, PhD, Principal Investigator
Jacob Kitzman, PhD, Co-Principal Investigator
University of Michigan, Ann Arbor, Michigan

Evaluation of Ctns -/- Mice Kidney Protection by Oral Supplementation with Basic Amino-Acids: Extension to Another Colony with Sequential Analysis of Fanconi Syndrome and Renal Insufficiency

$133,083.00

TWO-YEAR GRANT

(September 1, 2018 – August 31, 2020)

Robert Mak, MD, PhD, Principal Investigator
University of California, San Diego, La Jolla, California

Impact of Leptin Signaling on Skeletal Integrity and Growth in Infantile Neuropathic Cystinosis

$206,466.00

ONE-YEAR GRANT

(September 1, 2018 – August 31, 2019)

Robert Mak, MD, PhD, Principal Investigator
University of California, San Diego, La Jolla, California

The Effect of Resistance Exercise on Muscle Dysfunction in Cystinosis

$159,680.00

ONE-YEAR GRANT

(September 1, 2018 – August 31, 2019)

Richard Reimer, MD, Principal Investigator
Jacinda Sampson, MD, PhD, Co-Principal Investigator
Mary Leonard, MD, MSCE, Co-Principal Investigator
Paul Grimm, MD, Co-Principal Investigator
Trinh Tina Duong, MPT, PhD Candidate, Co-Principal Investigator
Feliks Kogan, PhD, Co-Principal Investigator
Stanford University, Palo Alto, California

Pharmacokinetic Evaluation and Optimization of Cysteamine Precursors

$153,900.00

ONE-YEAR GRANT

(March 1, 2018 – February 28, 2019)

Vincent Stanton, Jr, MD, Principal Investigator
Patrice Rioux, MD, PhD, Co-Principal Investigator
Thiogenesis Therapeutics, Inc., Belmont, Massachusetts and San Diego, California

RESEARCH GRANT EXTENSION – YEAR 2

Development of a Topical, Controlled Release Cysteamine Eye Drop

$150,145.00

ONE-YEAR GRANT

(October 19, 2018 – October 18, 2019)

Morgan Fedorchak, PhD, Principal Investigator
Kanwal Nischal, MD, FRCO, Co-Principal Investigator
University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

SEE
LAY ABSTRACTS
STARTING ON PAGE 22

RECENTLY
PUBLISHED STUDIES

CRF FUNDED RESEARCHERS have been instrumental in advancing the field of cystinosis through the publication of articles in prestigious journals. Published articles enable other scientists, pharmaceutical companies and the cystinosis community to learn more about the pathogenesis of cystinosis, to explore ideas for novel treatments and to prepare for clinical trials. We congratulate all of the published CRF funded researchers who have dedicated their careers to the children and adults with cystinosis.

1

Intrinsic Bone Defects in Cystinotic Mice

The American Journal of PATHOLOGY

published January 2019
The American Journal of Pathology

by Anna Taranta, PhD,
Department of Nephrology and Urology, Division of Nephrology, Bambino Gesù Children's Hospital, Rome, Italy

2

Chaperone-Mediated Autophagy Upregulation Rescues Megalin Expression and Localization in Cystinotic Proximal Tubule Cells

published February 2019
Frontiers in Endocrinology

frontiers in Endocrinology

by Sergio Catz, PhD,
The Scripps Research Institute, La Jolla, California

3

The Aminoglycoside Geneticin Permits Translational Readthrough of the CTNS W138X Nonsense Mutation in Fibroblasts from Patients with Nephropathic Cystinosis

published in February 2019
Pediatric Nephrology

by Paul Goodyer, MD,
The Research Institute of the McGill University, Montreal, Canada

4

Interaction Between Galectin-3 and Cystinosin Uncovers a Pathogenic Role of Inflammation in Kidney Involvement of Cystinosis

published April 2019
Kidney International

by Stéphanie Cherqui, PhD,
University of California, San Diego, in collaboration with **Corinne Antignac, MD, PhD,** Imagine Institute, Paris, France, **Sergio Catz, PhD,** The Scripps Research Institute, La Jolla, California, **Robert Mak, MD, PhD,** University of California, San Diego and **Tatiana Lobry,** University of California, San Diego

CYSTINOSIS RESEARCH FOUNDATION

SCIENTIFIC REVIEW BOARD

LEADERSHIP.
GUIDANCE.
COMMITMENT.

The Scientific Review Board (SRB) is composed of leading cystinosis scientists and experts from around the world. Members are actively involved in the grant-review process, evaluating and analyzing all research proposals that are submitted for potential funding, and advising the CRF on the scientific merit of each proposal.

CHAIR

Corinne Antignac, MD, PhD
Professor
Laboratory of Hereditary Kidney Diseases, Imagine Institute (Inserm U1163)
PARIS, FRANCE

BOARD MEMBERS

Sergio D. Catz, PhD
Professor
Molecular and Experimental Medicine
The Scripps Research Institute
LA JOLLA, CALIFORNIA

Stéphanie Cherqui, PhD
Assistant Professor
Department of Pediatrics
Division of Genetics
University of California, San Diego
SAN DIEGO, CALIFORNIA

Francesco Emma, MD
Head of Pediatric Nephrology
Director of Nephrology Laboratory
Bambino Gesù Children's Hospital
ROME, ITALY

Paul C. Grimm, MD
Professor of Pediatrics
Stanford University School of Medicine
Pediatric Nephrology
PALO ALTO, CALIFORNIA

Julie R. Ingelfinger, MD
Deputy Editor of the
New England Journal of Medicine
Professor of Pediatrics
Harvard Medical School
BOSTON, MASSACHUSETTS

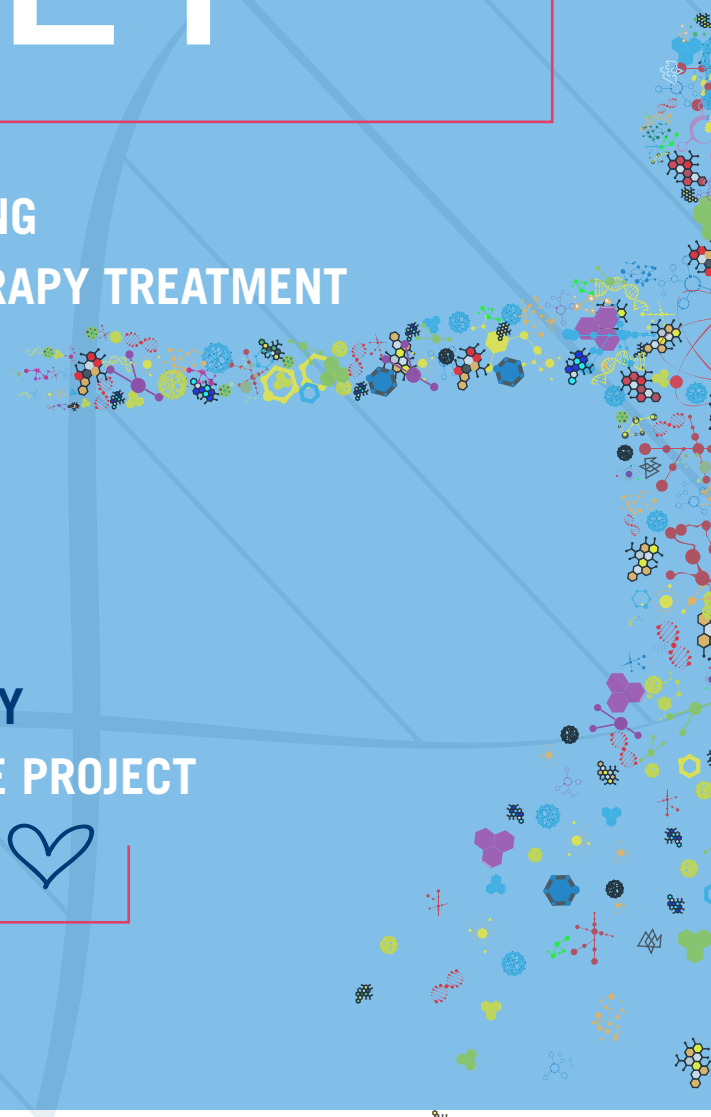
Stephen L. Jenkins, MD
Assistant Professor, Hospitalist
Department of Internal Medicine
University of Utah Hospital
SALT LAKE CITY, UTAH

Martin Konrad, MD
Department of General Pediatrics
University Children's Hospital
MUENSTER, GERMANY

Thank you for your dedication to the global cystinosis community.

THE POWER OF THE JOURNEY

AS HER GROUNDBREAKING STEM CELL AND GENE THERAPY TREATMENT TRANSITIONS TO HUMAN TESTING, DR. STÉPHANIE CHERQUI REFLECTS ON THE SENSE OF COMMUNITY LIFTING HER AND THE PROJECT TO NEW HEIGHTS!



BY DENNIS ARP

Optimism has always propelled the work of genetic researcher Stéphanie Cherqui. Now her commitment is more powerful than ever as she enters an exciting new period in her longtime pursuit of gene therapy that may serve as a cure for cystinosis.

"If successful in humans, this would represent a one-time treatment that would last for the life of the patient and prevent tissue damage," says the associate professor of pediatrics at the University of California, San Diego.

Likewise, motivation has never been a problem for Dr. Cherqui.

"I don't have to push myself," she says. "Research can be a long and difficult journey. Many times you may think, 'This is too difficult – there are so many mountains to climb.' You may reach a peak, and you have a moment when you think you have made it. But you quickly realize, 'Oh, there's another mountain up ahead.'"

After more than a decade of peaks and valleys, Dr. Cherqui is now tantalizingly close to the mountaintop. She and her research team have approval from the Food and Drug Administration to launch a Phase I / II clinical trial of their therapy using bone marrow stem cells. It's a huge achievement that deserves to be celebrated.

"Still, I don't want to overpromise," says Cherqui, PhD. "The data from the mouse model are very good, but we never know what can happen in humans. We have to be very careful. We have great hope, but there is still a long journey in front of us."

Shifting metaphors, Dr. Cherqui notes that she has the perspective of a marathoner, not a sprinter.

"It's like we're in the starting blocks, and the starter's gun is going off, but we still have a long run to make," Dr. Cherqui says. "This is a very complicated clinical process involving a very large team of professionals. We have to show safety and efficacy, establish the engineering and put a lot of procedures in place."

At this milestone moment in the history of Dr. Cherqui's groundbreaking research project, it's particularly appropriate that she take the long view. How could she consider the powerful possibilities on the horizon without reflecting on the journey that led to this moment? How could she build a clinical-trial team of 14, including 12 physicians, without thinking about the earliest days of her work, when the vision was singular? How could she appreciate the grants totaling more than $12 million from the National Institutes of Health (NIH) and the California Institute for Regenerative Medicine (CIRM) without expressing special gratitude for the seminal support she has received from the Cystinosis Research Foundation (CRF)?

"No one really believed in this approach, and then in 2006 the CRF gave me my first grant ever," Dr. Cherqui says. "Getting that grant was the first big moment of this journey. It was an amazing moment – that the CRF would trust in me enough to do this project. That support is what made future funding possible."

Dr. Cherqui isn't the only one engaging in a moment of reflection as the stem cell therapy moves into a new phase of research. Pediatric nephrologist Julie Ingelfinger has been treating cystinosis patients for more than 45 years, dating back to her fellowship, when her first cystinosis patient was a 9-year-old boy who had severe renal rickets and failing kidneys.

"He wasn't alive by the end of my fellowship," says Ingelfinger, MD, professor of pediatrics at Harvard Medical School and deputy editor of the New England Journal of Medicine. "That was the reality before cysteamine provided the chance to get cystine out of cells. That was revolutionary."

Over the past four decades, Dr. Ingelfinger has seen many advances, including tools of molecular and cellular biology, clinical transplantation, and drops for removing painful crystals from patients' eyes.

"These tools improved countless lives, but none of them is a cure," she says. "Stéphanie's project may provide a cure or, if not, then another level of protection from abnormally stored cystine. That would change the trajectory and prolong life. My hope, and that of patients and families, is that this will be a magic bullet. We just don't know yet."

Such are the mysteries – and the possibilities – of a life dedicated to scientific research. From the time she was a teenager, Dr. Cherqui knew it was a life she wanted to pursue. At 16, she first encountered the powerful potential of genetics.

DR. CHERQUI CONTINUES TO DRAW INSPIRATION FROM THE CYSTINOSIS COMMUNITY, TO WHICH SHE FEELS EXTREMELY CONNECTED.

"I knew I wanted to be a researcher exploring gene therapy," she says of her youth in France. "So, I'm doing exactly what I wanted to do. I was lucky enough to be able to work with Dr. Antignac, who taught me so much."

In the French lab of renowned investigator Corinne Antignac, MD, PhD, Dr. Cherqui enjoyed her earliest breakthrough moments, including in 1998, when she worked with colleagues to search out the mutation that was traceable to the cystinosis gene.

One day during lab work, a gene sequence appeared on the computer screen in colors and with peaks that distinguished it from others. There was lots of excitement, Dr. Cherqui recalls. More testing confirmed that the team had discovered the cystinosis gene.

As special as the feeling was that day, it couldn't match one that came nine years later. That's when Dr. Cherqui took a kidney sample from a mouse and viewed it under the microscope. She saw a whole lot of green cells in this tissue. The mouse had been transplanted with green bone marrow stem cells, and the abundance of green meant that the cells had migrated from the bone marrow to the affected kidney.

"There were so many green cells that I first thought this was unspecific background, and then I realized this was real fluorescent green cells," Dr. Cherqui recalls. "I thought, 'Is that possible?' That's the first time I realized something important was happening. It showed that the stem cells were becoming integrated in the kidney. That was a special moment – a moment of joy. It was a moment that will change your life."

Dr. Cherqui's research project has evolved greatly over the years. But through it all there remains her original supposition – that because cystinosis affects every organ of the body, the best approach is to seek out and replace the genetic mutation wherever it exists.

"The gene is expressed in every bit of tissue, so we have to deliver the functional gene everywhere. The idea is that the best way to do that is with blood stem cells that can naturally migrate in all tissues," Dr. Cherqui says.

As the project transitions from the mouse model to human testing, Dr. Cherqui and her team are eager to prove that blood stem cells from cystinosis patients can be genetically modified to carry healing power. Once the cystinosis mutation is removed and the stem cells transplanted, the hope is that the cells can foster a blood system that is disease-free.

Dr. Ingelfinger cautions that even if human testing confirms that the therapy is effective, older patients may already have suffered cellular damage, and that damage may not be reversible.

"So ultimately, the earlier the therapy can begin, the better chance it has for success," she says.

As Dr. Ingelfinger takes stock of Dr. Cherqui's research progress and puts it in perspective, she also is quick to credit the contributions of cystinosis patients and their families.

"Without them, the studies embarked upon now wouldn't have happened," she says.

Dr. Cherqui agrees, saying that she continues to draw inspiration from the cystinosis community, to which she feels "extremely connected."

"There's nothing worse than seeing a loved one in pain and distress," she adds. "As a mother, I can't imagine what the families go through. When I see the strength these families have, it's an inspiration every day."

These days, Dr. Cherqui is uplifted by the promise of her research moving within arm's reach of success. The climb continues – tempered by setbacks and success, but ultimately powered by an unshakable commitment to see it through to the end.

"I'm very happy I started this journey with cystinosis," she says. "My best reward is seeing patients get the chance to carry their best lives into the future."

Rady Children's Hospital and UCSD Physician of Excellence Award

We are very proud to announce Stéphanie Cherqui, PhD, has received this year's Rady Children's Hospital and UCSD Physician of Excellence Award for her Basic Science Research. This prestigious award recognizes UCSD faculty members who have done outstanding work in their respective areas.

Congratulations, Dr. Cherqui!

A GROWING OPPORTUNITY

Dr. Benjamin "Beno" Freedman's groundbreaking project explores the regenerative possibilities of mini-kidney organoids.

BY DENNIS ARP

Sometimes breakthrough ideas incubate in unexpected places – witness the fish tank Benjamin Freedman, PhD, maintained in his home as a teenager in Chicago.

Dr. Freedman had long enjoyed tracking the life cycles of aquatic creatures, including crayfish, which he kept in the aquarium. One time as a crayfish was molting, it lost a claw, which it eventually grew back, although much smaller than the original. Freedman noticed that with each new molt, the claw got bigger and bigger.

"I was fascinated watching this regeneration happen," recalls Dr. Freedman, now an Assistant Professor in the Division of Nephrology, Department of Medicine at the University of Washington. "I started thinking, 'If a crayfish can do it, do mammals have the same potential?'"

From those early observations a research specialty was born. These days, Dr. Freedman focuses on regenerative therapies for kidney disease, an all-too-common outcome for cystinosis patients. His cutting-edge investigations hold the promise of new treatments for cystinosis.

"We are thrilled to have someone of his caliber in our corner," says Nancy Stack, president of the Cystinosis Research Foundation (CRF).

A grant from the CRF is funding Dr. Freedman's project to use human mini-kidneys as surrogates for patients, allowing the researcher and his team to explore the potential of kidney regeneration, gene therapy and drug discovery to remedy the destructive effects of cystinosis on the kidneys.

"Cystinosis has always been on my radar, but after I went to the CRF research conference last year, I became even more aware of the necessity of this research," said Dr. Freedman, a member of both the Kidney Research Institute and the Institute for Stem Cell and Regenerative Medicine. "Meeting the families as well as other cystinosis researchers really got my gears going."

Dr. Freedman caught the attention of the CRF after his groundbreaking work with organoids in studying kidney structure and disease helped earn him the 2018 STEM CELLS Young Investigator Award. His lab in Seattle combines induced pluripotent stem cells and CRISPR gene editing to grow mini-kidney organoids using a person's own cells.

In one part of the research project the CRF is funding, Dr. Freedman and his team will recruit patients with cystinosis so they can turn the patients' urine into stem cells and kidney grafts. The team will test these cells and grafts

Dr. Freedman with his wife, Hongxia and son, Bruce.

for transplantability, with the hope of restoring kidney function without the need for anti-rejection medications, which carry their own special risks.

"Since we can grow mini-kidney organoids from a person's own cells, maybe it's possible to grow structures similar to that inside a person's own body," Dr. Freedman says. "We're not ready to do that in people, but we will be using other types of preclinical models to explore transplantation."

In a second part of the project, the research team will develop a gene therapy approach in hopes that it will restore patients' ability to process cystine and keep it from accumulating in the body.

"The rub here is that we need good ways to put the gene back into the tissues," Dr. Freedman says. "We want to practice this gene therapy on the mini-kidney organoids."

> **MEETING THE FAMILIES AS WELL AS OTHER CYSTINOSIS RESEARCHERS REALLY GOT MY GEARS GOING.**

The researchers will use a technique called CRISPR, a gene-editing technology that allows specific sequences of DNA to be targeted.

"We're going to cut and paste the sequence of the missing gene to see if we can get it to be expressed at levels that are significant," Dr. Freedman added. "We can measure whether the gene gets to where it's supposed to be, and whether it's able to produce the missing protein. If it's effective, it will be protective against cystinosis."

The third component of the project is more of a fact-finding expedition.

"We don't exactly understand the last steps of why cystinosis causes cells to get sick and die," Dr. Freedman says. "Because it's hard to watch that process happen inside a living kidney, especially in a human, we're excited that we now can re-create that process in a dish. If we can better understand the process, we can treat with different drugs to see if they can protect against the process."

Essentially the team is trying to discover a new and improved alternative to cysteamine.

"We're looking for something that does something similar to what cysteamine does while protecting the kidneys better and with fewer side effects," Dr. Freedman explains.

As his multipronged research project ramps up, Dr. Freedman expects that it will be a journey of two years or more.

"My general vision is that in two years we will have mapped the territory and identified which of these three strategies has the potential for further clinical development," he says. "On the regeneration side, we want to know if we can grow kidney structures in a living body that function like kidney tissue would function. With the gene therapy, we think we will have a deliverable – an off-the-shelf therapeutic we can use to introduce the gene that is involved in cystinosis back into the kidneys. On the drug side, the ideal outcome would identify novel candidate drugs that could potentially be tested with a patient cohort."

Dr. Freedman first started his research work on kidneys in 2010, and it has been "an incredible journey," he says. "We've gone from finding these kidney organoid structures for the first time to routinely growing them. Now we have robots so we can do it faster and with greater accuracy. We're very grateful to the CRF, because their support will allow us to explore these many new opportunities."

Looking back on almost a decade of kidney research, Dr. Freedman says that one of the greatest thrills has been seeing fantasy move to reality. "Hopefully the second decade will be just as exciting," he adds.

As he considers the latest paths to progress stretching out before him, he glances across his office to where he still keeps a fish tank. It's an enduring link to his earliest scientific explorations.

"The natural world has so many secrets," he says. "As researchers, we want to learn more about that unlocked potential. In it lies hope for helping people in need."

GENETIC ENERGY

Seeking to tap the power of CRISPR gene-editing technology, Dr. Kao launches a research project targeting corneal cystinosis.

BY DENNIS ARP

In the briskly evolving world of genetic research, sometimes a new development comes along that stands apart from the others, crying out for more investigation and broader application. The CRISPR-Cas9 technology is just such a breakthrough.

For years, Winston Kao, PhD, has been studying the biology of the eye and how to improve treatments when eyes become injured or diseased. Now the University of Cincinnati ophthalmology professor is leading a cutting-edge project that will use CRISPR gene-editing techniques in hopes of developing better treatment regimens for corneal cystinosis.

> THE PROJECT IS FUELED PRINCIPALLY BY HOPE, HARD WORK AND GRATITUDE.

A grant from the Cystinosis Research Foundation (CRF) is making this translational research possible.

"CRISPR-Cas9 has been around for a few years now, but it remains pretty much the hottest new thing in genetic research," says Stephen Jenkins, MD, a member of the CRF Scientific Review Board. "It allows researchers to specifically target stretches of genetic code even down to one base pair. It's a powerful technology, and Dr. Kao and his team are some of the first researchers to use it on cystinosis."

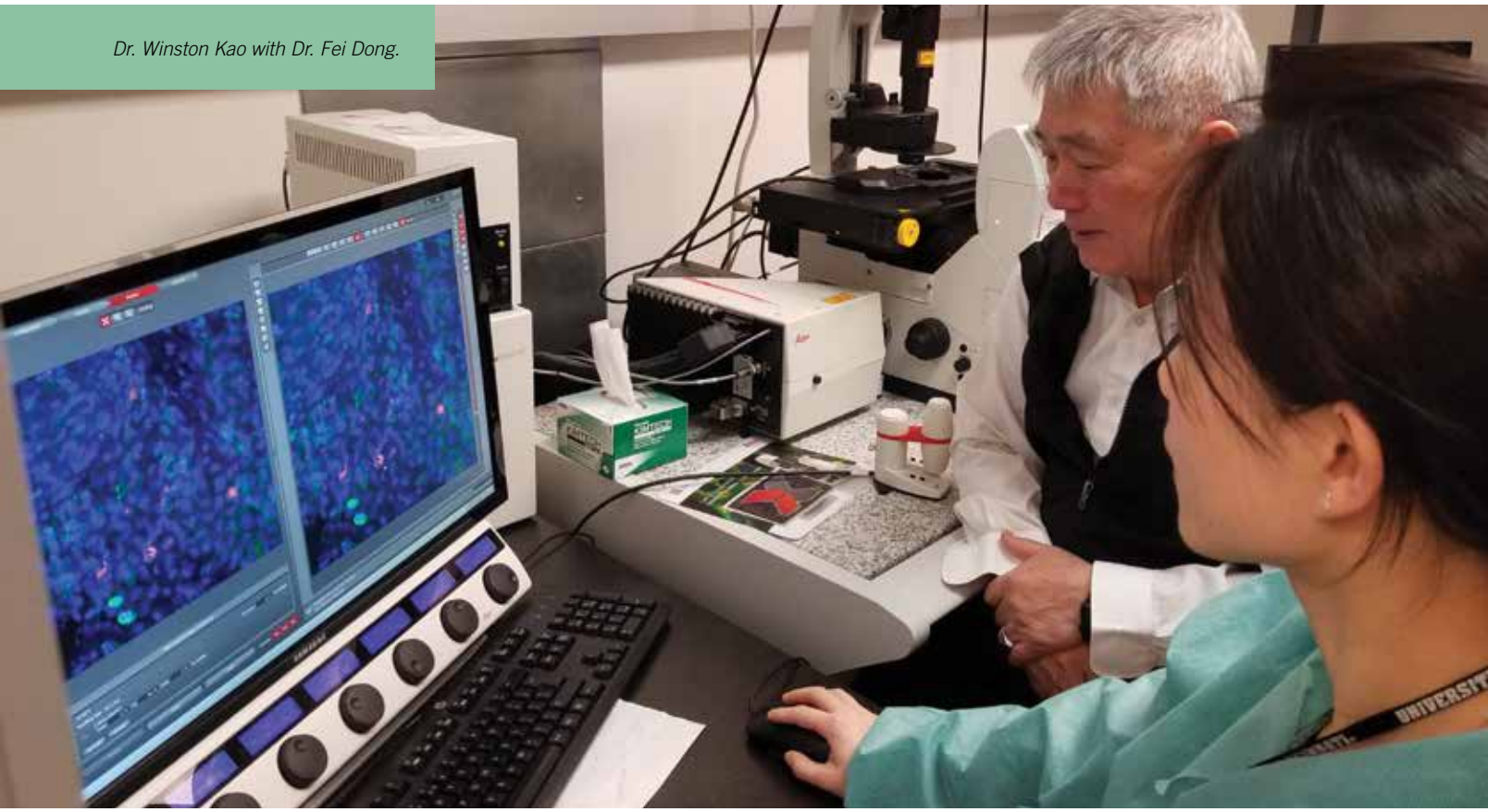
Dr. Kao's new project has two distinct aims, with both using CRISPR gene-editing to generate two mouse lines with different cystinosis mutations. In the first part of the project, Dr. Kao and fellow researchers will transplant umbilical mesenchymal stem cells into the corneas of the mice. The goal is to see if these transplanted functional cells (ones free of mutation) will engraft in cornea and share the functional protein, cystinosin, with the host corneal cells all around them.

If the therapy proves successful and functional proteins from the stem cells are received by the mutated cells, cystinosis patients might be able to break free from their onerous daily or even hourly regimens of eye drops. A one-time treatment such as Dr. Kao is exploring might eliminate the need for drops because cystine crystals would no longer accumulate in the corneas.

The project is just starting, but if the technique ultimately proves successful, it would mean a big leap forward in quality of life for cystinosis patients.

"We're excited about the possibilities, but we are still learning what does and doesn't work," Dr. Kao says. "The first cell therapy we tried involved injection of about ten thousand cells in 2 microliters into the cornea, and that didn't work very well. Now we are grafting the cells by a fibrin gel onto the denuded corneal surface by a very gentle scraping of the cornea (to aid with receptivity). The first phase of treatment had partial success, but we found that we had to do a longer treatment."

The second element of the project also involves corneal cystinosis, but it might also have applications for treating cystinosis in all affected organs and tissue. This aim will use CRISPR technology packaged with viral vectors. The initial testing will involve injections into the veins of the eyes to see if it can reduce corneal crystals. The research team also has plans for future testing involving the liver and kidneys.



Dr. Winston Kao with Dr. Fei Dong.

"This has potential for systemic reductions in cystine," Dr. Kao says.

Speaking as the parent of two children with cystinosis, Dr. Jenkins says he's particularly excited about the long-term possibility of using CRISPR vectors to edit blood stem cells wherever they're needed in patients.

"I'm excited about any innovation that can help with our cause," he says. "The chance to reduce the need for eye drops is important because they can be painful and hard to administer, especially for teenagers and adults. So I worry about the corneas, but I'm more worried about the kidneys because that's where we see more symptoms. It would be really big to have a therapy to cure the kidneys."

Dr. Kao says his project is years away from human trials, let alone general treatment of cystinosis patients.

"In the first year, we will focus on the stem cell side so we can get the more reliable step analyzed for efficacy," he says. "The timeline for the gene therapy is longer – we will probably be through our first animal treatments in a year. In two years, we will probably know more about whether we can cure the corneal disease."

With luck, the project might reach the stage of human trials in five years, Dr. Kao says.

"We are pursuing the unknown, so there are no reliable timelines," he adds. "This starts as an academic pursuit – to understand the basic biology. Ultimately, when we're able to translate whatever we're doing so it changes the lives of patients, that's where we find the real rewards."

At this early stage, the project is fueled principally by hope, hard work and gratitude, Dr. Kao says.

"We are so grateful for the CRF support, because without it our project would not go forward," he says. "To have an organization appreciate what we're doing and see value in this opportunity – at this point that means everything."

Characterization of mTORC1 signaling in early pathogenesis of cystinosis

Corinne Antignac, MD, PhD, *Principal Investigator*
IMAGINE INSTITUTE, PARIS, FRANCE

OBJECTIVE/RATIONALE:

We reported that cystinosin, in addition to its role in cystine transport out of the lysosome, is a component mTORC1pathway, which regulates translation of RNA in proteins. Our kidney RNA profiling analysis suggests that young cystinotic mice in the FVB genetic background that do not develop Fanconi may compensate mTORC1 activity and better dampen oxidative stress. We therefore will further study the mTORC1-related role of cystinosin in the early pathogenesis of cystinosis with a focus on RNA translation.

PROJECT DESCRIPTION:

Our project for the next two years is to further characterize mTORC1 signaling and to analyze early defects in the translation of RNA in our animal and cellular models of cystinosis. We will activate mTORC1 signaling with amino acids and compare the subset of actively translated RNAs between kidneys of wild-type vs cystinotic mice and in proximal tubular cell lines. We will also address the question of the impact of different types of CTNS mutations (leading to nephropathic versus non nephropathic less severe cystinosis) on mTORC1 signaling. Finally, we plan to have a better insight in a human model of cystinosis and aim to develop kidney organoids from induced Pluripotent Stem (iPS) cells from patients with cystinosis to confirm mTORC1 signaling alterations and transcriptional deregulations in the early course of cystinosis pathogenesis.

RELEVANCE TO THE UNDERSTANDING AND/OR TREATMENT OF CYSTINOSIS:

This project will help to better understand the role of cystinosin in the mTORC1 complex, a major regulator of cell growth. The implication of cystinosin in RNA translation pathways could provide therapeutic candidate targets to counteract the loss of function of the renal proximal tubule.

ANTICIPATED OUTCOME:

With the first aim, we expect to observe defects in the translation of RNA involved in mitochondrial and/or epithelial function in the absence of functional cystinosin. With the second aim, we expect to find the same effect on mTORC1 signaling with the overexpression of the K280R and N323K mutants since we have previously shown that although they do not allow cystine transport, these mutants are still interacting with the proteins of the mTORC1 complex and lead to mild forms of (non nephropathic) cystinosis.

Finally, the iPS cells and organoids will allow us to confirm findings in a human model and will be useful for the cystinosis research community.

Pathogenesis of cystinosis: Studies using transgenic zebrafish models

Olivier Devuyst, MD, PhD, *Research Mentor*
Zhiyong Chen, PhD, *Research Fellow*
UNIVERSITY OF ZÜRICH, ZÜRICH, SWITZERLAND

OBJECTIVE/RATIONALE:

The zebrafish is a relevant vertebrate model for the proximal tubule of the kidney, due to genetic conservation and functional similarity with the mammalian nephron. Our previous work has showed that CTNS deficiency cause cystin accumulation and lysosome/autophagy defects in zebrafish larvae. Zebrafish has emerged as a versatile vertebrate model for screens in drug discovery. The objective of this study is to use distinct advantages of the zebrafish model to advance into the drug development pipeline for cystinosis.

PROJECT DESCRIPTION:

Transgenic reporter fish lines with tissue-specific expression of fluorescent proteins will be developed to investigate the cellular dysfunction in the kidney, liver and brain, using promoters PiT1 (kidney proximal tubule), lfabp (liver) and huc (neuron). Changes in endo-lysosomal morphology, autophagy, lysosome chloride homeostasis and pH, and proliferation as well as mTORC1 activity will be analyzed in transgenic larvae with fluorescent microscopy in vivo. The endocytic defect will be monitored by quantification of the excretion of low-molecular weight (LMW) protein in water. These studies will allow us to determine relevant cellular and organ-specific phenotypes for drug library screening. The readouts will include optical imaging of fluorescent vesicles in the kidney and brain, quantification of urinary LMW proteins, as well as a swimming test with ZebraBox.

RELEVANCE TO THE UNDERSTANDING AND/OR TREATMENT OF CYSTINOSIS:

The study will offer new in vivo evidence on cellular dysfunction related to cystin accumulation at the early stage of disease progression and validate relevant readouts for drug library screening. The identification and validation of potential hits which could reverse clinically relevant manifestations is of immediate clinical relevance for patients with cystinosis.

ANTICIPATED OUTCOME:

The monitoring of LMW proteinuria will allow us to follow the function of the proximal tubule of the kidney in real time, and to determine the time-course of development of proximal tubule dysfunction in CTNS knockout zebrafish. The study of transgenic reporter lines will enable us to validate optical readouts for drug screening. We hope to identify new molecules which could improve the clinical manifestations of cystinosis.

Developing a therapeutic strategy for cystinotic nephropathy with iPS cells

Benjamin "Beno" Freedman, PhD, *Principal Investigator*
UNIVERSITY OF WASHINGTON, SEATTLE, WASHINGTON

OBJECTIVE/RATIONALE:

The kidneys are particularly vulnerable to cystinosis, even during childhood. Cysteamine delays kidney decline, but is not considered a cure. Our group has recently discovered a way to generate human 'mini-kidney' structures, or organoids, outside of the body, starting from stem cells. The goal of this project is to use mini-kidneys as surrogates for patients to explore the potential of kidney regeneration, gene therapy, and drug discovery to remedy the effects of cystinosis on the kidneys.

PROJECT DESCRIPTION:

Our work will be performed in three sub-projects ("aims"). In the first aim, we will recruit patients with cystinosis and turn their urine into stem cells and kidney grafts, which we will test for transplant ability. In our second aim, we will develop a gene therapy approach for cystinosis in human kidneys, by applying genome editing (CRISPR) to restore cystinosin function in organoids. In our third aim, we will intentionally re-create the symptoms of cystinosis in mini-kidneys outside of the body, to gain new insight into why kidney cells are damaged and how this can be prevented chemically. Together, these sub-projects will add up into a larger whole, bringing us closer to a cure.

Note: If you are a cystinosis patient and would like to donate urine, please contact benof@uw.edu to join our study.

RELEVANCE TO THE UNDERSTANDING AND/OR TREATMENT OF CYSTINOSIS:

We are taking a multi-faceted approach to determine which strategies have the most potential for treating cystinosis in human patients. The mini-kidney platform enables us to perform exploratory experiments of this sort that would not be possible in actual patients. This will enable us to help us better understand how cystinosis damages the kidneys and to discover specific and effective interventions that could be further tested in clinical trials.

ANTICIPATED OUTCOME:

Our experiments will teach us whether (1) kidney stem cells can be derived from cystinosis patients with the potential for engraftment back into the patients; (2) gene therapy can be effective in restoring the lost functionality of the cystinosin gene in human kidneys; and (3) a common blood protein might be a major culprit in damaging human kidney cells in cystinosis. Collectively, these studies will clarify which are the most promising strategies for therapy in cystinotic kidneys.

Cell therapy and gene editing for cystinosis

Winston Kao, PhD, *Principal Investigator*
Hassane Amlal, PhD, *Co-Principal Investigator*
Fei Dong, PhD, *Co-Principal Investigator*
UNIVERSITY OF CINCINNATI, CINCINNATI, OHIO

OBJECTIVE/RATIONALE:

To cure cystinosis, an autosomal recessive lysosomal storage disease (LSDs), caused by mutations of cystinosin (CTNS), we aim to develop new treating regimens that reduce the accumulation of lysosomal cystine and cystine crystals in corneas by intra stromal transplantation of umbilical mesenchymal stem cells (UMSC) and by CRISPR gene editing with intrastromal administration of AAV2 vectors. Intravenous infusion of CRISPR AAV2 vectors or transplantation of CRISPR edited HSC/HSPC (hematopoietic stem/hematopoietic progenitor stem cells) will be employed to ameliorate systemic cystinosis pathology.

PROJECT DESCRIPTION:

Two novel cystinosis mouse lines created by CRISPR gene editing will be studied. They will receive corneal UMSC transplantation and gene therapy by intrastromal and intravenous administration of CRISPR AAV virus for corneal and systemic pathology, respectively. HRTII in vivo confocal microscopy and stereo microscopy with epifluorescence attachment, and in vivo renal function tests will be used periodically to monitor corneal haze and crystal formation, and renal functions. Tissues collected from euthanized experimental mice will be subjected to histology and immunohistochemistry analysis to evaluate the treatment efficacy. Furthermore, bone marrow cells isolated from cystinosis mice will subjected to CRISPR gene editing. The edited HSC/HPSC will be isolated and expanded prior to being transplanted to receiving cystinosis mice that will be examined as described above.

RELEVANCE TO THE UNDERSTANDING AND/OR TREATMENT OF CYSTINOSIS:

Cysteamine is the most effective for reducing cystine crystals, but it causes lesions to multiple organs; studies show that availability of functional CTNS is essential for other symptoms besides cystine-crystals. Bone marrow transplantation has yielded encouraging results, but is complicated by GVHD diseases. Our treatments can potentially reduce the lysosomal cystine-crystals and provide functional CTNS for ameliorating symptoms caused beyond cystine crystals. Further, our treatment strategies could be adapted for other LSDs caused by mutations of lysosomal enzymes and membrane proteins.

ANTICIPATED OUTCOME:

We anticipate that UMSC treatment will reduce corneal haze and cystine crystals. Dil pre labeled donor cells are to be detected in corneal stroma. We anticipate that CRISPR treatment will correct the mutant CTNS allele in a subset of somatic and somatic progenitor/stem cells through CRISPR gene therapy, and allow the synthesis of a full length, functional cystinosin. The corrected cells will synthesize and secrete functional cystinosin in EV (exosomes and microsomes) and provide the needed transporter to other cells.

Dissect the protein turnover mechanism of cystinosis mutants

Ming Li, PhD, *Principal Investigator*
Jacob Kitzman, PhD, *Co-Principal Investigator*
UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

OBJECTIVE/RATIONALE:

Some people consider it as an "overkill" for grocery stores to throw away expired food even though most of it can still be consumed. Similarly, our lysosome has a strict protein quality control (QC) system that sometimes "overkills." Genetic mutations in some cystinosis patients can lead to the premature destruction of their cystinosin even though the protein is still functional. Studying this QC system will enable us to prevent the premature destruction of cystinosin in patients and lead to the development of new treatment strategies.

PROJECT DESCRIPTION:

The first step is to measure the life-span of disease-causing cystinosin mutants inside the cell. So far, we have collected 42 different types of cystinosis mutants, and we will measure them individually to identify the short-lived mutants. Then, we will identify the corresponding quality control system that destructs the short-lived cystinosin mutants. If the function of this lysosomal quality control system is inhibited, mutant cystinosin proteins will be stabilized on the lysosome surface to perform their normal duties. Therefore, our last step is to develop drugs that can inhibit the lysosomal QC system. Ultimately, we may provide a novel treatment strategy for certain types of cystinosis.

RELEVANCE TO THE UNDERSTANDING AND/OR TREATMENT OF CYSTINOSIS:

Our study will provide a new mechanism for the pathogenesis of Cystinosis. We believe that the premature destruction of certain cystinosin mutants might be an "overkill" caused by the lysosomal protein quality control system. Finding ways to inhibit this quality control system can be a new strategy to treat cystinosis.

ANTICIPATED OUTCOME:

We expect to discover which proteins are responsible for the quality control function on human lysosomes. We will isolate the chemicals that can obstruct the lysosomal QC system so that the mutant cystinosin in patients can be saved from the premature destruction. These chemicals will eventually be developed into drugs to treat certain types of cystinosis.

SPRING 2019

CALL FOR RESEARCH PROPOSALS

RESEARCH IS OUR HOPE

When Nancy and Jeff Stack established the Cystinosis Research Foundation in 2003 they were committed to aggressively funding cystinosis research to ensure the development of new and improved therapies and a cure for cystinosis. But never in their wildest dreams could they have imagined what has been accomplished in 16 short years. Since its inception, CRF has funded 180 multi-year research studies in 12 countries. Our researchers have published 76 articles in prestigious journals as a result of CRF funding. Every dollar donated goes directly to support cystinosis research.

The goal of CRF is to accelerate promising cystinosis research toward clinical trials. To that end, CRF prioritizes research that will lead to better treatments and a cure for cystinosis. CRF issues grants for bench, clinical and translational research, with a strong emphasis on translational and clinical research. CRF is interested in supporting new investigators and encourages them to apply either as research fellows or investigators.

In April, CRF announced $2.5 million was available for the 2019 Spring call for research proposals and fellowship grants. The grant awards will be announced in July 2019.

In 2018, CRF issued 15 new grants for over $3 million which brings us closer to better treatments and a cure. All research applications received by CRF are evaluated by CRF's Scientific Review Board (SRB) comprised of the leading international experts in the field of cystinosis. The SRB provides independent, objective reviews and recommendations for each research proposal submitted based on the NIH scale of standards. Additionally, the SRB follows grant review guidelines established by the CRF and advises the foundation on the scientific merits of each proposal.

In 2010, CRF established the **Cure Cystinosis International Registry (CCIR)** to serve as a hub of information about cystinosis and its complications. Currently, CCIR has 576 registrants from 44 countries. The site, which includes a Professional Research Portal, is a critical resource for researchers and scientists who register to access and view de-identified, aggregate cystinosis patient information. The portal can be accessed at *www.cystinosisregistry.org*.

www.cystinosisresearch.org/research/for-researchers

CRF is excited about the future of cystinosis research and is grateful to researchers for their interest in the cystinosis community. We look forward to working together to find better treatments and a cure for cystinosis.

CRF and Canadian Families Working Together for a Cure

Canadian cystinosis families are committed partners working with CRF to fund research that will lead to better treatments and a cure. Families across Canada continue to organize and plan events to raise money for research. Canadians affected by cystinosis have funded various research grants, through popular events such as the Swing, Shoot & Liv Golf Classic in honor of Olivia Little (Ontario), the JCFG Memorial Golf Tournament in honor of Andrew Cunningham (Alberta), and the Hope for James tournament in honor of James Fehr (Saskatchewan). Events like Shoot for Abbi in honor of Abbi Monaghan (Ontario), Seth's Circle of Hope in honor of Seth deBruyn (Alberta), the "Gala of Hope" in honor of Alan and Nora Campbell (Ontario), are examples of the creative fundraising events held throughout Canada.

Since 2003, CRF has issued 180 multi-year grants in 12 countries and today, CRF is the largest fund provider of cystinosis research in the world. Canadians funnel their colorful dollars through Canada Helps, managed by the Aqueduct Foundation and administered by Cystinosis Awareness Research Effort (CARE). Through Canada Helps, CARE has created an efficient and effective fundraising process, allowing Canadians to ensure that their charitable donors receive a tax receipt.
Since 2016, Canadian families have directly funded research through Aqueduct to CRF totaling $613,012 in grant payments.

Working together, our two countries have united in their effort to raise awareness about cystinosis, to advocate on behalf of all children and adults with cystinosis and to ensure that we will fund the most qualified researchers in the world. The friendships and partnerships developed between Canadian families and charitable organizations is a true beauty and bond that transcends borders. We are grateful for each other!

In Canadian medication news, the Canadian Health Care system is continuing to make progress for cystinosis patients with the approval of new medications and treatments. Very recently, Cystadrops® received approval and will become available soon to Canadian families, replacing the cumbersome nature of the compounded drops with a more efficient and effective treatment. We look forward to having both Procysbi® and Cystagon® as medication options, even as we continue to seek medication coverage for patients in Canada.

We support the CRF because we know the heart behind it is for all cystinosis patients, regardless of nationality. Although our health systems are vastly different from country to country, it is urgent that we advocate for each other because we become stronger when we do. We are grateful for the opportunities afforded to Canadians through the work done by the CRF and glad to be part of it!

2019 Canadian Donations Fund CRF Grants

Liang Feng, PhD
STANFORD UNIVERSITY

Molecular Mechanism of Cystinosis

$37,500 *Funded through Aqueduct*

Paul Goodyer, MD
MCGILL UNIVERSITY HEALTH CENTRE

ELX-02 therapy for cystinosis caused by CTNS nonsense mutation

$37,500 *Funded through Aqueduct*

The CARE and Liv-A-Little Foundations have a strong working relationship with CRF. Erin Little (Liv-A-Little) is a CRF board of trustees member. Karen McCullagh, Crystal Walker and Chad Little are co-chairs of CARE and help guide the funding process. Canadians can donate directly to CRF or contribute to CRF Scientific Review Board approved research studies through Canada Helps.

If you would like to learn more about how to fundraise in Canada or make a donation, please contact: CRF board member **Erin Little** *(ce.little@btms.com)* or **Karen McCullagh** *(kcmccullagh@gmail.com).*

THANK YOU CANADA

Since 2016, Canadian families have directly funded CRF research with $613,012 in grant payments through Aqueduct and Liv-A-Little Foundation.

BY
STEPHEN JENKINS, MD
AND
CLAY EMERSON

2019

day of HOPE

FAMILY CONFERENCE

A DAY TO COME TOGETHER

We just got back from the Day of Hope family conference, and it felt different this year. There was an extra-large dose of hope infused into all the activities. I think that hope came from the upcoming stem cell trial for adults with cystinosis, something we've all been waiting and praying for.

We had a record-breaking 68 families attend this year, with people from the United States, Canada, Ireland, France, Sweden and Australia. There were many newly diagnosed families, and others who attended for their first time. It was so great to meet new people and to catch up with old friends. Our boys were especially excited to see Henry Sturgis. They are his biggest fans.

We started the conference on Thursday with introductions. This is always a tender part, especially for new families. Everyone told a little bit about themselves and shared a wish, written on a star. I wished that we would see the first adult with cystinosis start the stem cell transplant trial, and that it would work. Many people shared similar wishes. After introductions we had delicious Mexican food while the children ran wild throughout the hotel.

Friday morning started bright and early. Nancy Stack, the president of the Cystinosis Research Foundation, gave us an update on all the work the CRF is doing. Since they started in 2003, the CRF has raised over $50 million, funding over 180 grants to over 100 scientists, resulting in 76 publications. We are funding numerous basic science studies, as well as multiple promising translational research projects. After Nancy's talk, I gave a brief presentation on the basics of cystinosis.

Next, we heard from Dr. Julian Midgley of Alberta Children's Hospital in Calgary, Canada. He talked about the important and complex process of transitioning from pediatric to adult care. He recommended starting early and planning ahead. Don't wait until the child's 18th birthday. He talked about how oftentimes parents need to remain involved in their child's care even after transitioning to adult providers. It will be different for each child and each family and should be tailored to the patient's needs.

Dr. Ranjan Dohil of UC San Diego talked about the GI effects of cystinosis and cysteamine therapy. He believes that cystine accumulation likely affects the muscles of the stomach, which can lead to dysmotility and gastroparesis. Cysteamine itself causes increased acid production, which can lead to heartburn and nausea. This is improved with a proton-pump inhibitor (PPI) like omeprazole, but there may be risks to taking long term PPIs, like low magnesium levels and possibly osteoporosis. He talked about gastrostomy tubes and the importance of changing the size as the child grows. He also talked about the importance of taking Procysbi® or Cystagon® on an empty stomach. Both drugs have impaired absorption when taken with foods that are high in fat and protein. He recommended fasting before for two hours, and then fasting after for at least thirty minutes.

Next, we heard from Dr. Paul Grimm of Stanford University about chronic kidney disease and anticipating the need for dialysis and kidney transplant. He pointed out that creatinine is a byproduct of muscle, so the more muscle you have, the higher your creatinine will be, and vice versa. A more accurate way to measure kidney function is a lab test called cystatin C. He recommended using the CKiD formula for calculating glomerular filtration rate (GFR) in children. For adults, the best way to calculate GFR is the CKD-Epi calculator. Your GFR can be plotted on a graph, and typically declines in a predictable, linear fashion. This allows you to prepare for when you or your child may need dialysis or transplant. He talked about things that make your GFR worsen faster, including obesity, acidosis (low bicarbonate levels), low potassium, and diets high in animal fat and protein. He recommended the DASH diet, which is rich in fruits and vegetables, to delay GFR deterioration. He also recommended strict cysteamine adherence, as this has been shown to delay GFR decline.

Dr. Robert Mak of UC San Diego talked about his research on inflammation in cystinosis. He is studying the NLRP3 pathway, which is activated in mice with cystinosis and leads to increased inflammation, which is associated with muscle wasting and bone disease. He tested some IL-1 inhibitors that are already available in cystinosis knockout mice, and found that they had improved muscle mass, muscle strength, stronger bones and fewer fractures. He also found, unexpectedly, that their Fanconi syndrome also improved. He plans to test these drugs further in his cystinosis knockout mice and hopes to do a study in humans.

After Dr. Mak we heard from Dr. Kathleen Rickert, also from UCSD. She is an orthopedic surgeon, and spoke about common leg abnormalities in cystinosis, including bow leggedness (varus deformity) and the more common knock-knees (valgus deformity). All children go through a normal evolution of alignment, starting with bow leggedness when they first walk, which corrects to neutral alignment, but then often overcorrects to knock knees around age 4. This will eventually correct back to neutral alignment by age 8. If you or your child has knock knees after age 8, then you should see an orthopedic surgeon. It can be corrected with growth-modulating surgery. These alignment abnormalities can cause knee pain, difficulty running and gait disturbances. She saw multiple patients in bone clinic last year with Dr. Mak. They found that the most common abnormality was mild valgus and flat feet. Flat feet can exaggerate the appearance of valgus deformity and can be treated with good inserts and SMO braces.

Next, we heard from a new speaker, Dr. Richard Reimer of Stanford University, who is an adult neurologist. He has been seeing patients with Dr. Paul Grimm in their cystinosis clinic. Cystinosis muscle disease causes hand weakness and swallowing difficulties. He is working with Dr. Mary Leonard, who did a previous study with Dr. Grimm on bone and muscle characteristics in 39 individuals with cystinosis. They found that people with cystinosis have less lean muscle mass, strength and endurance. He plans to do a study of high intensity interval training (HIIT) to see whether it improves any of those outcomes. He thinks there may be a mitochondrial component to cystinosis muscle disease and plans to study mitochondrial function in the trial participants with CrCEST imaging. He recommended using a mitochondrial cocktail as a possible treatment for muscle wasting. He recommended a brand called "Mito-Tonic®" which includes coenzyme Q10, levocarnitine and B vitamins.

HOPE CAME FROM THE UPCOMING STEM CELL TRIAL FOR ADULTS WITH CYSTINOSIS, SOMETHING WE'VE ALL BEEN WAITING AND PRAYING FOR.

Then we heard from Marya Bengali and Spencer Goodman, who work in Dr. Cherqui's lab. For the last couple years, they have been collecting photographs of skin from people with cystinosis with a special hand-held microscope called a Vivascope®. They found that cystine crystals accumulate in the skin, especially in the papillary dermis region. They found that people who are not compliant with cysteamine therapy have a lot more crystals. This may be a way of monitoring long term compliance. They will use the Vivascope® to evaluate participants in the stem cell transplant trial to see if skin crystals are reduced.

2019 day of HOPE FAMILY CONFERENCE

Next, Dr. Stéphanie Cherqui talked to us about the upcoming Phase I / II trial for gene-corrected autologous stem cell transplant. She got approval from the FDA back in December 2018 and is hoping to recruit the first patient in May or June. There will be six patients in this phase. Eligible patients must be over 18 years old and have good organ function. They can have a kidney transplant but must be at least 12 months out from transplantation. Interested candidates will come to San Diego and go through 2-4 days of screening and information. If they decide they want to do it, they will come back for 8-9 days for a full, intensive examination, which will include evaluation of kidneys, eyes, lungs, heart, endocrine glands, muscles, bones and neurologic function and quality of life. If they are deemed healthy enough to participate, they will undergo stem cell harvest. Blood is taken and sent to UCLA. At this point the patient goes home. At UCLA the stem cells are modified with a lentivirus vector, which takes about 60-90 days. The patient must stop oral cysteamine two weeks before the transplant, and eye drops two months before. The patient then returns to San Diego to get the transplant.

Dr. Ted Ball of UC San Diego talked about the actual transplant process. He is a hematologist/oncologist and has done over 2,000 transplants in his career. Before the transplant, patients will receive busulfan to make room in the bone marrow. It's given every 6 hours over 4 days. Then the patient's corrected stem cells are infused back into the patient. The next two weeks are critical because the patient won't have any white blood cells. All patients will receive prophylactic antibiotics, including ciprofloxacin, fluconazole and acyclovir, since they won't have an immune system to fight off infections. At day 7 they will receive a medication called neupogen that stimulates the bone marrow to release white blood cells. It's common to need blood or platelet transfusions during this period. Usually by day 12 the blood counts return to normal. Common side effects of the chemotherapy include sores in the mouth (mucositis), diarrhea, hair loss (it comes back!) and pneumonitis (lung inflammation) 30-60 days after transplant. Pneumonitis is treated with steroids. Infertility is common, so anyone who wants to have children will need to bank sperm or eggs ahead of time. Very rarely the chemotherapy can lead to hematologic cancer in the future. The mortality rate for an autologous transplant is very low, estimated 1-2%, but is not without risk. It is much safer than an allogeneic transplant, however, which has a 20% mortality

2019 day of HOPE FAMILY CONFERENCE

rate. After the transplant, patients will be in the hospital for 2-3 weeks. After discharge they will have to stay in San Diego for a couple months, with frequent outpatient follow-up visits.

Then we heard from Dr. Sergio Catz of The Scripps Research Institute. He spoke to us about his research on chaperone-mediated autophagy. There is a receptor called LAMP2A that recognizes which proteins need to be degraded in the lysosome and facilitates the internalization of these proteins. In cystinosis cells, this receptor is not located in the lysosomal membrane, which leads to a buildup of proteins outside the lysosome. This is not corrected with cysteamine. He is collaborating with another scientist, Dr. Ana Maria Cuervo, who has discovered a compound, QX77 (also called CA77), which corrects this defect, and improves cellular trafficking, autophagy and response to external stress. He is testing this compound in cystinosis knockout mice, and has found decreased cellular stress, improved LAMP2A distribution and increased megalin expression.

THE 12 ADULTS ON THE PANEL TALKED ABOUT THE HOPE THEY HAVE FOR THE FUTURE. THEY ARE AN INSPIRING GROUP OF PEOPLE.

After Dr. Catz we heard from Dr. Matthew Wade, an ophthalmologist from UC Irvine. He talked about how lots of things besides corneal crystals can cause light sensitivity, so patients should be vigilant and get regular eye checks. He emphasized it is particularly important for an ophthalmologist to check the optic discs. Abnormal optic discs can be a sign of increased intracranial pressures, which can cause headaches and blindness. He also talked about benzalkonium chloride (BAK), which is the common preservative found in eye drops. BAK roughs up the surface of the eye to let the drug in, but in the process can cause dry eye, eye pain, light sensitivity and foreign-body sensation. He recommended using preservative-free eye drops if you develop dry eye disease from the cysteamine eye drops.

Next we heard from Dr. Morgan Fedorchak of the University of Pittsburgh. She has developed a controlled-release eye drop. It is a thermo-responsive hydrogel that turns from liquid to solid when it touches the eye. The gel is filled with microspheres loaded with cysteamine. She has been manufacturing the eye drops at a cGMP facility, which means it will be much faster to scale up production for a trial. She is doing a rabbit study to test for toxicity and should be finished with that later this year. She is starting her knockout mouse study now and will hopefully finish that in the first part of 2020. After that she can apply to the FDA to do a human trial.

Dr. Doris Trauner from UCSD shared the results of her study on sleep apnea in people with cystinosis. She was able to do sleep studies on 19 people, eight women and 11 men. The majority had sleep apnea (58%), while 16 of the 19 people had abnormally low oxygen saturations during the night and most had multiple nocturnal awakenings. While sleep apnea is often thought of as a disease of older, obese people, she found that it was common even in young, thin adults. Sleep apnea is treated with continuous positive airway pressure (CPAP). All adults would benefit from being screened. The study is ongoing, and they continue to enroll more adults.

After a full day of science, we were ready for some fresh air and fun. Buses transported everyone to the Back Bay park and beach where we had a fantastic barbecue feast. I may have started with dessert this year. Lars sampled every flavor of cotton candy. They also had these life-changing Hungarian chimney cake ice cream cones. We spent a lot of the evening talking about the upcoming stem cell trial, excited about the prospect of a cure.

Saturday morning we were back at it with Dr. Grimm. This time he talked about dialysis and transplants. He explained why it's ideal to get a transplant before you even need dialysis. Adults can usually get listed for transplant once their GFR is 20, while kids can get listed for transplant when they have a GFR of 60. Kids get to be on the top of the transplant list, so it's better to get listed before you turn 18 years old. Living donor kidneys are the best, even if it's not as well-matched. The average kidney transplant lasts about 15-20 years.

If you're not able to get a kidney transplant right away, then you may need dialysis. There are two ways to do dialysis: hemodialysis and peritoneal dialysis. Hemodialysis is initially done through a central catheter that goes into the internal jugular vein. It must be done three times a week for 3-4 hours, although some people are able to get a home unit that can be run every day. Patients who plan to do hemodialysis long term get something called an arteriovenous fistula. This is made by a vascular surgeon. Because you need good veins to make a fistula, Dr. Grimm recommended that everyone should avoid blood draws and IVs in the antecubital fossa (where your elbow bends) if possible and should try the veins of the hands first. If you need a long-term IV for antibiotics, instead of a PICC line you should get a tunneled internal jugular line, because PICC lines can damage the veins of the arm. The other kind of dialysis is peritoneal dialysis. This is done by placing a catheter into the abdominal cavity and filling it with special dialysis fluid. This kind of dialysis can be done at home or even on vacation.

After Dr. Grimm spoke, we heard from Dr. Benjamin "Beno" Freedman of University of Washington in Seattle. He has figured out a way to use viable cells harvested from a patient's urine to create "mini-organs". He reprograms adult cells into Induced Pluripotent Stem Cells (iPS). These cells are functionally similar to embryonic stem cells. These iPS cells can be reprogrammed into cells which resemble organs in the body, including kidneys. These "kidneys-in-a-dish" can be used to better understand how cystinosis impacts the kidneys as well as test new treatment therapies. Additionally, this technique may one day be used to create new organs or organ grafts from the patient's own cells.

Next we heard from Dr. Paul Goodyer of Montréal Children's Hospital, about a possible new treatment for people with nonsense mutations. There are more than 100 different genetic mutations that have been found to cause cystinosis. One type of mutation is called a "nonsense" mutation, which results in the premature termination of protein synthesis. Dr. Goodyer's research has shown that approximately 20% of patients with cystinosis in North America have a nonsense mutation from at least one parent. There is a pharmaceutical company that has developed a drug that allows the body's genetic machinery to ignore or "read-through" nonsense mutations, resulting in the creation of a complete and functional protein. Dr. Goodyer has already demonstrated the compound's ability to work in mice with cystinosis as well as human cells in the laboratory. Dr. Goodyer expects a human clinical trial to be conducted in Canada starting within the year.

After the last science talk, we had breakout sessions for different age groups, which allowed people in different phases of their cystinosis journey to connect with other people who were going through similar experiences. After the breakout sessions, we had a question and answer panel with all the researchers and physicians.

Following that, we did a panel with our adults with cystinosis. There were twelve adults on the panel this year. They talked about the amazing things they are doing in their lives. On the panel we had a dental assistant, two pre-school teachers, an oil field worker, a high school teacher, a consumer health company consultant, a clothing store owner, a landscape designer, a non-profit employee who works with foster children, a certified welder and a police officer (sorry if I missed anyone). They talked about not limiting your children and letting them pursue the activities and dreams that they want. They discussed the importance of gradually transferring responsibility and not treating them as the sick kid. They shared how much better life was after getting their kidney transplants. They talked about the hope they have for the future. It was an inspiring group of people.

We left the conference so full of hope, and so grateful for everything the Stack family and the CRF are doing to improve the lives of those affected by cystinosis. I look forward to seeing everybody again next year. And if you've never been to the conference and want to come, please reach out to the CRF.

We'd love to see you there next year!

SAVE THE DATE **April 16-18, 2020**

Hope filled the room

on Saturday March 30, as 480 guests from around the world came together at the Fashion Island Hotel in Newport Beach, California for the Natalie's Wish Celebration. As the cystinosis community's largest fundraiser and a celebration of the research progress we have collectively funded, the event was a record-breaking success raising more than $4 million for cystinosis research in one night.

Guests entered the captivating ballroom and were greeted with vibrant spring flowers in pastel hues of orange, yellow, blue and green. Market lights hung from the ceiling and twinkle lights lined the walls creating the atmosphere of a night under the stars capturing the spirit of the evening: Together we shine bright.

The evening featured a wonderful performance by Matt Mauser and the Pete Jacobs Band, a local sensation that captures the essence of Frank Sinatra at the height of his career. The big band played lively covers of Sinatra hits such as "The Best is Yet to Come."

The Natalie's Wish Celebration was the grand finale of the three-day family conference, Day of Hope. An incredible 68 cystinosis families from all over the world joined the celebration. Guests traveled from Australia, Sweden, Canada, Ireland, Netherlands and Norway to support each other, celebrate our milestones and honor Stéphanie Cherqui, PhD of UC San Diego, for the recent FDA approval of her groundbreaking stem cell and gene therapy treatment clinical trial for cystinosis.

2019 Natalie's WISH CELEBRATION

CRF board member Kevin Partington opened the evening with introductory remarks and a thank you to sponsors and in-kind donors. Nancy and Jeff Stack provided exciting milestones the foundation has reached, as well as provided updates on the scientific research studies the community has funded. At this point, the researchers in attendance were acknowledged with a round of applause for their dedication to a cure and the difference they continue to make in the lives of the children and adults with cystinosis.

Natalie Stack shared her life update full of promise, hope and happiness. She spoke about her job as a case supervisor at Court Appointed Special Advocates (CASA) and the passion she has for advocating for children in the foster care system. Natalie shared about the impact the recent FDA approvals of the stem cell and gene therapy clinical trails for cystinosis has had on her life. She beamed as she expressed her gratitude to her parents, doctors, researchers and the entire cystinosis community for making her wish a reality.

Stéphanie Cherqui, PhD of UC San Diego, then spoke about her groundbreaking research on stem cell and gene therapy as a treatment for cystinosis. She touched on how she began in cystinosis research, how her research has progressed over the years and how no one really believed in her approach. She expressed that they are working around the clock in their lab at UCSD towards a cure, and she shared the impact these trials could have on the cystinosis community. Her message was full of optimism as she expressed the hope they have and the long journey still in front of them.

The peak of the evening was the vivacious live auction. Guests bid on a variety of featured items including exciting live events, lavish getaways, exclusive gourmet dinners, and exceptional collections of fine wines. Following the auction, guests had the opportunity to donate directly through Fund-A-Cure. The bid numbers just kept coming. Once the totals were tallied, it was announced that more than $4 million was raised for cystinosis. This room broke out in applause and more celebrating ensued.

It was a night to remember!

THANK YOU TOGETHER WE Shine BRIGHT

THE CYSTINOSIS RESEARCH FOUNDATION IS

ETERNALLY GRATEFUL

to all of its 2019 Natalie's Wish Celebration donors

$500,000 AND ABOVE
- The Thomas Haas Family
- Nancy and Geoffrey Stack Family Foundation

$200,000 - $300,000
- Traci and Tom Gendron
- The Hayde Family Trust
- The David Pyle Family

$100,000 - $199,999
- Laura A Khouri Revocable Trust
- Moran Realty Trust, Thomas P. Moran
- Susan and Thomas F. Moran
- Sue Werner and John Hagestad

$40,000 - $55,000
- Deborah and Larry Bridges
- Silverline Construction Inc.
- Christine and Bill Thormahlen Family Trust

$25,000
- The Gerson and Barbara Bakar Philanthropic Fund
- Sheri and Chris Dialynas
- Edelman, in honor of Aidan O'Leary
- Ralph H. Eidem, Jr.
- Oltmans Construction Co.

$20,000
- Denice and Mark Flerchinger

$15,000
- ANONYMOUS
- The Allan Hunter Family

$10,000 - $14,999
- Joni and Bob Alter
- Belinda and Bruce Broughton
- Carolyn and C. Preston Butcher
- Contract Carpet Corporation, Sharon and Rod Berle
- Cathy and Bruce Crair
- Emmy and David Dahl
- D.L.D. Insurance Brokers, Inc.
- Rebecca and Randy Hall
- Nanci and Jim Irwin
- Amanda and Paul Kelly
- Mary Ann King and Alex Rose
- Leadiant Biosciences Inc.
- Lugano Diamonds
- Janice and John Markley
- Lori and Joe McKay
- Bianca and Dave Mossman/ Donahue Schriber
- Lynne and Augie Nieto
- Sares Regis Group
- Cindie and Bert Selva
- Joan and Larry Webb
- Linda and Tim Zeller

$5,000 - $9,999
- Allen Matkins Leck Gamble Mallory & Natsis LLP
- Avanath Capital Management
- AVROBIO
- Bank of America
- Shelley and Philip Belling
- Dr. Michele and Ed Carpenter
- C.C. Pascal Charitable Foundation
- Kristin and Aram Chahbazian
- Donna and Dac Clark
- Daniela and Nathan Crair
- Gerson Bakar & Associates
- Susan and Jeff Hamar
- Heidi and James Harper
- IHP Capital Partners
- Valerie and Bill Kircher
- Nancy and Ned Kriz
- Karin T. Krogius and Scott Mason
- Lucas Development Corp.
- Cyndi and Larry Lukanish
- Barbara and Roy March
- David E. Martin Architects
- Christine and Nate Miller
- Angela and Bill Montgomery
- Natalie and Thomas P. Moran
- Mark Nimmo, Sullivan Curtis Monroe
- Sue Ellen and Paul O'Connor
- Ray Redfern
- Sares Regis Group of Northern California
- Tejon Ranch Company
- Jill and Larry Tucker
- University of California, San Diego
- Lisa and Tom Van Dorpe
- John Williams
- Stuart Winston

$2,500 - $4,999
- Kay and Michael Bissell
- Bixby Land Company
- Kim and Dick Crawford
- Lisa and Rex DeLong
- Stephanie and Jim Gilly
- Chapman Glucksman Dean Roeb & Barger
- Beth Anne and Donald Haarer
- Hillgren Family Foundation Fund
- Idea Hall
- Karen and Tom Linden
- Camille Longino and Tony Rodriguez
- Robert J. Lucas
- Moiso Living Trust, Melinda and Tony Moiso
- Bianca and Dave Mossman
- Erin McCarthy and James O'Leary
- Denise and Patrick Russell
- Keiko Sakamoto and Bill Witte
- Jill and Tom Schriber
- Zoe and Don Solsby
- US Bank

$2,000 - $2,499
- Linda and Kris Elftmann
- The Geraghty Family Fund, Barbara and Edward Geraghty
- Amy and Jeremy Krahe
- Robert Mak, MD, PhD
- Carolyn and Gary McKitterick
- Dory and Thomas O'Connor
- Timothy Quinn
- Jody and Trevor Strauss
- TCA Architects, Inc.
- Sara and Terry Volbert
- Candice Wilkinson

$1,500 - $1,999
- Cynthia and Douglas Fritz
- Melissa and Jim Long
- Teresa and Kevin Partington
- Leah and Kenny Schmidt
- Sherry and Rick Stinehart

$1,250 - $1,499
- Nelda Arnold and Dean Henry
- Lesley and Dr. Alan Beyer
- Call & Jensen
- Mr. and Mrs. D. Robinson Cluck
- CommerceWest Bank
- Wendy and Christopher Ferraro
- Gayle and Roy Jones
- Jana and Nathan Kraulik
- Stephen Lanni
- Dinny and Ron Thomas
- VCA Consultants

ON SATURDAY, MARCH 30, 2019,
WE RAISED MORE THAN

$4 MILLION

FOR CYSTINOSIS RESEARCH

$1,000 - $1,249

- 24 Hours for Hank
- Becky and Mike Alexander
- BJ and Jon Anderson
- Jean Blum
- Laurie and Randy Boehme
- Lan and Charles Bolus
- Mariette Booth
- Judy and Pastor Dave Christensen
- Marianne and David Clarke
- Connie and Ken Coatsworth
- Chris Coburn
- Diane and Jim Connelly
- The Thomas E. and Molly S. Davin Family Trust
- Drs. Magdalene and Ranjan Dohil
- Jana Frazier
- Debbie and Dick Gebhard
- Ruthy and David Green
- Chip Harvey
- Susan and Mark Hillgren
- Joan Howey
- Ashton and Stephen Jenkins, MD
- Debbie and Curt Johnson
- Suzie and Jim King
- Josefin and Robert Kühnel
- Barbara and Pat Moore
- Diane and William Neumann
- Kelly and Eric Olsen
- Bonnie and Hillar Paju
- Pam and Steve Quinn
- Elizabeth and Steve Rabosky
- Jenny Raycraft Family
- Carol Riley
- Sandy Sewell
- Lynda Stack, Riley Stack and Tucker Wisdom-Stack
- Cindy and Al Stokke
- John Tenaglia
- Michael Wolfe

$750 - $999

- Joann and Henry Acuff
- Jean et Chantal Faucheux
- Sandra and Gary Crouch
- Fuscoe Engineering, Inc.
- Janet and John Griffith
- Anne and John Kittleson
- Julie and Jack Mitchell
- Paula and Douglas Neff

$500 - $749

- Shaye and Larry Anders
- ANONYMOUS
- Julianne and Brad Armstrong
- Naomi and Jeff Bailey
- Hinda and Hal Beral
- Gayle Britt
- Ginger Bryant
- Corraline and Craig Capelouto
- Shelah and David Combs
- Shannon and Jared Copeland
- Debbie and Larry Fehr
- Pauline and Mark Forrester
- Richard Goddard
- Holly and George Granger
- Debbie and Greg Heath
- Donna and Mike Heiken
- Olivia and A. Andrew Johnson
- Erica and Joshua Johnson
- Terry and Phillip LaMotte
- Claire and Andrew Mackay
- Maisons - Louann and Anthony Thibert
- Yvette Mayville
- Tommy Melang
- Nancy and Mark Nimmo
- Kathleen Rickert, MD and Kendell Madden
- Kathryn Stack
- Doris Trauner, MD and Richard Stanford
- Nancy Trujillo
- Crystal and Bob Walker
- Julie and Justin Wilson

$250 - $499

- Samantha and Garrett Ardaiz
- Lora Carpenter and Shaun Nichols
- Rose and DJ Clarke
- Cindy and Doug Crocker
- Karen and Don Cunningham
- Kelsey Cunningham
- Joan and Robert Curtin
- Marthe Drolet
- Jennifer and Todd Ferrara
- Amy Green
- Jeremy Johnson and Jerrod Blandino
- Jessica and Wayne Jondle
- Lori and Michael Kelly, MD
- Barbara and Jeff Kulyk
- Kathy Leventhal
- Steve Longo
- Sue and Andy Maguire
- Julian Midgley, BM BCh
- Marylyn Milburn
- Janine Padia
- Karen and Frank Ritchie
- Deborah and Frank Rugani
- Chloe Strauss in honor of Gabbie Strauss
- Brian Sturgis
- Natalie and Jerry Tarolli
- Jenny Wichart
- Brandon Winer
- Joan and Jim Ziegler

$100 - $249

- Arian Abassi
- Agena Sumiko
- Dani Jo and Rich Alexander
- Amber and Scott Alexander
- Fund a Cure - in honor of Odin and Atlas Ardaiz
- Nancy and Dennis Bear
- Denise and Scott Brown
- Carol Thatcher and Mark de Bruijn
- Leah Klaassen and Devin Fehr
- Breanna and David Fernandez
- Cubby and Richard Fyke
- Christina Garkovich
- Timonthy Gleason
- Nicole Groux and Stewie Hartzell
- Richard Groux
- Maddie Hall and Ron Sebonia
- Pamela and Jeffrey Howard
- Khalid Hussain
- Rebecca and Nicholas Jespersen
- Winston Kao, PhD
- Kim Letch
- Shashona Reedy and Danny Lowery
- Kate and Adam Lukhard
- Sandy and Jerry Martin
- Philippa Muir
- Anne Marie O'Dowd
- Gail and Marty O'Hea
- Christine Peacock
- Alexander Rezzo
- Vicki and John Rezzo
- Chris Selzer
- Lauren and Robert Silvernail
- Rebecca and Parker Stone
- Brittany and Wes Wilson
- Mary Beth and Don Woods

GIFTS IN KIND

- Bryant Estate, Bettina and Donald L. Bryant, Jr.
- Melanie and Tim Byrne, Lincoln Property Company
- Cardinale Estate
- Richard A. Eddy
- Laura Khouri and Michael K. Hayde
- Meadowood Napa Valley
- The Napa Valley Reserve, Carol and Philip Norfleet
- RD Olson Family
- OVID Napa Valley, David Duncan
- Chef Ross Pangilinan
- Pelican Resort, Tom Donovan
- Nancy and Geoffrey Stack
- Vineyard 29, Anne and Chuck McMinn

cystinosis RESEARCH FOUNDATION | RESEARCH HOPE CURE

cystinosisresearch.org (949) 223-7610

EVERY BREATH *is a* SECOND CHANCE

Samantha Ann Grover, 30, born on October 5, 1988, in Exeter, New Hampshire passed away gracefully and peacefully on Wednesday, April 24, 2019 after a long and courageous battle against cystinosis. She resided in Fruitland Park, Florida at her time of passing but spent most of her life in Epping, New Hampshire. Samantha's loving family and friends loved and supported their "Angel." Samantha flooded her family and friends with her positive attitude throughout her cystinosis battle knowing that "every breath is a second chance" and that she was committed to, in her words, "Just Keep Swimming."

Samantha lit up a room with her infectious smile and laughter, bringing light and love to all that knew her. Samantha inspired so many people. The people she knew and met described her as a superstar, fighter, kind and strong. Along with crazy, humorous, loving, a sweet soul and strong in her faith. Samantha has departed this life to a place where she will be embraced by her Holy Father, free of any pain and suffering.

She leaves behind a large and loving extended family. Her mother and stepfather Christine and Timothy Rohan, father and stepmother Kevin and Mary Grover. Brothers and sisters Brandon Grover, Tim Rohan Jr., Jason and Katie Cook, Josh Cook, Justin Cook, Katie Rohan and Allison Grover. Grandmother and husband, Carol "Nana" and Richard Emmil. Grandmother Mary Desroches-Wilson, grandparents George and Florence Grover. Uncles and aunts Skip and Amanda Smart, Mac and Lynn Rohan, Paul and Beth Rohan, Tim and Rae Conroy, John and Krissy Rohan, Karen Grover and Tom Haas, Dawn and Ron Drew, Paul Dibenedetto, Bill Rohan, Mike Elliott, John Elliott, Katie Rohan, Amy Edwards. Samantha was predeceased by her Aunt Tabetha Smart and Uncle Pat Rohan. Grandfather Willis "Bampa" Smart, Great Grandparents Raymond and Mary Smart, John and Dolly Jackson. Great grandmother Barbara "Nana" Desroches. Along with her family, she leaves behind her four-legged daughter "Bella" who she loved deeply.

Samantha and her mom Christine. Photo Courtesy of Amanda Van Meter Burch of Avy Photography.

12-year-old Henry Sturgis shares his informational *(and entertaining)* presentation telling his story and teaching about cystinosis.

Henry showed that he is an impressive and mature 12-year-old at this year's 11th Annual 24 Hours for Hank ski event in Sandpoint, Idaho, where he shared a PowerPoint presentation on his cystinosis journey. His presentation was both informative and entertaining and audience members left with a better understanding of cystinosis and the roll it plays in Henry's day-to-day life.

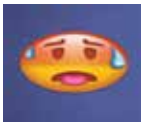
BEGIN

Why is cystinosis so hard to cure?

I have a disease called cystinosis. It is a disease where I have to take meds to help protect all the organs in my body, including my eye. Here is the most important pill. I have to take thirteen of them, twice a day.

NEXT

- **I take five different meds everyday.**
- **That equals 49 pills a day, everyday! I can't skip.**
- **Plus eye drops.**



Another thing that is different about me is that I have different body parts. My eyes are also different. I'm supposed to take eye drops every hour. Without them I would go blind. The eye drops BURN!!!!!!!!!

NEXT

NEXT

Kids that don't take meds only live up to 10 years old. Max age with meds is 45 in age, but the CRF almost has a cure sooooo...

NEXT

24 Hours for Hank gives all of our money to the CRF. The CRF funds research for a cure!

All they need to do is extract the bad cells and make them good and they will fight the rest off.

NEXT

It has taken more than 12 years so far.
The CRF gave some mice cystinosis turning them green.
They gave them the cure.
And the mice turned back to white!
Next step is to use the cure on humans
We just need an approval letter from the FDA.

END

Theater Queen

By Elizabeth Chaffin, Kaitlynn's mom

SEALY, TEXAS

I SPEND MY DAYS AND NIGHTS worrying about a tiny, blonde, porcelain 17 year old girl. She is the last thing on my mind when I go to sleep and the first person I talk to in the morning. My daughter Kaitlynn has cystinosis. She was the recipient of a donor kidney in August 2018. She takes her Procysbi® and her immunosuppressants, and we are so fortunate that she no longer has to take many of the supplements that were replaced because of the newly functioning kidney. Kaitlynn also managed to avoid dialysis while she teetered below 20 percent kidney function for two years.

Cystinosis is an overwhelming part of my life. I have support from my mother, Kaitlynn's grandmother, who lives one block away and amazing support from Kaitlynn's honorary other mother, Erin Moore. Mrs. Moore has been Kaitlynn's theater teacher throughout her high school career. Kaitlynn has been actively involved in theater and Mrs. Moore has been actively involved with all things Kaitlynn. Mrs. Moore has checked on us regularly and truly embodied a parental role. In addition to theater, Kaitlynn has a beautiful singing voice courtesy of Matthew Kent, her choir director. Kaitlynn's busy schedule with theater and choir has kept her fighting. She had always said she could not do dialysis because she did not have time; I was dreading the day when she would no longer have a choice. Kaitlynn made it, barely, but thanks to Mrs. Moore and Mr. Kent she made it. Kaitlynn received her kidney just before the start of her senior year and only missed four weeks of school. Since her return, Mrs. Moore and Mr. Kent have been actively involved in seeing my baby girl through her senior year. Mrs. Moore even includes instructions on how to become an organ donor on the programs for all of the shows.

I have said that Kaitlynn is my greatest worry, but I am so thankful that I worry far more about Kaitlynn and her health than she does. Kaitlynn has been unstoppable. She doesn't often discuss her illness, but when she does she makes sure to let you know it does not affect her. When I say Kaitlynn stresses me terribly, most of the time she has me pacing because of normal teenage behavior. I have celebrated and cursed the monumental moments of her poor judgment. I thankfully worry about her cell phone use, her boyfriend (I could totally do without), her driving habits, how many friends she has crammed into her room, what kind of party she is attempting to throw when no one is home and her non-medical absences from certain classes. Kaitlynn, through and through, is a very typical, mouthy, dramatic teenage girl. I beam with pride to hear how she makes friends, how she responds to those who may attempt to insult her, her genuine likability and, yes, even her ability to skip school. Although she has been through so much and still has a long road in front of her,
I find minimal peace in knowing that Kaitlynn will always be my very strong-willed little girl who has somehow overcome adversities that were never deserved.

MR. KENT AND MRS. MOORE

SETH deBRUYN

SETH'S CIRCLE OF HOPE 2018

By Kristen Murray, Seth's mom

CALGARY, ALBERTA, CANADA

Hope (still!) Shines Bright

October 21, 2018 marked the 5th anniversary of our son Seth's diagnosis with cystinosis. We commemorated the day by once again joining in Seth's Circle of Hope, a celebration that we initiated in 2014 and that has since grown beyond our wildest imagination.

When we were first acquainted with cystinosis, we were shrouded by fear and sadness and felt hopeless as we contemplated an ominous path ahead. As difficult as the journey at first seemed, darkness soon gave way to light. Light flickered as we were showered by the love and support of family and friends. It glimmered as we learned about the CRF…sparkled as we acquainted with heroic children, adults and families living with cystinosis…beamed as we witnessed our beloved son living so happily and courageously… with cystinosis.

To honor the light in our lives, and to 'reclaim' the first anniversary of Seth's diagnosis as a space for joy and hope, we invited our family and friends to join us in lighting a candle on October 21st, 2014 at 7:00 pm, MDT, the precise time at which we had received Seth's diagnosis the previous year. We were overwhelmed by the incredible response to this initial gathering that we called 'Seth's Circle of Hope.' We were moved by the love, hope and strength that boldly shone as hundreds of people across the globe, from Canada to Norway to Bhutan to Mexico City, lit candles together in honor of Seth and all who live with cystinosis. We were touched by the generous donations to the Cystinosis Research Foundation in Seth's honor that would follow.

Four years later, our Circle is stronger and brighter than ever. Seth's Circle of Hope has become a special event in our lives, and in the lives of our large, extended family, friends and even friends of family and friends whom we have yet to meet. And so, as we lit our candles in October 2018, we were empowered by the positivity that seemed to tangibly emanate from our expansive global community. We were also inspired by the love and support that streamed from new-found friends in our neighborhood and by the amazing strides that Seth and Leif's schoolmates (and their parents!) took to join and strengthen our Circle of Hope.

Thrilled as we have been to find ourselves in the midst of a strong neighborhood community, we were hesitant to share our journey with cystinosis with new neighbors and friends for fear of burdening them with the 'weight' of our reality. Our concern dissipated, however, as we invited families to join in Seth's 2018 Circle of Hope, and as they enthusiastically gathered round. Without hesitation, many families expressed their appreciation for an opportunity to partake in a unique invocation of light and hope and joined us in lighting candles on October 21st. Clad, as we would learn, in everything from Halloween costumes to pajamas as they gathered - our new-found neighborhood friends surrounded us with love and positive intention. They bolstered our circle and brightened our hope.

The light generated in our Circle of Hope continued to shine as our neighbors transformed positive intention into incredible action. We were inspired by the generosity of neighbors Alison, Francesco and their children. We had shared a little about cystinosis with Alison and Francesco

prior to our circle and described how their son, Seth's classmate, eagerly volunteered to join Seth in his daily 'walk' to the office to take his medication on school days. Their son's enthusiasm helped Seth to embrace a new perspective on 'afternoon meds' as opportunity for adventure, fun and friendship; an 'event' to be shared and enjoyed.

We were touched by Alison and Francesco's compassionate response to this story, by their concern for Seth's health and by their interest in the CRF's hopeful mission. Not only did the family happily join in Seth's Circle of Hope, but they made a generous donation to the CRF in Seth's honor. Downplaying their contribution, Alison and Francesco shared that they 'simply' wanted to support the CRF, an organization they recognized as giving hope to all who are impacted by cystinosis. Their gestures have had profound impact on our family, offering us strength, comfort and enhanced sense of community as we navigate our journey with cystinosis.

WE WERE EMPOWERED BY THE POSITIVITY THAT SEEMED TO TANGIBLY EMANATE FROM OUR EXPANSIVE GLOBAL COMMUNITY.

And light would continue to shine on our pathway. Just a month after Seth's Circle of Hope, our neighbors Candace and Evan hosted a wonderful party at a local indoor bike park to celebrate their son's 6th birthday. It was the second party of its kind, as the family had hosted their first fundraiser for Seth as part of a combined birthday party for both of their children a year earlier. At each of these special events, Candace and Evan invited guests to donate to the CRF in Seth's honor in lieu of gifts and generously offered to match all proceeds. Demonstrating empathy beyond their years, their children selflessly embraced the idea of foregoing gifts in the interest, as they said, of 'helping Seth's doctors find a cure for cystinosis.'

As always, the family's guests enjoyed laughter, delicious food, adventure and high energy celebration. Post-party, Candace and Evan presented generous donations to the CRF in Seth's honor. We are grateful for the family's strong community spirit. We are moved by their thoughtful and creative effort to support the CRF and are strengthened by their continued joy, kindness and collaboration.

And so, we reflect on the success that was Seth's Circle of Hope, 2018. Joining together with a remarkable community of friends and family and new-found neighbors, we lit our candles, celebrating the gifts of friendship, love and hope that we have in life. Joining in thought, and also in deed, we collectively raised more than $21,000 to support CRF researchers in their mission to bring forth better treatments and a cure for cystinosis. With wonderful new friends and neighbors, and encircled by a loving community that radiates beyond, we rekindled hope for a future in which light, health and happiness abound.

IT'S ALL ABOUT

By Katelyn Campbell, Alan and Nora's mom
WALLACEBURG, ONTARIO, CANADA

A one in four chance that every child we have could be born with cystinosis. Those are scary odds when you are planning your family. We had imagined a family with two or three children, and the thought of them having any health complications barely crossed our minds.

When Alan was diagnosed in April 2016, I said there was no way we could have more children. We would be a family of three. As time passed, we settled into a life that included cystinosis, and those odds started to sound more approachable. We started to feel more confident in our ability to love and care for Alan and another child, with or without cystinosis.

When Nora's diagnosis came at five days old, I questioned that decision. Could we really raise two children with a rare disease? Were we strong enough to be everything they needed us to be? I was feeling a roller coaster of emotions, the happiness of bringing home a new baby and the difficulty of accepting her diagnosis. The thought that we were unlucky to have had not one, but two children with cystinosis crossed my mind more than once in those first few days. I was feeling anger, sadness and fear for what was to come. I was frustrated that the joy of bringing Nora home was being overshadowed by her diagnosis.

But luck, as I have come to see, has a lot more to do with your perspective. From where I am standing today, I see blessings all around me. We have access to health care and medications that support our rare children and our parenting journey with them. We have family and friends who support us, help us and lift us up when we need it. We have our cystinosis community that we draw strength and inspiration from. We have the Cystinosis Research Foundation that fuels our hope and keeps us connected.

Most importantly, we have Alan and Nora.

Alan is now 5 years old and in full day senior kindergarten. He has an amazing personality and makes us smile everyday. He is imaginative, funny, kind and curious. Watching him be a big brother to Nora has been one of our greatest gifts. The way he loves her, looks out for her, cherishes each hug and kiss she lets him have is a daily light in our home. Alan is interested in Pokémon, Star Wars, Goosebumps, and playing with his friends and family. He is becoming so independent and has been growing like a weed.

Nora is 18 months old and changing every day. She has been more active lately, scooting around the house, crawling and pulling herself up to stand. We are so deeply in love with our sweet girl. She loves getting a laugh from the people around her, repeating her actions over and over to try and reproduce the laughter. She loves reading books, playing with her big bro, and any time her dad walks into a room. Nora is so curious and smart. She is learning many new words and has us wrapped around her little finger.

Adam and I are two of the luckiest people in the world. We get to be Alan and Nora's parents, and we get to experience this life with them. We have met so many caring, generous people who have come into our lives because of this diagnosis. Being their mom has helped me become a better person – a kinder, stronger and more compassionate person. There are no two other children that I would wish to call my own. I am so lucky they call me mom.

PERSPECTIVE

READ ABOUT THE CAMPBELL'S FIRST FUNDRAISER, "GALA OF HOPE" ON PAGE 75

HOPE for HAYDEN

Discovering a Loving Community

By Angela and Nick Kirchhof, Hayden's parents

DENVER, COLORADO

Our daughter Hayden was diagnosed with cystinosis on November 28, 2018, when she was 14 months old. Over the past several months, we've been overwhelmed by grief – but we've also been lifted up by kindness, love and support from our community, family and friends.

In the days that followed a visit to the pediatric nephrologist, where we first heard the word "cystinosis," we scoured the internet and Facebook for information. We were desperate to find anything that proved the nephrologist wrong – something that would let us go back to the days before we knew about this disease. Instead, we found a community of people describing experiences that were too familiar for us to ignore, talking about a reality that would soon become our own.

In those first few weeks, we were careful about how much we let ourselves read, as it was too much to bear in the middle of the night when sleep was nowhere to be found. And frankly, we still worry about Hayden's future today. But something else happened in those first few weeks that made it easier to face our new normal – and that was the multitude of kind messages coming through on Facebook from families that were like ours, offering words of comfort and reassurance that things would get better.

When we shared our story with our network of family and friends on Facebook, we were blown away by the outpouring of support. We were so thankful to have connected with Nancy Stack and the Cystinosis Research Foundation, so we could direct people's financial support toward an organization that is working so tirelessly to find a cure.

Our community has donated more than $34,000 to the CRF in three months, and we're earnestly planning more events this spring. In April, Nick's alma mater, Fort Lewis College, is holding a goal-a-thon with the men's soccer team. And during the month of May, a relative is donating 5 percent of the profits from her small business in Hayden's name to the CRF. Many others have also offered support, and we plan on having more events to help spread awareness and raise funds throughout the year.

We're still learning about life with cystinosis, and not all days are easier than the ones that came before. But we have found that we're getting stronger, and what makes it possible to face each day is Hayden and her big, infectious personality. She's eager to greet anyone that meets her eye, and has never met a dog she doesn't like. Hayden is our daily reminder of what it means to be resilient, strong and to have a love for life.

The hard work and determination from so many people has given us so much hope for a cure, and for that we will always be grateful. We look forward to the day when Hayden will be able to speak about the disease she had as a kid that no longer has impacts her daily life.

HAYDEN IS OUR DAILY REMINDER OF WHAT IT MEANS TO BE RESILIENT, STRONG AND TO HAVE A LOVE FOR LIFE.

HOPE *for the* BRIGHTEST FUTURE!

By Heather Wegerif
CALGARY, ALBERTA, CANADA

SHINE Bright

THE STUDIES I PARTICIPATED IN WHEN I WAS IN GRADE SCHOOL HAVE PLAYED A HUGE ROLE IN GETTING ME THE ASSISTANCE I NEEDED TO BE SUCCESSFUL.

HELLO, my name is Heather Wegerif. I am 28 years old and I live in Calgary, Alberta, Canada. I was diagnosed with cystinosis when I was 13 months old by Dr. Paul Goodyer, when my family temporarily lived in Montreal, Quebec. Four years ago (March 5, 2015) I had a kidney transplant that came from my mom, Louise. She was always the one who wanted to be tested first. (Although, when the time came, both my two older sisters were ready and willing to be tested, too.) I know I am lucky to have my entire family wanting to be tested, and I was also fortunate that I didn't need to go on dialysis beforehand.

I have been closely followed by my pediatric nephrologist, Dr. Julian Midgley, for 25 years. After I turned 18, instead of leaving the children's hospital and going into adult only care, I (and all his other cystinosis patients) was given special permission to continue to be followed by Dr. Midgley at the children's hospital only for cystinosis care. My transplant-related care would now come from the adult hospital.

After I transitioned from the children's hospital into the adult hospital, it took a while for someone who knew about cystinosis, or had an interest, to take me on as a patient. Adult nephrologists generally have little knowledge of cystinosis. Being one of the oldest with cystinosis in my community and now going into a regular renal program, the first few appointments were filled with, "your potassium levels are low… eat more bananas." I just smiled and nodded.

Now, post-transplant, I have my own nephrologist who is following me and Sophie (that's my kidney's name). I am seen regularly at the "Transplant Clinic," but I am seen almost twice as often at the children's hospital by Dr. Midgley for cystinosis care. I think that just speaks volumes as to the level of care Dr. Midgley provides for his cystinosis patients.

Last year I started taking the new delayed release drug Procysbi®. What I like the most about it is taking my pills every 12 hours instead of every six hours. Now the timing of all my pills for the Procysbi® and transplant pills time together nicely. BUT I do miss having grapefruit juice!

In the last few years one of my accomplishments is becoming a Registered Dental Assistant. Going to school full-time was something I was not able to do pre-transplant. My kidney transplant was one year before I started my school program. My unsung heroes during the program were the learner support staff and the assisted technology that got me the help I needed to be successful because of my learning disability. I have a cognitive learning disability, another effect that is part of cystinosis. I have been part of Dr. Doris Trauner's studies over the past several years. The studies I participated in when I was in grade school have played a huge role in getting me the assistance I needed to be successful. I want to say a big "thank you" for all the research being done for cystinosis. It gives us all so much hope for the brightest future!

ROLLING WITH THE PUNCHES
A PROTOCOL FOR PATIENCE

By Kim Waldron

SARATOGA SPRINGS, UTAH

ALMOST 17 YEARS AGO

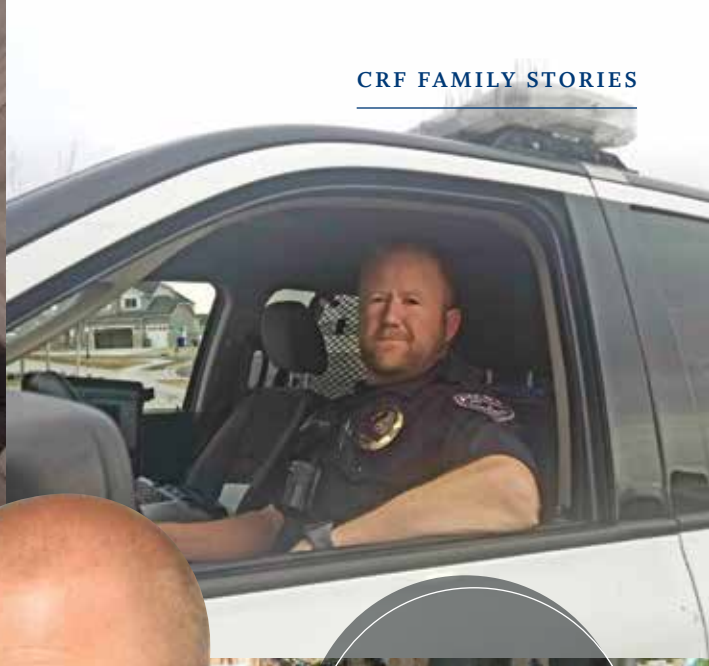
I met my soulmate. At the time I did not think of the challenges that might lie in our future. All I knew was I had met someone who cared, listened and was strong. Someone who approached life with a sense of humor, something I had been lacking in my life. Brandon is unlike anyone I had ever met. Before I even knew of his struggles with cystinosis and everything he had already been through in his life, I knew I had never met someone as patient as him – and believe me that is what you would need to be married to me. I know I can be strong-willed and frustrating. Before we were engaged, I had the first surgery of my life. I had an umbilical hernia repair that was missed when I was a child. I was sick afterwards and in a lot of pain. He stayed by me and held my puke bucket, and right then I knew he was the one. I know, glamorous!

I remember when Brandon first told me about cystinosis. He asked me if I ever noticed a smell, which I had not really noticed, and he proceeded to give me a brief overview of the condition. It did not scare me, we all have things physically and mentally that we deal with. I then looked it up on good ole Google and the thing that I read that terrified me the most was the life expectancy. Here I was looking at a man who was fit, strong and healthy. How could he have a life expectancy so short? I brought this up with him and he gave me examples of others who have far surpassed the numbers I saw and that they were outdated. A few short months later we were married.

Life was going well. We had just bought a condo and we wanted to start a family. We knew it might be hard but did not think the answer we would receive is that we had zero percent chance of ever conceiving a baby due to cystinosis and/or him being post-transplant. I was devastated and I admit now I did not even think of how much this hurt him. His whole life has been hard work. Hard work in school that I took for granted because it came so easily to me. Hard work to stay fit when he is so tired from all the medicine. Hard work to go to work even if he is having a "Cystinosis Day." Then this, something that comes so easy for so many was again hard work for him. Through all of this he never complains and just rolls with the punches he is dealt with.

One of those punches was when he decided to switch careers and follow his dreams to become a police officer like his father. He gave everything he had into the academy and at 37 was passing all the physical requirements expected of him, but the studying was difficult, and he missed passing the first block by two questions. If he wanted to try again, he would have to wait nine more months. Deciding to go back was not an easy decision. He was working a full-time job, and then had to attend school from 5-9:30pm each night and all day Saturday. We hardly saw him during that time. Many would just give up at that point since it was such a sacrifice the first time. Brandon came right back and passed first block, then passed second block and was recruited by a department that he had been volunteering with for seven years prior. His hard work had paid off, and in 2018 at the age of 38 he became a law enforcement officer.

In summary, I am grateful for cystinosis, not for the disease itself, but for the man it made my husband. Without sitting in doctors' offices for hours and making glove balloons or playing jokes with his mom during those visits, I would not have the patient husband I have today. Without having to work so hard for everything in his life he may have given up on his dream of becoming a police officer at 38 years old. Cystinosis gave us our two beautiful daughters who we would not have had we not had to look at other ways of growing our family. For all those things I am grateful for cystinosis and the man it has formed.



HIS HARD WORK HAD PAID OFF, AND IN 2018 AT THE AGE OF 38 HE BECAME A LAW ENFORCEMENT OFFICER.

Hearts for Hadley

HADLEY WAS SELECTED AS THE CHILDREN'S MIRACLE NETWORK 2019 CHAMPION FOR ST. LUKE'S CHILDREN'S HOSPITAL

Dancing with the star

By Marcu Alexander, Hadley's mom

BOISE, IDAHO

When Hadley was diagnosed with cystinosis in April 2012 at 18 months our lives were drastically changed. It was such a relief to finally have answers and a plan for treatment, but the news was devastating and the unknown was terrifying. We attended our first CRF Day of Hope conference two weeks after diagnosis and dove head first into this new world without looking back. We began raising money and awareness for cystinosis research. Our goal was to share our story and information about cystinosis with anyone who would listen. Beyond making sure Hadley was well medicated and seeing the right specialists, it was the only control we had over the disease. We started our non-profit Hearts for Hadley and began holding fundraisers to raise money for the CRF.

We're now seven years into our cystinosis journey and are even more committed to spreading the word and raising money for this relentless disease. I'm always looking for new and creative ways to share our story and raise awareness, so when Hadley was selected as the Children's Miracle Network 2019 Champion for St. Luke's Children's Hospital, we happily accepted. Each year, Children's Miracle Network (CMN) hospitals select a young patient to act as a spokesperson for the hospital and share their personal health experience to help raise awareness and money for their CMN hospital. We are so grateful for St. Luke's Children's Hospital and feel fortunate to have the opportunity to give back to them.

As Champion, Hadley gets to participate in several local events over the next year to help raise money for St. Luke's. The hospital welcomed Hadley in February with a cookies and milk reception to introduce her to the community and share a little about her life with cystinosis. The team made her feel so special and was thoughtful to include her big sister, Stella, in the whole process. Miss Idaho even came to Hadley's party, which really blew her mind!

The first big event that our family had the honor of participating in was a dance marathon at Boise State University. Boise State Dance Marathon started in 2012 by a couple of students wanting to raise money and make a difference in the lives of the young patients who are seen at St. Luke's Hospital. Students fundraise throughout the year and the conclusion is the dance marathon where hundreds of BSU students fill the recreation center on campus and dance their hearts out for 17 hours!

The event has grown exponentially since 2012 when $5,000 was raised for St. Luke's. This year they raised an incredible $208,000. The amount of effort the students put in to make this event fun and successful is inspiring! Hadley and many of the previous St. Luke's Champions were welcomed with open arms and made to feel like the stars of the show. Two students were assigned to each child to make their time at the event as special as possible. We had friends and family come join in on the fun during the five hours we were there. The kids had a blast dancing, playing games, eating pizza and dominating the bounce house. Our family took to the stage to introduce everyone to Hadley and share our story about cystinosis. We connected with other local families whose children are dealing with serious medical conditions and who share our love for St. Luke's and the great care they provide to our kids. Each family is dealing with different circumstances, but I always feel an instant bond when I meet another mother who has a sick child. It's almost as if we share a secret language. It's the same feeling I get every time we go to the CRF Day of Hope family conference!

When it was time for all the kids to leave the dance marathon, the students formed a "Tunnel of Hope" for each family to pass through with their Champion on the way out. I couldn't help but get emotional as these incredible young adults cheered our kids on and showed them such love and compassion. It's moments like that which remind me of the goodness in people. We are so grateful to live in a city that cares so much about community. We also witness this every time we put on a Hearts for Hadley event and it makes me so happy we decided to move to Boise almost six years ago.


I LITERALLY PUSHED OUT OF MY CHAIR AND SHOUTED "WHAT!" AND THE BIGGEST SMILE OVERCAME MY FACE.
Tina

14 years ago

my life changed forever

By Tina Flerchinger

CLARKSTON, WASHINGTON

Hello, my name is Tina Flerchinger and I am a freshman in high school. Living with cystinosis over the past few years has been challenging, but it has made me into who I am today.

Just like every other cystinosis patient, I have grit. Grit is a necessity to conquering cystinosis. Grit has helped me get through every day, including when I was 17 months old and lived in the hospital for over a month; I even had a G-tube for seven years in order to get all my medications and nutrition. Growing up, I continued to take medications and in middle school I got a shot every night. I have made frequent visits to the emergency room because of dehydration. Now, I take 70 pills a day, as well as administer eye drops five times a day. At least once a week, I experience a day where I throw up my morning medications and must retake them, causing me to have a headache, feel nauseous, and sometimes vomit for an entire day. I know that my determination and grit have gotten me through these tough times and continue to get me through every day of my life.

When you have cystinosis your body is fighting a battle on the inside. But I have learned that cystinosis doesn't stop me. I can still get straight A's, play tennis, ski, boogie board and talk about politics (my favorite topic). I have learned that my abilities are not limited by my disease. Cystinosis has built my character and has helped me overcome many challenges in life. Therefore, I know that with determination, I can do anything I set my mind to. I have learned over the years that cystinosis does NOT define me…I define it.

When I found out that a cure had been approved by the FDA for a clinical trial, I was eating dinner with my family. I was thrilled after years and years of waiting for this day to come. I literally pushed out of my chair and shouted "What!" and the biggest smile overcame my face. It didn't seem real. I am so excited for what the future holds for me and my cystinosis friends. This is just the start of our journey, not the end. I am excited that we have found the cure, but I also understand that I still need to continue to take my many medications because it is just as important now as it was before. When the day comes for me to be cured, I will be ready. For now, I need to make sure I stay as healthy as possible. I am thankful to Natalie for making her wish, as well as Dr. Cherqui, Nancy and Jeff Stack, all cystinosis families and communities who support cystinosis research, and God. Thank you for helping a dream become reality.

A Dream Come True

WE ARE ONE STEP CLOSER TO A CURE

By Teresa and Kevin Partington, Jenna and Patrick's parents
SACRAMENTO, CALIFORNIA

Yesterday, Kevin and I returned from a board meeting of the Cystinosis Research Foundation, which we are proud to have served on for 13 years. It has always been a remarkable thing to watch the Cystinosis Research Foundation at work. As a supporter reading this publication*, you should be made aware of the high level of accountability and professionalism that the CRF operates on. Here's what a typical meeting agenda looks like:

A Chair Report by Nancy Stack, President (she's got brains and tenacity, and she runs the CRF like a well-oiled machine)

A Research Report by Stéphanie Cherqui, PhD, (who has cured mice of cystinosis and is about to enroll her first human patient)

A Gifting and Funding Report by Jeff Stack (every donation received and every study funded is impeccably reported)

A Financial Report by Don Solsby, Treasurer (he presents a very transparent balance sheet and regular audit reporting)

And finally, Family Foundation Reporting allows me, Kevin and other parents of children with cystinosis who sit on the board, to offer updates on our children and what we are doing in our region to raise money to pass along to the Cystinosis Research Foundation

We gather twice a year, and each meeting has seen us taking baby steps closer to a cure for cystinosis. Yesterday, members of the board held back tears as Stéphanie Cherqui detailed the big steps ahead: phases one and two of the first FDA-approved clinical trial for stem cell and gene therapy for humans with cystinosis. By the time you read this, the first patient may very well be undergoing treatment at UCSD.

As most of you reading this update know, my children Jenna and Patrick both have cystinosis. The way their genetic disease has shaped their bodies, minds and spirits is the only way Kevin and I have known them. We love them exactly as they are, which has made it easy to keep our hopes and visions for their cure at a distance. It's a protective way of thinking, a way to live in the present, a way to cope with the day-to-day and keep from getting ahead of ourselves. But yesterday, as I listened to what Dr. Cherqui will soon be setting in motion, I let myself "go there" for a moment. The science behind this potential cure has seemed impossible, far-fetched or too science-fiction for my thinking. But she reminded us that other systemic diseases have been cured by treatments like the one proposed for cystinosis. The FDA, a painstakingly cautious and overwhelmed entity approved Dr. Cherqui's submission IN JUST 30 DAYS, WITH NO COMMENTS.

Are you kidding me?! This JUST. MIGHT. WORK!

While I love the twins just as they are, the idea that they might enjoy longer, healthier lives, free from pain and myriad medications would be icing on the cake. More than we could ever ask for. A dream come true.

In the meantime, Jenna and Patrick have chosen their high schools. They will be attending different schools – breaking away from one another during their day-to-day for the first time in their lives. They are ready to move on from the magical place that is Holy Spirit School (though I'm not certain I am!). The twins are working on comprehensive "Exit Projects" regarding their topic of choice. Patrick will research, write and speak about the history of the American roller coaster. Jenna

*This publication is completely underwritten. No donor dollars are used in the creation and distribution of Cystinosis Magazine.

is covering the history of the Screen Actors Guild. To know their choice of topics is to have a pretty good idea of their personalities and passions at age 14. Their eighth grade class has been given uniform freedoms for the final trimester. Students can wear college sweatshirts of their choice (Jenna dons a bright green Notre Dame hoodie, Patrick chose a navy University of San Diego sweatshirt with a subtle logo). Jewelry has been approved for girls and Jenna left for school today with about six mismatched bangles hanging from her wrist.

The kids' overall health is pretty good right now. Patrick's knocked-knees have straightened just as we'd hoped as a result of his surgeries. Jenna's are not correcting quite as quickly, if at all, so we continue to watch and hope for good results. Neither of them is quite able to run, so strength and fitness is something we try to focus on, but stamina is low, and they are quick to exhaustion.

Jenna and Patrick are about three years from the average age of kidney transplantation for people with cystinosis. Their creatinine levels have slowly risen over the years, validating the prediction that they will likely need a transplant during their high school tenure. But now, we have a stem cell transplant to consider. The timing for their potential enrollment in the trial, or treatment after FDA approval, is on pace with kidney transplant predictions. It's troubling to have to think about kidney transplants, but the idea that Jenna and Patrick might have an alternative is surreal.

In the meantime, our family and Jenna & Patrick's Foundation of Hope will continue to create awareness about cystinosis and raise funds for research projects (more than 35 are currently underway), as the nuances of this systemic disease become better understood and improved treatment options become available. Our next event will be the "Swing #9" golf tournament which will be held at Catta Verdara Golf Club on October 3, 2019. We will take a break from the "Bling" dinner event this year, focusing our efforts on getting two high school freshmen acclimated. A letter campaign will take the place of Bling #9, so plan to hear from me again via mail in fall 2019.

As you read our updates twice a year, you are accompanying us on our family's unique journey. While coming up with these words can be emotional, I have come to appreciate having a place to share the piece of our lives that is cystinosis. We tend to avoid indulging thoughts and concerns about the disease, as we live day-to-day. What Kevin and I do acknowledge each day is our gratitude for our lives together, our two great kids, our supportive community, our loving families and friends, and the progressive, professional charitable organization that is the Cystinosis Research Foundation.

We are Blessed!

"Around the

Aliyah, 8 years old

One of the first phrases that our family heard upon Aliyah's diagnosis was that her medication schedule would be "around the clock." This daunting reality became all-consuming very quickly, as we set cell phone alarms throughout the day for doses every six hours. For a long time, it seemed that this schedule would swallow up our lives, interrupting play dates, swimming lessons, class time, and most notably, sleep. But we are so very, very grateful that treatments exist for this rare disease, and to this day every sacrifice is worth the health of our beautiful girls.

In considering a variety of fundraising options recently, it struck me that introducing our friends and family to the reality of an "around the clock" schedule might be enlightening and interesting for those who didn't know what life looks like with cystinosis! And so we embarked on what felt like an unusual and somewhat intimate personal-challenge fundraiser – a facebook group, whereby participants set their own alarms every six hours and joined us at each dose for three days. We shared videos of Aliyah taking her eye drops, of Madelyn filling the little pill containers for the week, and of Bob and I (Crystal) washing 180 syringes to fill. Participants' alarms rang at 2am with ours, and watched us on live video prepare and administer the dose in the dark. One night, they even heard me redirect a sleepy Aliyah out of the closet on her way to the bathroom!

For us, the fundraiser was also a learning experience, even though we live with the around the clock reality every day. For starters, showing up on facebook at exactly 8am, 2pm, 8pm and 2am was very challenging, as it added an additional task to the interruption of meds but also, we realized that typically we give ourselves about 10 minutes of grace time on either side of the clock. We also realized that sharing everything that we did with cystinosis was a little unrealistic, and more importantly, very intrusive to our participants! For instance, we didn't share the preparation of meds for school, or the 8 doses of eye drops; we didn't stay online while we cleaned the syringes after each dose, or when I drove out to pick up meds and medical supplies. In eliminating these things, our reality suddenly seemed less complicated, but our participants seemed to feel that their alarms were constantly buzzing.

Clock"

By Crystal Walker, Sara, Aliyah and Madelyn's mom
CALGARY, ALBERTA, CANADA

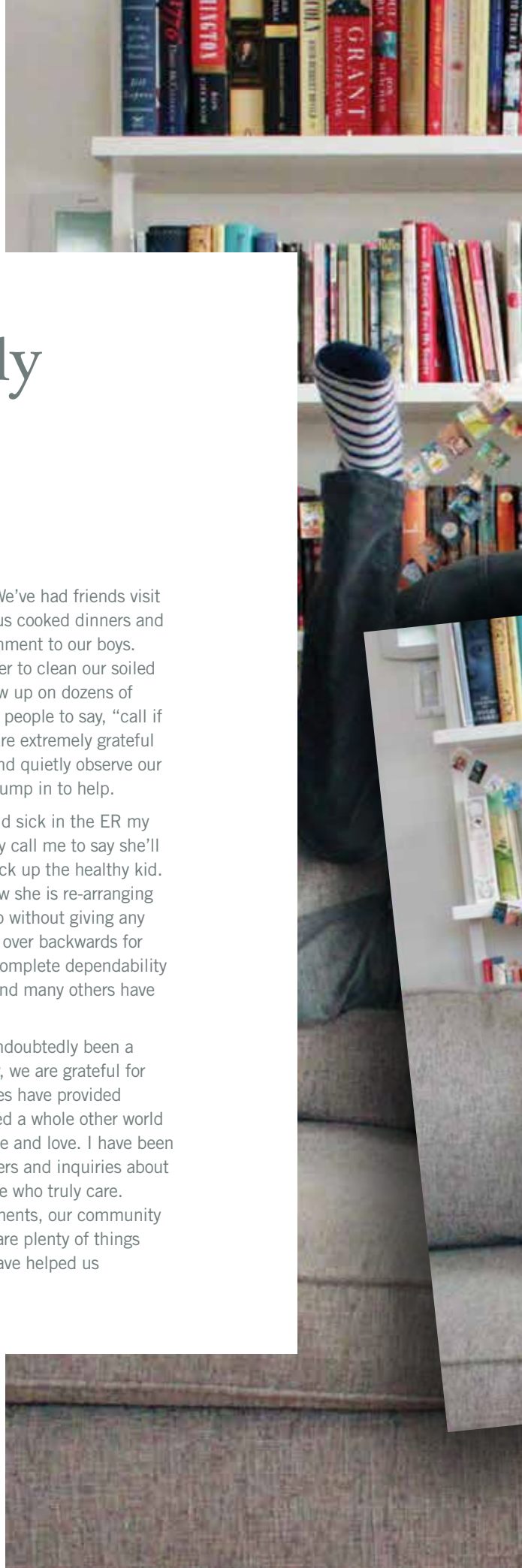
We also learned about the realities some of our friends experience with diabetes or kidney conditions, and recognized our similarities and connections with others living with health conditions. And, more importantly, we remembered afresh that our children are healthy, thriving, and active. We took care on the videos that our language about their "disease" is always cautious, seeking to encourage the girls to live strong, compassionate, and grateful lives and to recognize that while they may have cystinosis, they are no better or worse and no weaker or stronger than anyone around them, but that in fact, it is the depth of their character that makes them who they are.

We continuously are energized and excited by the work supported by the CRF, and felt so privileged to be able to share specific areas where our friends' and families' dollars go to create new and better treatments…and with hope and perseverance, a cure!

The week following Around the Clock surprised us. After the intensity of allowing our friends and family into our lives so intimately, we thought that cystinosis would take a back-burner in our days, but it carried on being its intrusive self. A child in Aliyah's class had told other kids he wouldn't play with her because she smelled bad. Courageous Aliyah countered that he wouldn't make a very good friend if that was how he approached people! And it became apparent that Aliyah's medication schedule consistently interrupted her favourite subject at school, causing us to develop some creative methods for medication administration so that she wouldn't have to leave her classroom. That same week, we adjusted all of our medication schedules for cystinosis clinic, changing the alarms to accommodate for the blood draws.

CYSTINOSIS IS A CONSISTENT PART OF OUR CONVERSATION BECAUSE IT IS A CONSISTENT PART OF OUR LIFE, AFFECTING THE TAPESTRY OF EVERY DAY. Sharing these challenges with our friends and family gave them some insight into our lives and us insight into theirs! We remain grateful for every healthy day and for all of the interruptions in our lives that allow us to watch our girls thrive, and we know that their futures are very, very bright!

Madelyn, 5 years old



The Jenkins Family Update 2019

By Ashton Jenkins, Sam and Lars' mom

SALT LAKE CITY, UTAH

Not long ago, Sam was sitting in a hospital recliner at Primary Children's Hospital receiving his ninth infusion for the treatment of membranous nephropathy. I was sitting next to him observing his cute little face. In that moment I felt content with life. As soon as the happy thought crossed my mind, guilt crept in. My thoughts turned to the question, "How can I feel happiness and peace when my child is sick?" Samuel has days when cystinosis dictates that his body slow down and rest. He also has a lot of tough moments on good days when he needs to slip away to find a toilet to throw up in. Though the disease has not progressed far in Lars, he has a similar routine. However, the vast majority of moments that make up their lives are full of happiness and gratitude. Sam and Lars don't focus on the pain and injustice in life. Instead they look forward to building their next Lego creation together or planning who their next play date will be with. They have taught me that I don't need to suffer every time something bad happens because there are so many good things in life to be thankful for. Friends and family are among those good things.

Our family has been surrounded by countless friends and family members who have stepped in to support us when cystinosis seems to trigger chaos in our daily lives. We've had friends visit us in the hospital, bring us cooked dinners and provide valuable entertainment to our boys. I've even had a friend offer to clean our soiled carpets that Samuel threw up on dozens of times. While it is nice for people to say, "call if you need anything," we are extremely grateful for people who lovingly and quietly observe our family's needs and then jump in to help.

When we have one child sick in the ER my sister Whitney will quickly call me to say she'll drive to the hospital to pick up the healthy kid. Behind the scenes, I know she is re-arranging her busy schedule to help without giving any hint as to how she bends over backwards for me. I'm grateful for the complete dependability and generosity that she and many others have shown our family.

While cystinosis has undoubtedly been a huge battle for our family, we are grateful for the growth our experiences have provided us. Cystinosis has unveiled a whole other world of human struggle, service and love. I have been humbled by the kind letters and inquiries about the boys' health by people who truly care. While there are hard moments, our community has taught us that there are plenty of things to be grateful for. They have helped us find happiness.

THEY HAVE TAUGHT ME THAT I DON'T NEED TO SUFFER EVERY TIME SOMETHING BAD HAPPENS BECAUSE THERE ARE SO MANY GOOD THINGS IN LIFE TO BE THANKFUL FOR.

Liv turns 9

By Erin Little, Olivia's mom

PORT ELGIN, ONTARIO, CANADA

We seem to be in a honeymoon phase with Olivia. Everything is just perfect for her, I guess, as perfect as living with a rare disease gets. Olivia has been thriving with stage 3 chronic kidney disease for eight years. Eight years ago, it was predicted that Olivia would have her first kidney transplant when she turned nine years old. We are proud to say that on December 14, 2018, Olivia turned nine and we don't seem to be any closer to a transplant than we were eight years ago. Olivia didn't have a great head start with her diagnosis; her acute kidney failure left her with only half of her kidney function. It felt so unfair in the beginning, and to be honest some days I still feel that she was cheated. It has been our goal from the beginning to do whatever it takes to keep her as healthy as possible because we hoped for the cure someday.

And hope is now closer than ever.

What does nine years old look like for Olivia?

Olivia has become a lot more self-aware and because of that she seems to ask more questions. I can see her struggling to be this new-found little girl and yet she still has a burning desire to play. She still doesn't know she has a disease called cystinosis although her knowledge of what she needs to do to take care of herself daily is astonishing. She has taken on the task of calling the pharmacy for her prescription refills and it's so fun to listen to her be so informative about what she needs. She struggles but never gives up on trying to pronounce the laundry list of medications.

She loves animals so much, and she is in the process of proving that she is ready for her own dog. Olivia dreams of having a Bernese Mountain Dog, one that will sleep in her room and one that she can talk to. Her love for animals is amazing; she's the only one in our family with a passion for animals. We laugh that she chose a pet that could reach 120lbs. because we think she's trying to get a pet as close to the size of a horse as possible. With spring right around the corner, she will be getting back in the saddle and spending as much time in the barn as possible. She even does 7:00am chores once a week with her coach. To be at the barn by 7:00am she must set her alarm for 6:00am wake up, do her laundry, have breakfast and be at the door at 6:45am. She's never been late. She's usually waiting at the door for me to chauffeur her with her water bottle in hand. Olivia started yoga this winter and her strength and determination is unbelievable. She is currently striving to complete an unassisted hand stand; she won't give up until she accomplishes it. Olivia is tired through it all. As her mom, I can see it in her eyes, but she doesn't let that stop her. Watching her fierce determination makes me so proud to be her mother.

We have believed since the beginning that cystinosis wouldn't be forever, and hope is so close we can feel it. The thought that Olivia will one day live her life free of the daily tasks that burden me brings tears of joy to my eyes. I hate to use the word burden because I never want Olivia to think that she's the burden. Let's be honest, there are probably a million other things I would rather be doing than making meds, doing laundry, calling insurance companies, managing appointments and hourly eye drops. I can't tell you how many times I'm in the middle of doing something "cystinosis" and have to tell my girls, "one more minute." We fight hard for her so that one day she will have all her minutes in a day to do what she loves. We continue to hope that all this work is going to give her a life free of all the burdens that come with managing a disease.

CRF Welcomes

NEW MEDICAL AND SCIENTIFIC ADVISORY BOARD MEMBERS

Larry Greenbaum, MD, PhD

Larry Greenbaum, MD, PhD is Division Director of Pediatric Nephrology and the Bernard Marcus Professor of Pediatric Nephrology at the Emory School of Medicine in Atlanta, Georgia. He is also the Director of Pediatric Nephrology at Children's Healthcare of Atlanta. He received his MD and PhD degrees from the Yale School of Medicine, and completed a residency in Pediatrics and a fellowship in Pediatric Nephrology at the UCLA School of Medicine.

Dr. Greenbaum conducts clinical research in a variety of areas in pediatric nephrology, including renal osteodystrophy, cystinosis, urinary tract infections, chronic kidney disease and nephrotic syndrome. He co-edited the textbooks *Practical Strategies in Pediatric Diagnosis and Therapy* and *Clinical Pediatric Nephrology*. He is a major contributor to Nelson Textbook of Pediatrics. He has received multiple awards for teaching residents and medical students. Dr. Greenbaum is serving as the immediate past-president of the American Society of Pediatric Nephrology and on the steering committee of the Pediatric Nephrology Research Consortium. He was previously the chair of the Executive Committee of the American Academy of Pediatrics Section on Nephrology.

Julian Midgley, MD

Dr. Julian Midgley is the past Chief of Pediatric Nephrology at the Alberta Children's Hospital. Dr. Midgley's medical training began in the UK at Cambridge University and then Oxford Medical School. He continued his pediatric training in various hospitals in the UK including a year in pediatric kidney transplantation at Guy's Hospital in London, UK.

Following a nephrology fellowship at the Hospital for Sick Children in Toronto in 1994, Dr. Midgley moved west to Calgary where he was recruited as the first pediatric nephrologist at the Alberta Children's Hospital. In Calgary, Dr. Midgley has developed, along with five colleagues, a complete pediatric service for Southern Alberta including a busy chronic kidney disease, dialysis and transplant program. On arrival in Calgary Dr. Midgley assumed care of a young patient with cystinosis and now follows 18 patients from three years to over 50 years of age.

In addition to clinical activities, Dr. Midgley has varied interests in education from medical students to continuing medical education as well as patient support/advocacy and is a past president of the Kidney Foundation of Canada.

UNITED STATES

Globally, We Shine Bright.

KATIE AHNEN - $1,740

HADLEY ALEXANDER - $104,185

ODIN & ATLAS ARDAIZ - $250

LILY BEAUREGARD - $10,073

JACKSON BLUM-LANG - $300

CHASE CHODAKOWSKY - $1,400

JOSHUA CLARKE - $10,313

CHARLOTTE COE - $245

BAILEY DEDIO - $983

TANNER EDWARDS - $2,825

HOPE FOR BROOKE,
BROOKE EMERSON - $26,905

TINA FLERCHINGER - $43,480

CALEB GOWAN - $2,215

HOLT GRIER - $3,220

SAMANTHA GROVER - $2,260

NICOLE HALL - $10,006

SHEA HAMMOND - $10,218

LANDON HARTZ - $34,446

MARY HEAD - $22,100

SAM & LARS JENKINS - $14,465

Your generosity continues to give hope to those with cystinosis and their families.
THAT HOPE UNITES US
We are one step closer to a cure!

JOSIE KANUPKE - $25,634

SHANNON KEIZER - $428

AARAV KHALASI - $3,923

HAYDEN KIRCHHOF - $15,313

JAKE KRAHE - $3,695

KENZIE LAWATSCH - $13,678

KALEB LAWSHE - $2,295

JACKSON LIMA - $829

LOLA LONG - $71,771

In 2018, our global community helped raise more than **$4.6 million** for cystinosis research.

WE ARE ONE STEP CLOSER TO A CURE

PRESTON LUKE - $1,386

KEEGAN MANZ - $3,529

STELLA GRACE MILLER - $2,220

AIDAN O'LEARY - $72,833

JENNA AND PATRICK PARTINGTON - $306,095

EMMA & GRACIE PATTERSON - $970

MORGAN PEACHMAN - $36,765

HENRY STURGIS - $165,210

EMMA'S WISH, EMMA GRACE SUETTA - $9,221

PEYTAN TAYLOR - $1,160

KADEN THOMAS - $740

WESTON TSCHANNEN MEMORIAL - $10,000

KELCIE WESTMORELAND - $485

AUSTRALIA

ETHAN FENN - $390

NORWAY

DENIS LILLAND - $12,164

SWEDEN

KAROLIS SCHRODER - $5,613

CANADA

SOPHIE'S CHAMPION'S, SOPHIE BETOURNAY - $18,795

NORA AND ALAN CAMPBELL - $28,310

ANDREW CUNNINGHAM - $27,463

SETH'S CIRCLE OF HOPE, SETH DEBRUYN - $21,000

HOPE FOR JAMES, JAMES FEHR - $22,190

AMANDA KUEPFER - $3,311

MARVELED BY MADDIE, MADDIE LAWRENCE - $10,352

MARYLYNN'S ROAD TO A CURE, MARYLYNN LEPACK - $2,375

OLIVIA LITTLE - $141,845

ABBI MONAGHAN - $1,070

ALIYAH AND MADELYN WALKER - $13,615

Family's Facebook Event donations of $73,836 are included in the above totals.

CALENDAR OF EVENTS

We would like to acknowledge all families for their support of cystinosis research, unfortunately some events may have passed by the time this issue is mailed.

Friday, May 31, 2019

LOTS OF LOVE FOR LANDON CHARITY GOLF OUTING, IN HONOR OF LANDON HARTZ

Blackhawk Golf Course, Beaver Falls, Pennsylvania

For information contact Jimmy Hartz, LotsofloveforLandon@gmail.com

Monday, July 29, 2019

AIDAN'S ARMY GOLFS FORE A CURE TOURNAMENT, IN HONOR OF AIDAN O'LEARY

Forest Lake Country Club, Bloomfield Hills, Michigan

For information contact Katie Emerine, kcotantemerine@gmail.com, 248-225-8209

Monday, August 12, 2019

KEGS4KAUSE — HEARTS FOR HADLEY, IN HONOR OF HADLEY ALEXANDER

Boise, Idaho

For information contact Marcu Alexander, hearts4hadley@gmail.com

Saturday, September 14, 2019

8TH ANNUAL SWING, SHOOT AND LIV GOLF CLASSIC, IN HONOR OF OLIVIA LITTLE

Saugeen Golf Club, Port Elgin, Ontario, Canada

For information contact Erin Little, Erin.Little@livalittlefoundation.com

Saturday, September 21, 2019

6TH ANNUAL HEARTS FOR HADLEY, IN HONOR OF HADLEY ALEXANDER

Jack's Urban Meeting Place, Boise, Idaho

For information contact Marcu Alexander, hearts4hadley@gmail.com

September 2019

5TH ANNUAL MULLIGANS FORE MORGAN, IN HONOR OF MORGAN PEACHMAN

Bob-O-Link Golf Course, Avon, Ohio

For information contact Jennifer Peachman, jennifer.peachman@gmail.com

Thursday, October 3, 2019

9TH ANNUAL SWING GOLF EVENT JENNA & PATRICK'S FOUNDATION OF HOPE, IN HONOR OF JENNA AND PATRICK PARTINGTON

Swing Golf Event - Catta Verdera Country Club

For information contact Kevin Partington, Kevin.Partington@cushwake.com

Saturday, November 3, 2019

HARTZ HALLOWEEN PARTY, IN HONOR OF LANDON HARTZ

Home Economics Building, South Park, Pennsylvania

For information contact Lauren Hartz, laurenlhartz@gmail.com

The following pages celebrate the events dedicated to awareness and a cure by our cystinosis community. Together, we are stronger. Together, we are one!

TOGETHER, WE ARE one

1 PURPOSE. 1 JOURNEY. 1 CURE.

TOGETHER, WE ARE one

Brooke Emerson — Hammonton, New Jersey

THE SUCCESS IS CATCHING ON! THIRD ANNUAL FISHING FOR BROOKE'S CURE FUNDRAISER

On April 13, 2018, we held our 3rd Annual Fishing for Brooke's Cure fundraiser. Jill and I, in addition to the rest of the team (my long-time friends Hans Benford, Ralph Girard, Mike Kwiatkowski and Ian Pullman), reached out to friends, family and coworkers, and solicited pledges and direct donations. We are so blessed to have these fishermen not only take time away from work and their families and fish until their fingers were sliced from the scales of fish, but also solicit donations from hundreds of people on behalf of Brooke and the entire cystinosis community. Our fight to cure cystinosis and find better treatments has become their fight as well.

We travelled hours away to a secret fishing spot and fished from sun-up to sundown. While the fishing was relatively slow, we still managed to catch a group total of 134 fish. With 167 pledges from people and organizations in 16 different states, we raised over $27,000; our most successful event to date!

On Friday March 22, 2019, we held our 4th Annual Fishing for Brooke's Cure fundraiser! It was a success as the fishing team travelled even further south to find the best fishing spots and raise even more money for CRF. This year, we were especially thrilled to land 235 fish with the help of the Student Chapter of the American Fisheries Society at East Carolina University. The student chapter held their own fishing derby in conjunction with our fundraiser. We received 207 pledges and donations totaled more than $27,000 in Brooke's honor to help fund cystinosis research for better treatments and the cure!

— Clay Emerson, Brooke's Father

1 PURPOSE. 1 JOURNEY. 1 CURE.

Josie Kanupke — Oak Forest, Illinois

GETTING JOLLY FOR JOSIE

On December 8, 2018, our family pulled off an almost impossible feat, we hosted our first ever benefit for the Cystinosis Research Foundation on behalf of our daughter, Josie. "Getting Jolly for Josie" was a Christmas themed event held at the Fraternal Order of Eagles in Blue Island, Illinois. We decided in the beginning of June to put this plan into place, never hosting or even being involved in such an event. My awesome sister-in-law, Laura Christopherson, took the lead. Without her this would have never happened. She started right away, laid out a plan and went to work. My wife, Katie, and Laura worked non-stop for the next few months. Countless phone calls, emails, and personal meetings for donations, food, beverages and entertainment.

The day of the event was upon us. In just six short months, we saw our hard work pay off. Family and friends stepped up with raffle gift baskets, volunteering, selling tickets and working the event so my wife and I could host and enjoy ourselves. The band that evening was The Soda Jerks, a local band that volunteered their time. Two local breweries, 350 Brewery and Blue Island Brewery, donated to our event as well. By the end of the night we were both exhausted. We turned to each other and said, "We did it!" with a collective sigh of relief.

With everyone's hard work and dedication to our cause, we raised over $20,000 that night in Josie's name, all being donated to the CRF. Hopefully, our annual event will become bigger and bigger each year. We would like to thank everyone involved, especially Aunt Laura and Zoe from the CRF.

— Tom Kanupke

Josie and Laura Christopherson

GETTING Jolly FOR Josie

TOGETHER, WE ARE one

Joshua Clark — Huntington Beach, California

DJ and Joshua Clarke
with Pack 227 Scout Master Thomas Scully

SCOUTS MAKE BIG IMPACT ON JOSHUA'S JOURNEY OF HOPE!

Every year Cub Scout Pack 227 focuses on an outside charity to benefit from its fundraising efforts. This year that charity was "Joshua's Journey of Hope." With its annual charity support, Pack 227 has the opportunity to demonstrate some of the principles of the Scout Law, which include, "A Scout is Helpful" and "A Scout is Kind."

During the past year the pack raised money for JJOH in a number of ways, including hosting a lemonade stand, a "Get Air" fundraiser and simply having Scouts collect and donate loose change from home. When all was said and done, Pack 227 had collected $2,000 which was presented in the form of a check, to Joshua at the pack's annual religious retreat in November. The donation was especially meaningful for Joshua, who is a former member of Pack 227. He has formed friendships with many of the Scouts that will last a lifetime.

Joshua's Journey of Hope

Landon Hartz — Pittsburgh, Pennsylvania

HALLOWEEN PARTY NOVEMBER 2018

The Hartz family hosted the Seventh Annual Lots of Love for Landon Halloween party in Pittsburgh on November 3, 2018. The party included almost 300 guests, many of whom have attended most, if not all, of the parties and who have supported the family since Landon was diagnosed with cystinosis in 2011. Other families came for the first time and left with a new perspective and insight about the journey that the Hartzes have been on over the past seven years.

DJ Mark "Hypnotyza" Raich donated his time for the fifth year in a row and family and close friends of the Hartz family made sure the event was a big success. Guests enjoyed a catered meal, fun music, dancing, door prizes, 50/50 raffle and a Chinese auction with close to 30 items. Many guests showed off their costumes and winners were awarded prizes in a variety of categories.

More than $10,000 was raised and donated to the Cystinosis Research Foundation. The next event is scheduled for November 2, 2019, so mark your calendars now!

1 PURPOSE. 1 JOURNEY. 1 CURE.

Emma and Gracie Patterson — University Place, Washington

DEDICATED STUDENTS HOLD CAR WASH IN HONOR OF CYSTINOSIS RESEARCH!

I am a teacher at Glacier Middle School in Buckley, WA. My daughters Emma and Gracie have cystinosis. One of my leadership classes called GRIZZ Success came up with an idea to hold a car wash to raise as much money as we could for cystinosis research. Once the idea was out there, it took off!

The mom of one of my students coordinated with the local Les Schwab shop, who graciously let us use their space on a cold Sunday in November. I was truly touched by the dedication of these students in raising money for cystinosis. They were bound and determined to raise as much as they could. They never gave up! Even with weather in the 40s and rain, they still had customers and raised $700! I'm so proud of my leadership students and they were very successful in supporting a cause they were passionate about! I appreciate all of them so much!

— Christy Kehr

Lola Long — Chaska, Minnesota

CURL FOR A CURE

Lola's third "Curl For The Cure" was held on April 13 at the Chaska, Minnesota Curling Center. We are pleased to have hosted another successful event and are extremely grateful to our friends in the community and our family who were able to attend. The curling competition was more intense than ever this year. We had over 70 curlers and many of the teams were back for rematches on the ice!

After the curling sessions ended, we filled the event center with more than 200 people. Dinner and drinks were served and everyone had the opportunity to bid on an incredible selection of silent auction items. Raffle items were available and a wine toss was made possible by local wine shops and Miner Family Vineyards in Napa, California.

We would like to thank all of our sponsors for their gracious support as well as everyone in attendance. We feel so fortunate to be able to share Lola's story, raise awareness about cystinosis and help fund a cure by raising over $44,500 so far, with more donations still coming in!

Lola's Curl FOR A Cure

TOGETHER, WE ARE one

Emma Grace Suetta — Etna, California

Delaney Davidson (L) and Cody Davidson (R) give back!

4H LIVESTOCK AUCTION TO HONOR EMMA SUETTA!

In our rural community, much of our economy is based in agriculture. 4H is very popular here, and one of the most chosen projects is livestock. Cody Davidson (13 years old) and Delaney Davidson (10 years old), friends of the Suetta family, have been members of 4H for four years. Cody has been involved with the swine project every year and Delaney's first year was in 2018. A lot of hard work goes into these projects! The participants receive their pigs when the pigs are only a couple months old, and the kids have to ensure they have a warm, safe environment for these young animals. They have to clean the pen every day, and feed early before school and again once homework is done in the evening. In the summer, they have to ensure the pigs are cool enough, and that they are getting plenty of water all day. They have to work with their pigs daily to train them to walk around the arena calmly, with just the tap of a show stick to their shoulder to turn left or right. The culmination of all this hard work is our Siskiyou Golden Fair Livestock Auction. The kids personally deliver handwritten letters to their potential buyers, inviting them to the auction. On auction day, it's not unheard of here for pigs to sell for $6-$10 per pound! The buyers know how much work the kids have put into their animals, and Siskiyou County is VERY generous to their 4H kids.

The morning of the Livestock Auction in August 2018, Cody wondered aloud if he could donate some of his hard-earned auction money to the Cystinosis Research Foundation in honor of our friend Emma Grace Suetta. His sister heard him, and they both decided they would each donate 20% of their earnings! Cody donated $623, and Delaney donated $690! They were both shocked that they were able to give this much and decided they will make this their annual contribution to the Cystinosis Research Foundation! They were so proud to be a part of helping to find a cure for Emma Grace and were beyond happy when we heard that a potential cure was approved for clinical trials! These amazing kids are learning at a young age what it means to give back, and it makes this momma's heart happy.

— Shelly Suetta

1 PURPOSE. 1 JOURNEY. 1 CURE.

Alan and Nora Campbell — Wallaceburg, Ontario, Canada

GALA OF HOPE

On November 10, 2018, we hosted the "Gala of Hope," our first fundraiser for cystinosis research. We were nervous when we started planning, unsure of how our community would respond to a gala type event, and how it would feel telling our story in such intimate detail for the first time.

We quickly learned that our small town is full of big, generous hearts. To our amazement, local businesses stepped up and hosted their own fundraisers in support of our gala. Riverport Restaurant donated sales from breakfast specials, with their amazing staff matching the donation. Madness Ink hosted a flash fundraiser on a selection of tattoos and artwork, with all proceeds going to the gala. Many other individuals and businesses offered to sell 50/50 tickets, become event sponsors, or donate services or silent auction items in a show of support.

The night of the gala we hosted 170 guests for a fun, formal night out with delicious catered food and live music that kept us dancing all night. Everyone loved when Alan and Nora made an appearance to say grace and draw our 50/50 winner. During dinner, Adam and I shared a bit about what cystinosis is, and what that looks like for our family. We shared the 2017 Natalie's Wish video, which helped our guests see that their generosity really can make a difference. Our silent auction table boasted over 70 items, from box seat NHL tickets to home goods and cleaning products. We've already been flooded with questions on when the next event will be, as we sold out nearly a month before the event this year.

There are no words to describe what it feels like to witness a community rallying around your family. Seeing everyone from coworkers to childhood friends that night, it was like watching your hope come to life in front of you. But somehow, it's even harder to imagine that love turned into over $28,000 raised for cystinosis research. We are incredibly grateful for the kindness of everyone around us and for the chance to play our role in finding a cure.

WELCOME NEW BOARD MEMBER

Jill Emerson

Jill Emerson's cystinosis journey began when her 4-year-old daughter, Brooke, was diagnosed at 16 months. After a year of doctors' visits at two different children's hospitals to determine the cause of Brooke's "failure to thrive" label, doctors finally did genetic testing which confirmed the cystinosis diagnosis. Feeling alone and overwhelmed with a diagnosis that even Brooke's doctors had never heard of or treated, Jill and her husband, Clay, immediately took it upon themselves to learn as much about cystinosis as possible. Within an hour of diagnosis, Jill was on the phone with CRF and a fellow cystinosis parent and CRF board member, Teresa Partington. And within two months of diagnosis, Jill and her husband Clay held their first fundraiser for CRF and attended their first Day of Hope conference. Jill and her family have attended every Day of Hope conference since diagnosis, and just held Hope for Brooke's 4th annual Fishing for Brooke's Cure fundraiser. Their family goal is aligned with CRF's mission to find better treatments and a cure for cystinosis so that Brooke and the entire cystinosis community can live a life free of this disease.

The CRF community, including the CRF Board, has been invaluable in Jill and her family's cystinosis journey. What was a devastating diagnosis quickly turned into a hopeful quest for a cure because of the support received from and work done by CRF. Jill is excited and honored to begin the next part of her journey as a CRF board member.

Jill is a Certified Public Accountant (CPA) who received a Bachelor of Science in Accounting from Penn State and a Master of Science in Business – HRM from St. Joseph's University. She has spent her career working in the accounting industry, with the last 10 years focused strictly on working with nonprofit organizations. For the last decade, Jill has worked at Your Part-Time Controller, LLC (YPTC), a national accounting firm which provides outsourced accounting services to nonprofit organizations. In her tenure, Jill has been responsible for managing client relationships and performing Controller and CFO services. Jill has led several system implementations and conducted board and committee trainings on current nonprofit issues, financial strategy, and current technical pronouncements and governmental issues impacting nonprofits. Her clients have ranged from healthcare centers, educational organizations, arts and culture organizations, social services organizations as well as foundations. She has also played an active role in recruiting and new-hire training, and directed the firm's pro-bono program which offered bookkeeping and accounting training programs to employees of area nonprofit organizations. Currently, Jill serves as a member of YPTC's Quality Control Department, which is responsible for the technical review of all financial reports issued by the firm's employees. She has found her career working with nonprofit organizations to be extremely rewarding as she has been able to intersect her accounting expertise with her passion to serve her community.

Jill hopes that her business experience as a CPA working with nonprofit organizations, as well as her experiences navigating the care of her toddler with cystinosis, will be an asset to CRF and the board. She will serve with enthusiasm, determination, and dedication to the mission of CRF and the cystinosis community!

Jill, Clay, and Brooke reside in Hammonton, New Jersey, a suburb of Philadelphia, Pennsylvania. If Jill isn't running around after Brooke, you can find her cooking, reading, or exercising. As a family, the Emersons value time spent together outdoors fishing, with family at the beach, and exploring nature.

LEADERSHIP. GUIDANCE. COMMITMENT.

BOARD OF TRUSTEES

CHAIR

Nancy J. Stack,
President
Cystinosis Research Foundation

VICE CHAIR

Geoffrey L. Stack,
Founding Partner
SARES REGIS GROUP

TREASURER

Donald L. Solsby,
Senior Vice President
Seacoast Commerce Bank

BOARD MEMBERS

Marcu Alexander, Founder
Hearts for Hadley

Stéphanie Cherqui, PhD,
Assistant Professor
University of California, San Diego

Bruce Crair,
Senior Vice President
Boingo Wireless

Jill Emerson, CPA
Hope for Brooke

Denice Flerchinger,
Founder
Tina's Hope For A Cure

Thomas A. Gendron,
Chair of the Board,
CEO and President
Woodward, Inc.

Traci Gendron, Founder
Tanner's Time for a Cure

John S. Hagestad,
Founding Partner
SARES REGIS GROUP

Lauren Hartz, Founder
Lots of Love for Landon

Michael K. Hayde, CEO
Western National Group

Stephen L. Jenkins, MD,
University of Utah Hospital
Sam's Hope for a Cure

Erin Little, Co-Founder
Liv-A-Little Foundation

David W. Mossman,
Managing Member
Aztec Mustang

Kevin Partington,
Executive Director
Cushman & Wakefield

Teresa Partington, Founder
Jenna & Patrick's Foundation of Hope

Natalie Stack
Patient Advocate

Brian Sturgis, Senior Director,
Business Operations
SimulStat Incorporated

MEDICAL AND SCIENTIFIC ADVISORY BOARD

Bruce A. Barshop, MD, PhD
University of California, San Diego
San Diego, CA

Stéphanie Cherqui, PhD
University of California, San Diego
San Diego, CA

Ranjan Dohil, MD
University of California, San Diego
San Diego, CA

Laurence Greenbaum, MD, PhD
Emory University School of Medicine and Children's Healthcare of Atlanta
Atlanta, GA

Paul C. Grimm, MD
Lucile Packard Children's Hospital, Stanford University School of Medicine
Palo Alto, CA

Stephen L. Jenkins, MD
University of Utah Hospital
Salt Lake City, Utah

Robert Mak, MD, PhD
University of California, San Diego
San Diego, CA

Julian Midgley, BM, Bch
Alberta Children's Hospital
Calgary, AB, Canada

Doris Trauner, MD
University of California, San Diego
San Diego, CA

cystinosis
RESEARCH FOUNDATION
RESEARCH • HOPE • CURE

Zoe R. Solsby
Vice President

MISSION

The mission of the Cystinosis Research Foundation is to find better treatments and a cure for cystinosis by supporting bench, clinical and translational research. Since 2003, CRF has raised over $50 million with 100% of all your donations going to support cystinosis research.

EDUCATION

The CRF is dedicated to educating the medical and public communities about cystinosis to ensure early diagnosis and proper treatment.

★★★★ CHARITY NAVIGATOR Four Star Charity

cystinosis RESEARCH FOUNDATION | RESEARCH HOPE CURE

Together we shine bright