## BRAIN & BEHAVIOR RESEARCH FOUNDATION

### **2021 ANNUAL REPORT**

Awarding research grants to develop improved treatments, cures, and methods of prevention for mental illness.



Awarding NARSAD Grants



BBRF is the world's largest private funder of mental health research grants, supporting transformative discoveries in order to develop improved treatments, cures, and methods of prevention for our loved ones.

### Mission

The Brain & Behavior Research Foundation is committed to alleviating the suffering caused by mental illness by awarding grants that will lead to advances and breakthroughs in scientific research. "Together we can dramatically improve the lives of those living with mental illness and enable more people to live full, happy, and productive lives."

Jeffrey Borenstein, M.D. BBRF President & CEO

#### OF EVERY DOLLAR DONATED FOR RESEARCH Our operating expenses are covered

Our operating expenses are covere by separate foundation grants.

### What We Support

BBRF funds research in the following areas:

- Addiction
- ADHD
- Anxiety
- Autism
- Bipolar Disorder
- Borderline Personality Disorder
- Depression
- Eating Disorders
- OCD
- PTSD
- Schizophrenia
- Suicide Prevention



**Jeffrey Borenstein, M.D.** President & CEO



Herbert Pardes, M.D. President, Scientific Council



**Geoffrey Simon** Chair, Board of Directors

The Brain and Behavior Research Foundation (BBRF) is the largest private funder of mental health research grants. Since 1987, BBRF has awarded more than \$430 million in research grants to more than 6,000 scientists around the world who are searching for better treatments, cures, and methods of prevention for mental illness.

This support has led to discoveries that have improved our understanding of the brain and produced new treatments for psychiatric illness.

#### Impact of BBRF funded research:

- The First Rapid-Acting Antidepressants
- Transcranial Magnetic Stimulation (TMS) for Treating Depression, OCD, and Potentially Other Conditions
- Computer-Guided Cognitive Remediation for Enhanced Recovery in Schizophrenia
- Potentially Lowering the Child's Mental Illness Risk via Maternal Choline Supplements During Pregnancy
- Harnessing Stem Cell Technology to Study Autism, Schizophrenia
- Groundbreaking Technology Optogenetics Now Used in Thousands of Research Labs Globally to Study the Brain and Psychiatric Illness

We are proud to report that in 2021 BBRF funded more than \$16 million in new research grants across a broad spectrum of brain illnesses including: Addiction, ADHD, Anxiety, Autism, Bipolar Disorder, Borderline Personality Disorder, Depression, Eating Disorders, OCD, Psychosis, PTSD, Schizophrenia, as well as Suicide Prevention.

BBRF is a collaboration between generous donors and dedicated scientists. The research we fund together is transformative. One reason that research funded by BBRF has such great impact is because we do not limit our focus to one illness or condition. Another reason is because BBRF grant recipients are chosen by our worldrenowned Scientific Council.

The BBRF Scientific Council is comprised of 181 scientists who rigorously evaluate every grant application, identifying the most promising, innovative science, with the greatest potential for significant breakthroughs. This past year the Council evaluated more than 750 grant proposals and awarded 150 Young Investigator grants, funding two-years of research for \$35,000 per year.

BBRF grants serve as a springboard for talented scientists to get new ideas off the ground, including basic science and clinical research. This crucial funding early in their careers often leads to additional funding from the National Institutes of Health (NIH) and other sources, both governmental and private.

This annual report features Leading Research Achievements by BBRF Grantees, Prizewinners & Scientific Council Members. Many of their significant BBRF-funded research findings were published in leading psychiatric and medical journals during 2021. Among these major scientific achievements is timely research about the effects of COVID-19 on the brain and mental health. These advancements, as well as other important discoveries, are changing how we help people who live with mental illness.

This year BBRF awarded Outstanding Achievement Prizes in Mental Health to nine scientists for their extraordinary work in advancing psychiatric research. The Prizewinners were featured presenters at BBRF's 2021 International Mental Health Virtual Symposium. The 2021 BBRF International Mental Health Virtual Symposium is available to watch online at: www.bbrfoundation.org/ event/international-mental-health-research-symposium

Our annual Pardes Humanitarian Prizewinners in Mental Health were Kay Redfield Jamison, Ph.D.; Elyn R. Saks, J.D., Ph.D.; and Charlene Sunkel. Three 2021 Pardes Honorary Prizes were given to John M. Davis, M.D., Michael R. Phillips, M.D., MPH, and Norman Sartorius, M.D., Ph.D., FRCPsych.

The Brain & Behavior Magazine continues to inform readers of the most important advancements in scientific research. This is supplemented by eNews, our weekly email newsletter that features the research of BBRF Grantees, Prizewinners, and Scientific Council Members. Through these and other efforts, we aim to share timely information with you what is happening in research labs, and about breakthroughs that are providing new knowledge and insights from bench to bedside. BBRF is also breaking new ground in Public Media. We recently launched the 7th season of "Healthy Minds." This award-winning program aims to decrease stigma and prejudice by providing accurate information to the public about psychiatric conditions and treatments as well as cutting edge research advancements. "Healthy Minds" is available on PBS stations around the U.S. and online at PBS.org. Here's the link: https://www.pbs.org/show/ healthy-minds-with-dr-jeffrey-borenstein/

While steady advancements in brain research are being made, more still needs to be done. 100% of every dollar donated for research is invested in our research grants. We can do this because our operating expenses are covered by separate foundation grants. This means that every dollar donated for research goes directly to the scientist.

We thank you for your ongoing and generous support and welcome those of you who will join us on the path toward research for recovery.

Sincerely,

Jeffrey Borenstein, M.D. President and CEO

Herbert Pardes, M.D. President, Scientific Council

frey Simon

Geoffrey Simon Chair, Board of Directors

### **Our Scientific Council**

- 181 Scientific Council Members (21 Emeritus)
- **51** Members of the National Academy of Medicine
- **41** Chairs of Psychiatry & Neuroscience Departments
- **16** National Institute of Health Chiefs & Directors
- 7 Members of the National Academy of Sciences
- **3** Recipients of the National Medal of Science
- 2 Directors of the National Institute of Mental Health
- 1 Nobel Prize Winner

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Herbert Pardes, M.D.

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Mary-Claire King, Ph.D.

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### **Our New Scientific Council Members**

The Scientific Council guides the Foundation to fund creative and impactful research relevant to the whole spectrum of mental illness.

Led by Dr. Herbert Pardes, the founding President of our Scientific Council, the all-volunteer group of preeminent mental health researchers reviews hundreds of grant applications each year and select the most promising research ideas with the greatest potential to lead to breakthroughs.



"At its very core BBRF strives to find the dynamic path forward. Scientists who have received a BBRF grant have generated seminal ideas, launched discoveries that have changed the direction of research, and helped foster the development and testing of novel therapies offering new and better therapeutic options to patients. The Scientific Council is working hard to find and support those earlycareer scientists who are on the path to solving the most intricate and complicated of illnesses—mental illness." - Herbert Pardes, M.D.



Randy P. Auerbach, Ph.D. Associate Professor (Tenured) of Medical Psychology (in Psychiatry), Department of Psychiatry, *Columbia University* 



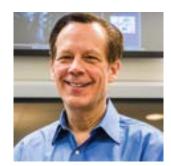
Guo-li Ming, M.D., Ph.D. Perelman Professor of Neuroscience, *University of Pennsylvania* 2010 BBRF Independent Investigator



Vadim Bolshakov, Ph.D. Director, *Cellular Neurobiology Laboratory, McLean Hospital* Professor, *Harvard Medical School* 2013 BBRF Distinguished Investigator 2006, 2004 BBRF Independent Investigator



Kathleen T. Brady, M.D., Ph.D. Distinguished University Professor Director, South Carolina Clinical and Translational Research Institute, *Medical University of South Carolina* 



Robert Desimone, Ph.D. Director, McGovern Institute Doris and Don Berkey Professor, Brain and Cognitive Sciences, *Massachusetts Institute* of Technology

2020 BBRF Goldman-Rakic Prizewinner for Cognitive Neuroscience Research

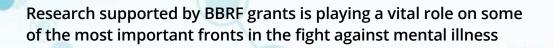


Susan B. Powell, Ph.D. Professor of Psychiatry, University of California, San Diego 2004 BBRF Young Investigator



Scott J. Russo, Ph.D. Director, Center for Affective Neuroscience, Dept. of Neuroscience, *Icahn School of Medicine at Mount Sinai* 2008, 2006, BBRF Young Investigator

### BBRF Grants Are Making a Difference



#### The First Rapid-Acting Antidepressants

In 2019, the FDA approved esketamine, the first-ever rapidacting antidepressant for patients with treatment-resistant depression, and brexanolone, which can lift postpartum depression within 48 hours. 90 BBRF grants over 20 years helped build the foundation for these long-sought advances.

### Non-Invasive Brain Stimulation to Treat Depression, OCD, PTSD

BBRF grants seeded research which led to FDA approval in 2008 of rTMS (repetitive transcranial magnetic stimulation) for treatment-resistant major depression. BBRF grantees are now testing more powerful and fasteracting brain-stimulation technologies with a wide range of potential applications.



Awarding NARSAD Grants

#### Computer-Guided Cognitive Remediation for Enhanced Recovery in Schizophrenia

Recovery may be possible for more people with schizophrenia and other disorders in which cognitive function is impaired, including bipolar disorder and depression. Recently, BBRF-funded scientists clinically validated computer-guided methods of enhancing verbal and auditory learning capacity, processing speed, working memory, and recall ability in chronic schizophrenia patients.

#### Lowering the Child's Mental Illness Risk via Maternal Choline Supplements

BBRF grantees have pioneered choline supplementation in the diet of pregnant women to reduce the risk of mental illness in children. Today, the American Medical Association recommends including choline in prenatal vitamin supplements.

### Harnessing Stem-Cell Technology to Study Autism, Schizophrenia

BBRF grantees have pioneered the use of stem-cell technologies to create functioning brain "organoids" living test-beds that can be used to assess new drug candidates as well as reveal how genetic variations cause pathologies in the fetal brain as it develops. This research is especially pertinent in autism, schizophrenia and other disorders with developmental roots.

### Computer-Guided Early Diagnosis of Mental Illness

BBRF-funded investigators are training machines that, in turn, train themselves—ultimately, to a level of precision not possible in humans to recognize potentially diagnostic patterns of clinical data or biological markers in schizophrenia, firstepisode psychosis, major depression, and bipolar disorder.

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### 2021 Leading Research Achievements by Foundation Grantees, Prize Winners, & Scientific Council Members

#### DIAGNOSTIC TOOLS/EARLY INTERVENTION: ADHD Low Maternal Vitamin D in Early Pregnancy Is Linked With ADHD Risk in the Child



Andre Sourander, M.D., Ph.D.

University of Turku, Finland 2008 BBRF Independent Investigator

Journal of the American Academy of Child & Adolescent Psychiatry, January 1, 2021 Researchers discovered that a low level of maternal vitamin D during the early part of pregnancy raises the odds that a child born of that pregnancy will develop clinically diagnosed ADHD by adolescence. The team studied 1,067 mother-child pairs in which the child was diagnosed with ADHD within 12 years of birth, and an equal number of mother-child pairs, matched demographically, in which the child was not diagnosed with ADHD. Maternal vitamin D levels were based on blood samples taken in the first or early second trimester of pregnancy. Vitamin D receptors, expressed in the brain, help regulate calcium signaling between brain cells; the nutrient also impacts factors which help neurons mature and grow. It is theorized that vitamin D depletion can lead to alterations in dopamine signaling, possibly giving rise to "hyperlocomotion" and increased activity.

The research team included: **David Gyllenberg M.D., Ph.D.**, 2015 BBRF Young Investigator; **Alan S. Brown, M.D., MPH**, 2019 BBRF Lieber Prize, 2015 BBRF Distinguished Investigator, 2004 and 2000 BBRF Independent Investigator, 1996 and 1993 BBRF Young Investigator.

#### NEW TECHNOLOGIES: EATING DISORDERS New Technology Enables Manipulation of Neurons in Peripheral Organs & Reveals Mechanism of Appetite Suppression



#### Sung II Park, Ph.D.

Texas A&M University 2018 BBRF Young Investigator

*Nature Communications,* January 8, 2021 Dr. Park and his team invented a new technology called optoelectronics that enabled them to activate and deactivate neurons in peripheral organs via tiny wireless devices; testing it, they discovered an unexpected mechanism for suppressing appetite. In contrast to optogenetic technology, which can manipulate neuronal activity within the brain only, optoelectronic devices are powered by extremely small light-emitting diodes with soft, highly flexible tethers that can be implanted successfully in peripheral organs. The focus of the team's test of the technology were endings of the vagus nerve within the stomach, known to be important in the regulation of appetite. By activating specific vagus nerve endings in a specific area of the stomach in mice, appetite was suppressed—to the point of almost complete suppression when the stimulation was increased in intensity. This could have future implications in the treatment of eating disorders as well as obesity.

#### NEXT-GENERATION THERAPIES: PTSD Repeated Ketamine Infusions Over 2 Weeks Significantly Reduced Chronic PTSD Symptoms



#### Adriana Feder, M.D.

Ichan School of Medicine at Mount Sinai

2015 BBRF Independent Investigator, 2002 BBRF Young Investigator

American Journal of Psychiatry, February 1, 2021 A small clinical trial showed that repeated infusions of the drug ketamine over a 2-week period can significantly reduce PTSD symptom severity, while also helping to reduce depression symptoms that often accompany PTSD. The first randomized study to test the efficacy of a course of repeated infusions in individuals with PTSD, the study recruited 30 chronic PTSD patients with moderate to severe symptoms, half of whom received 6 infusions of ketamine over 2 weeks while half received placebo infusions. Those responding to ketamine (reduction in symptoms of 30% of more) were followed until their symptoms returned. The positive results suggest the team can now test whether FDA-approved esketamine has similar benefits in chronic PTSD; and whether psychotherapy, added to a course of ketamine or esketamine, might reduce the likelihood of relapse once the infusions end.

The research team included: **Dennis S. Charney, M.D.**, BBRF Scientific Council, Emeritus, 2019 BBRF Colvin Prize; **James W. Murrough, M.D.**, 2009 BBRF Young Investigator; **Laura Bevilacqua, M.D.**, 2017 BBRF Young Investigator.

#### DIAGNOSTIC TOOLS/EARLY INTERVENTION; BASIC RESEARCH: SCHIZOPHRENIA, PSYCHOSIS Study Links Schizophrenia Medicines' Anticholinergic Impact to Risk of Cognitive Impairment



#### Yash B. Joshi, M.D., Ph.D.

University of California, San Diego 2018 BBRF Young Investigator



#### Gregory A. Light, Ph.D.

University of California, San Diego 2009 BBRF Independent Investigator, 2001 BBRF Young Investigator

American Journal of Psychiatry, May 14, 2021 A study of antipsychotic and other medications commonly prescribed to people with chronic schizophrenia has concluded that medicines with anticholinergic effects can "substantially" contribute to the risk of long-term cognitive impairment. The study assessed the total burden of anticholinergic medications (blocking action of the neurotransmitter acetylcholine) taken by 1,120 chronic schizophrenia outpatients, many of whom take medicines for comorbid health conditions that also have anticholinergic effects. Overall, 63% of participants had a significant burden, which the team associated with generalized impairments in cognitive functioning. Results, if validated, could help guide prescribing physicians make medication decisions that reduce patients' cognitive impairment risk.

The research team included: **Ming T. Tsuang, M.D., Ph.D.**, BBRF Scientific Council, 2010 BBRF Lieber Prize, 1998 BBRF Distinguished Investigator; **Raquel E. Gur, M.D., Ph.D.**, BBRF Scientific Council, 2009 BBRF Lieber Prize, 1999 BBRF Distinguished Investigator; **Neal R. Swerdlow, M.D., Ph.D.**, 2016 BBRF Distinguished Investigator, 1995 BBRF Independent Investigator, 1990 BBRF Young Investigator; **Bruce I. Turetsky, M.D.**, 2001 BBRF Independent Investigator; **Debby W. Tsuang, M.D.**, Ph.D., 2009 BBRF Independent Investigator, 2001 BBRF Young Investigator; **Tiffany A. Greenwood, Ph.D.**, 2008 BBRF Young Investigator; **William S. Stone, Ph.D.**, 2000 and 1997 BBRF Young Investigator; **Ruben C. Gur, Ph.D.**, 2007 BBRF Distinguished Investigator; **Juan Molina, M.D.**, 2020 BBRF Yong Investigator.

#### BASIC RESEARCH; NEXT-GENERATION THERAPIES: Depression Brain Lesions and Treatment Targets in Depression Are Found to Affect the Same Circuitry, Suggesting New Treatment Possibilities



#### Shan H. Siddiqi, M.D.

Harvard Medical School, Brigham & Women's Hospital 2019 BBRF Young Investigator

*Nature Human Behaviour,* July 8, 2021 Researchers discovered that the brain circuitry underlying depression is the same or similar in a wide variety of patients and circumstances. Specifically, their work revealed that physical brain damage, or "lesions," that result in depression affect the same or similar brain circuitry as the circuitry targeted by both invasive and non-invasive brain stimulation therapies that alleviate depression symptoms. These and other results of the study could lead to identification of new treatment targets in depression and possibly other neuropsychiatric disorders.

The research team included: Helen S. Mayberg, M.D., BBRF Scientific Council, 2007 BBRF Falcone Prize, 2002 BBRF Distinguished Investigator, 1995 BBRF Independent Investigator, 1992 BBRF Young Investigator; Mark S. George, M.D., BBRF Scientific Council, 2008 BBRF Falcone Prize, 1998 BBRF Independent Investigator, 1996 BBRF Young Investigator; Robin Cash, Ph.D., 2020 BBRF Young Investigator; Ki Sueng Choi, Ph.D., 2016 BBRF Young Investigator; Darin Dougherty, M.D., 2003 BBRF Young Investigator; Paul Fitzgerald, Ph.D., 2005 BBRF Young Investigator; Alvaro Pascual-Leone, M.D., Ph.D., 1998 BBRF Independent Investigator.

#### BASIC RESEARCH; DIAGNOSTIC TOOLS/EARLY INTERVENTION: ANXIETY Excessive Sensory Response at Birth May Signal Risk for Later Anxiety, Research Suggests



#### Chad M. Sylvester, M.D., Ph.D.

Washington University, St. Louis 2017 BBRF Young Investigator

American Journal of Psychiatry, August 1, 2021 The response of various brain systems to unexpected stimuli provides insights into processes in the brain that enable individuals to respond to salient information and to suppress responses to stimuli that are not relevant or helpful in a given context. New evidence in infants connects sensory overresponse to unexpected auditory stimuli and risk of anxiety disorder. Brain network activity levels in the newborns were shown to be correlated with their mothers' scores on a standard measure of anxiety, suggesting their potential utility as biomarkers. In older children and adults with anxiety disorder, researchers have noted weakened inhibitory responses. Results of this study suggest neural stimulus-response properties near birth signal risk for processes in the brain that generate later-life anxiety and elevated risk in adulthood of depression, substanceuse disorders, eating disorders, and bipolar disorder.

The research team included three BBRF Scientific Council members: **Joan Luby**, **M.D.**, BBRF 2020 Ruane Prize, 2004 BBRF Klerman Prize, 2008 and 2004 BBRF Independent Investigator, 1999 BBRF Young Investigator; **Daniel Pine**, **M.D.**, 2011 BBRF Ruane Prize, 2000 BBRF Independent Investigator; **Deanna Barch**, **Ph.D.**, 2013 BBRF Distinguished Investigator, 2006 BBRF Independent Investigator, 2000 and 1995 BBRF Young Investigator.

#### NEXT-GENERATION THERAPIES: Depression Positive Preliminary Results in Highly Personalized Deep-Brain Stimulation Therapy for Treatment-Resistant Depression



Katherine W. Scangos, M.D., Ph.D.

University of California, San Francisco 2018 BBRF Young Investigator Researchers reported initial success in using a novel, highly personalized, and technologically advanced deep-brain stimulation (DBS) approach to rapidly relieve symptoms, eliminate suicidal thoughts, and by 4 months, achieve remission in a patient with lifelong and severe treatmentresistant depression. The team used a form of brain stimulation called closed-loop neuromodulation, in which prior extensive mapping of the patient's neural circuitry preceded the implantation, via surgery, of a battery-powered deep-brain stimulation (DBS) device. The device was "tuned" to activate briefly (in 6-second bursts) throughout each day in response to signals within the brain sensed by the device and which had been linked with the onset of the patient's depressed moods.



Andrew D. Krystal, M.D. University of California,

San Francisco 1997, 1993 BBRF Young Investigator

*Nature Medicine,* October 4, 2021

#### NEXT-GENERATION THERAPIES: Depression Non-Invasive Brain-Stimulation Protocol for Treatment-Resistant Depression Enabled 79% to Experience Remission Following 5-Day Treatment Course



#### Nolan R. Williams, M.D.

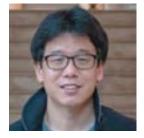
Stanford University

2019 BBRF Klerman Prize 2018, 2016 BBRF Young Investigator

*American Journal of Psychiatry,* October 29, 2021 In its first randomized, placebo-controlled test, an enhanced form of non-invasive brain stimulation called SNT (Stanford Neuromodulation Therapy, formerly called SAINT) generated "a large antidepressant effect" that enabled 79% of treatment-resistant patients to experience remissions within 4 weeks of the conclusion of the 5-day course of treatment. Over a 4-week period following the treatment course, over 85% of participants who received SNT responded (symptom reduction of 50% or greater). In addition to other possible applications, the brevity of the SNT treatment course compared with standard rTMS therapy and its high rate of effectiveness suggests its potential utility in treating patients in emergency or inpatient settings.

The research team included **Alan Schatzberg, M.D.**, BBRF Scientific Council member.

#### BASIC RESEARCH, NEXT-GENERATION THERAPIES: Depression Two Signaling Pathways Involved in Regulating Synaptic Plasticity Suggest Novel Targets for Rapid-Acting Antidepressants



#### Kanzo Suzuki, Ph.D.

Vanderbilt University 2018 BBRF Young Investigator Researchers reported the involvement of two chemical signaling pathways in generating homeostatic plasticity, which they suggest plays a key role in rapid antidepressant action such as that seen following the administration of the drug ketamine. The research could advance the search for novel drugs that will have ketamine's rapid action, but fewer side effects. It suggests how changes in pathways "downstream" of the NMDA receptor—thought to be the target of ketamine and precipitated by ketamine's blockade of the receptor—may produce homeostatic plasticity, which appears to modulate circuit function globally in the brain, and does not directly affect synaptic plasticity mechanisms that process and store information. Drugs targeting homeostatic mechanisms thus might preserve memory and cognitive function.



Lisa Monteggia, Ph.D.

Vanderbilt University

BBRF Scientific Council, 2014 BBRF Distinguished Investigator, 2010 BBRF Independent Investigator, 2005 BBRF Freedman Prize, 2003, 2001 BBRF Young Investigator



#### Ege Kavalali, Ph.D.

Vanderbilt University 2012 BBRF Distinguished Investigator

*Cell Reports,* November 2, 2021

#### BASIC RESEARCH: Addiction Researchers Propose a New Understanding of Dopamine's Role in Learning and Memory



Erin S. Calipari, Ph.D.

Vanderbilt University 2016 BBRF Young Investigator



Munir Gunes Kutlu, Ph.D. Vanderbilt University 2019 BBRF Young Investigator

*Current Biology,* November 8, 2021 Researchers proposed a markedly new way of understanding the role of dopamine in the brain. Ubiquitous throughout the brain and body, and serving a variety of functions, dopamine has long been regarded as key to the brain's reward system, and thus has often been thought of as playing a key role in the biology of addiction. Dysregulation of the dopamine system has also been hypothesized in depression, anxiety, and schizophrenia. For the last 20 years, dopamine has been thought to be central in a mechanism that enables individuals to adapt once expected rewards do not materialize. The new research suggests "rewardprediction error" is only part of what dopamine does. While rewards increase dopamine levels in the brain, so do stressful stimuli: dopamine helps encode information about all types of important and relevant events and drives adaptive behavior—regardless of whether it is positive or negative. The revised view has potentially broad implications for our understanding of behavioral control and a number of psychiatric disorders.

The research team also included **Cody A. Siciliano, Ph.D.**, 2017 BBRF Young Investigator.

### 2021 Leading COVID-Related Discoveries by Foundation Grantees, Prize Winners, & Scientific Council Members

#### People With Schizophrenia Have Increased Risk of Dying From COVID-19



#### Donald C. Goff, M.D.

NYU Langone Medical Center 2009, 2003 BBRF Independent Investigator

JAMA Psychiatry, January 27, 2021 A study conducted in a major New York City hospital system found that people with schizophrenia have 2.7 times the overall risk of dying within 45 days if they are infected with the COVID-19 virus. Higher mortality was not seen in people with depression or anxiety who contracted the virus.

The research team included: Mark Olfson, M.D., MPH, 2005 BBRF Distinguished Investigator

#### A Close Look at How COVID-19 Infection Can Damage the Brain



#### Maura Boldrini, M.D.

Columbia University 2014 BBRF Independent Investigator, 2006, 2003 BBRF Young Investigator

JAMA Psychiatry, March 26, 2021 Neuropsychiatric symptoms in COVID-19 patients suggest independent brain damage attributable to viral infection, researchers said. Symptoms include cognitive and attention deficits ("brain fog"), anxiety, depression, psychosis, seizures, and suicidal behavior. Inflammation in the central nervous system is a likely contributor, they said. The researchers noted that COVID-19 proteins have been found in the lining of blood vessels in the brain. They suggested various means by which viral particles might leak through the blood-brain barrier, a membrane designed to protect the brain from viruses, toxins, and other harmful factors.

#### New Evidence Suggests COVID May Enter the Brain via Cellular 'Trojan Horses'



#### Lu Wang, Ph.D.

University of California, San Diego 2019 BBRF Young Investigator Nature Medicine, July 9, 2021 Researchers published new evidence suggesting how the COVID virus gains access to the brain. They found that cells called pericytes which surround the brain's blood vessels may act as "Trojan horses," providing a path for the virus to enter, replicate, and then infect surrounding brain cells and tissue. The team discovered that pericytes contain ACE2 receptors, a known passageway for COVID entry into cells elsewhere in the body. ACE2 receptors are found in abundance in the lungs, arteries, heart, kidney and intestines, but were not previously known to be produced in human pericytes.

### Study Sheds Light on Prevalence of 'Long-COVID,' Including Cognitive and Psychiatric Symptoms



#### Paul J. Harrison, M.D. FRCPsych

Oxford University, UK

2004 BBRF Independent Investigator

PLOS Medicine, September 28, 2021 In a study involving over 273,000 patients, researchers provided a detailed picture of "long COVID"—how common its 9 core symptoms are and who is most likely to experience them. Most commonly reported was depression/anxiety, experienced by 22% within 6 months of diagnosis and 15% 3 to 6 months after diagnosis. Among other observations: long-COVID features were recorded in children and young adults, and also in more than half of non-hospitalized patients, confirming that they occur even in young people and those with relatively mild illness. This is significant in public health terms given that most people with COVID-19 are in the latter group, the researchers noted.

#### Negative Symptoms in Schizophrenia Worsened Under Pandemic Conditions



#### Gregory P. Strauss, Ph.D.

University of Georgia 2018 BBRF Young Investigator

October 30, 2021

European Archives of Psychiatry & Clinical Neuroscience, Researchers found that social distancing and isolation stemming from the pandemic caused a significant worsening of negative symptoms (flattened emotions, reduced motivation, difficulty speaking, a disinclination to socialize or seek pleasure) in schizophrenia patients, and to a lesser degree in those at clinically high risk of developing psychosis.



Claudia Espinosa-Garcia, Ph.D., 2019 BBRF Young Investigator Grantee in her lab at Emory University.

### BBRF Grants Pave the Way to Improved Treatments, Cures, and Methods of Prevention

#### **SINCE 1987:**



#### THE MULTIPLIER EFFECT

BBRF Grant recipients have gone on to receive an estimated \$4.3 billion in additional research funding in next stage NIMH and NIH grants.

#### No other organization outside of the federal government has funded the number of mental health research grants that the Foundation has—or been responsible for more breakthroughs in the field.

Our Grants support a broad range of the best ideas in brain research. Funding is focused on four priority areas to better understand and treat mental illness, aiming toward prevention and cures:

#### **Research Categories**

#### **Basic Research**

To understand what happens in the brain to cause mental illness

#### Diagnostic Tools/Early Intervention

To recognize early signs of mental illness and treat as early as possible

#### **New Technologies**

To advance or create new ways of studying and understanding the brain

#### **IDVII** Next-Generation Therapies

To reduce symptoms of mental illness and ultimately cure and prevent brain and behavior disorders

The path to being awarded a BBRF Grant starts with an application. Applicants for grants describe why they think their project could help lead to new insights and advances in brain and behavior disorders and represent the best and the brightest talent from world-class institutions.

The BBRF's Scientific Council, which is made up of 181 preeminent mental health researchers and led by Dr. Herbert Pardes, volunteer their time to review and evaluate applications. The Scientific Council not only looks for projects with the greatest potential for immediate breakthroughs in neurobiological and psychiatric research, but also at projects which can yield parallel benefits for many years to come.

This venture capital-like approach to research funding has had tremendous success in advancing the field and helping more people live full, happy, and productive lives.

"For more than 30 years BBRF has focused on funding visionary young investigators who see opportunities in forging new paths. By supporting ground-breaking work BBRF helps set the trajectory of brain research and builds momentum toward discoveries that we expect will yield advances in neuroscience. BBRF grants enable outstanding scientists to pursue bold new ideas to answer important questions or help identify potentially gamechanging targets for treatment. The awards function as seed funding for new directions which would otherwise be highly unlikely."

Herbert Pardes, M.D. President, BBRF Scientific Council

### BBRF Young Investigator Grants in 2021



BBRF Young Investigator Grants give early-career scientists the initial funding they need to begin to test their ideas and solidify their academic research careers. Young Investigator Grants provide scientists with \$35,000/year for two years, totaling \$70,000. This seed money enables them to generate the preliminary data, or "proof of concept" that they need to compete for larger grants from traditional funding sources like the National Institutes of Health.

A number of the new 2021 projects focus on early development of the brain, beginning in the fetal period and extending into the months and years following birth.

Some grantees are addressing very timely issues. One project, for instance, seeks to discover whether major depression is associated with impaired response to COVID-19 vaccines. Another project seeks to assess how racial discrimination may heighten risk of future depression in adolescent African-American girls with mothers who have been clinically depressed. Another project assesses the impact of stress upon refugees and victims of war trauma.

A few other intriguing 2021 Young Investigator projects include: probing a possible relationship between "screen time" and emotional and cognitive problems in adolescents; the possible role of dietary supplements to improve the health of women with the eating disorder anorexia nervosa who are pregnant; testing a biofeedback-based therapy to treat PTSD in young people; testing a smartphone app which collects data that could help prevent suicidal behaviors.

These are just a few highlights of the research projects that our grantees will be working on. It's an exciting and very promising time in brain research that we hope will lead to improved treatments in the years to come.

#### Co-Chairs of the Young Investigator Grant Selection Committee



Judy M. Ford, Ph.D. Professor, Department of Psychiatry *University of California, San Francisco* BBRF Scientific Council Member 2003 BBRF Independent Investigator



Suzanne N. Haber, Ph.D. Professor, Department of Pharmacology and Physiology University of Rochester School of Medicine and Dentistry BBRF Scientific Council Member 2011 BBRF Distinguished Investigator

"Breakthroughs in science cannot be predicted. Sometimes researchers start with one idea but are led in a different direction by their results or the results of other scientists. BBRF Young Investigators represent the next generation of scientists who we expect will make great strides in basic research, new technologies, nextgeneration therapies and early intervention techniques. This is the kind of out-of-the-box research that will offer the best hope for improved treatments, cures, and methods of prevention for our loved ones."

**Dr. Jeffrey Borenstein** 

### 2021 BBRF Young Investigator Grants by Illness

Some grantees are listed under multiple categories as their grant projects are relevant to more than one illness.

#### ADDICTION / SUBSTANCE-USE DISORDERS

Ana-Clara Bobadilla, Ph.D.

Gabriel D. Bosse, Ph.D.

Mickaël Degoulet, Ph.D.

Rafiq Huda, Ph.D.

Sara Liane Kroll, Ph.D.

Nathan J. Marchant, Ph.D.

Sara Pinto dos Santos Matias, Ph.D.

Tara Raam, Ph.D.

William Renthal, M.D., Ph.D.

Vaughn R. Steele, Ph.D.

Tamara J. Sussman, Ph.D.

Youna Vandaele, Ph.D.

Elizabeth A. West, Ph.D.

Junhua Yang, Ph.D.

Anna Zilverstand, Ph.D.

#### ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD)

Julien Ferent, Ph.D.

Heather M. Joseph, M.D. Basic Research Diagnostic Tools/Early Intervention

Brian C. Kavanaugh, Psy.D.

Jesse Marshall, Ph.D. Basic Research

Rhiannon V. McNeill, Ph.D.

Richard C. Sando, Ph.D.

Max Tischfield, Ph.D.

**Basic Research** 

#### **ANXIETY DISORDERS**

Mohsin Saeed Ahmed, M.D., Ph.D.

Estefania Pereira Cardoso Azevedo, Ph.D. Basic Research

Nicholas L. Balderston, Ph.D. Next-Generation Therapies

Daniel S. Barron, M.D., Ph.D.

Isaac Cervantes-Sandoval, Ph.D.

Nuria Daviu Abant, Ph.D. Basic Research Next-Generation Therapies

Ian Thomas Ellwood, Ph.D. Basic Research New Technologies

Angela Fang, Ph.D. Next-Generation Therapies Anna J. Finley, Ph.D. Diagnostic Tools/Early Intervention

Akhgar Ghassabian, M.D., Ph.D.

Lindsay R. Halladay, Ph.D.

Katia M. Harle, Ph.D.

Iliana Irini Karipidis, Ph.D.

Dalia Khalil, Ph.D.

Mudasir A. Khanday, Ph.D.

João Paulo Lima Santos, M.D. Basic Research

Bianca J. Marlin, Ph.D.

Susanna Molas Casacuberta, Ph.D.

Cynthia Ortinau, M.D. Diagnostic Tools/Early Intervention

Tara Raam, Ph.D.

Juan F. Ramirez-Villegas, Ph.D.

Patrick R. Sweeney, Ph.D. Next-Generation Therapies

Kristin L. Szuhany, Ph.D.

Shawniqua Williams Roberson, M.D. Diagnostic Tools/Early Intervention Next-Generation Therapies

#### AUTISM SPECTRUM DISORDER (ASD)

Aparna Bhaduri, Ph.D. Basic Research

Shuo Chen, Ph.D. Basic Research

Stephanie Dooves, Ph.D.

Ben B. Engelhard, Ph.D.

Shannon Farris, Ph.D. Basic Research

Julien Ferent, Ph.D.

Erin M. Gibson, Ph.D.

Ariel Gilad, Ph.D. Basic Research

Anubhuti Goel, Ph.D.

Kuangfu Hsiao, Ph.D.

Matthew A. Lalli, Ph.D. Basic Research New Technologies

Marco Lanzilotto, Ph.D.

Zhen Li, Ph.D.

Jesse Marshall, Ph.D. Basic Research

Tara Raam, Ph.D.

Siyuan Rao, Ph.D.

Simon Thomas Schafer, Ph.D.

Keerthi Thirtamara Rajamani, Ph.D.

Justin M. Wolter, Ph.D.

#### **BIPOLAR DISORDER**

Nicole M. Benson, M.D. Diagnostic Tools/Early Intervention

Pao-Huan Chen, M.D.

Garrett A. Kaas, Ph.D.

Karina A. Kruth, Ph.D.

Amy Peters, Ph.D. Diagnostic Tools/Early Intervention New Technologies

#### BORDERLINE PERSONALITY DISORDER

Lois W. Choi-Kain, M.D. Diagnostic Tools/Early Intervention Next-Generation Therapies

Brandy N. Tiernan, Ph.D.

#### **DEPRESSION**

Liza Ashbrook, M.D.

Anita Ellen Autry, Ph.D.

Pia Baldinger-Melich, M.D., Ph.D.

Marjolein E.A. Barendse, Ph.D.

Daniel S. Barron, M.D., Ph.D.

**Chloe C. Boyle, Ph.D.** Basic Research

Katharine K. Brewster, M.D.

Nuria Daviu Abant, Ph.D. Basic Research Next-Generation Therapies

Anna J. Finley, Ph.D. Diagnostic Tools/Early Intervention

Bart N. Ford, Ph.D.

Akhgar Ghassabian, M.D., Ph.D.

Lindsay R. Halladay, Ph.D.

Holly K. Hamilton, Ph.D. Basic Research Next-Generation Therapies

Katia M. Harle, Ph.D.

Iliana Irini Karipidis, Ph.D.

Dalia Khalil, Ph.D.

Ji-Woon Kim, Ph.D. Basic Research Market-Generation Therapies

Long Li, Ph.D. Basic Research

João Paulo Lima Santos, M.D.

Carla Nasca, Ph.D.

Cynthia Ortinau, M.D.

Eric M. Parise, Ph.D.

Beatriz Penalver Bernabe, Ph.D.

Sara Pinto dos Santos Matias, Ph.D.

Tara Raam, Ph.D.

Ryan Rampersaud, M.D., Ph.D.

Marit F.L. Ruitenberg, Ph.D.

Shai Sabbah, Ph.D.

Nicolas B. Senese, Ph.D. Basic Research Next-Generation Therapies

Patrick R. Sweeney, Ph.D.

Michael L. Wallace, Ph.D.

Yun Wang, M.D., Ph.D.

Shawniqua Williams Roberson, M.D. Diagnostic Tools/Early Intervention Next-Generation Therapies

Mary L. Woody, Ph.D.

Frances Xia, Ph.D.

Peng Zhong, Ph.D.

#### **EATING DISORDERS**

Estefania Pereira Cardoso Azevedo, Ph.D. Basic Research

Neta Gazit Shimoni, Ph.D. Basic Research Next-Generation Therapies

Moritz Herle, Ph.D. Basic Research

Michael D. Kendig, Ph.D.

Marilena Marraudino, Ph.D.

Patrick R. Sweeney, Ph.D.

Blair Uniacke, M.D. Basic Research Diagnostic Tools/Early Intervention

#### OBSESSIVE-COMPULSIVE DISORDER (OCD)

Miles Wischnewski, Ph.D.

#### **PSYCHOSIS**

Ivan Alekseichuk, Ph.D. Next-Generation Therapies

Neal D. Amin, M.D., Ph.D. New Technologies Basic Research

**Dominic B. Dwyer, Ph.D. Basic Research** 

Tina D. Kristensen, Ph.D.

Maria Rogdaki, M.D., Ph.D. Basic Research Mart-Generation Therapies

Johanna Seitz-Holland, M.D., Ph.D.

Kazunari Yoshida, M.D., Ph.D. Diagnostic Tools/Early Intervention

#### POST-TRAUMATIC STRESS DISORDER (PTSD)

Mohsin Saeed Ahmed, M.D., Ph.D.

Liza Ashbrook, M.D.

Antoine Besnard, Ph.D. Basic Research Diagnostic Tools/Early Intervention

Isaac Cervantes-Sandoval, Ph.D.

Elizabeth V. Goldfarb, Ph.D.

Lindsay R. Halladay, Ph.D.

Nathaniel G. Harnett, Ph.D. Basic Research

Dalia Khalil, Ph.D.

Bianca J. Marlin, Ph.D.

Joshua R. Oltmanns, Ph.D. Diagnostic Tools/Early Intervention

Justin D. Russell, Ph.D. *Next-Generation Therapies* 

Melissa J. Sharpe, Ph.D.

Kristin L. Szuhany, Ph.D. Next-Generation Therapies

Sanne J.H. van Rooij, Ph.D.

Shawniqua Williams Roberson, M.D. Diagnostic Tools/Early Intervention Next-Generation Therapies

#### **SCHIZOPHRENIA**

Ivan Alekseichuk, Ph.D. New Technologies Next-Generation Therapies

Kerem Böge, Ph.D.

Kelsey A. Bonfils, Ph.D.

Lucas M. Cheadle, Ph.D.

Javier Diaz Alonso, Ph.D.

Jennifer Jane Donegan, Ph.D.

Xiaoming Du, Ph.D. Next-Generation Therapies

Amanda L. Elliott, M.D., Ph.D.

Joana Ferreira, Ph.D.

Yudong Gao, Ph.D. Basic Research New Technologies

Ariel Gilad, Ph.D. Basic Research

Melanie J. Grubisha, M.D., Ph.D.

Jordan Hamm, Ph.D.

Rasmus Herlo, Ph.D. Basic Research

Stephanie L. Hickey, Ph.D.

Brian C. Kavanaugh, Psy.D.

Qingyun Li, Ph.D.

Jeffrey Lopez-Rojas, Ph.D.

Robert G. Mealer, M.D., Ph.D. Basic Research

Ryan H. Purcell, Ph.D.

Sebastian Reinartz, Ph.D.

Maria Rogdaki, M.D., Ph.D. Basic Research Next-Generation Therapies

Keerthi Thirtamara Rajamani, Ph.D.

Alejandro M. Trujillo, Ph.D. Diagnostic Tools/Early Intervention

Kazunari Yoshida, M.D., Ph.D. Diagnostic Tools/Early Intervention

#### **SUICIDE PREVENTION**

Giovanna Punzi, M.D.

Anna Robinson Van Meter, Ph.D. Diagnostic Tools/Early Intervention

**Cory R. Weissman, M.D.** *Next-Generation Therapies* 

Melinda Westlund Schreiner, Ph.D.

#### **BIOLOGY OF THE BRAIN**

(These projects focus on how the brain works.)

Wenjie Bian, Ph.D. (Dopamine and Sleep) Basic Research

Jonathan A. Coleman, Ph.D. (Synaptic Vessicles)

Jonathan R. Coleman, Ph.D. (Genetic Variation)

Guusje Collin, M.D., Ph.D. (Neurofeedback) Colling Diagnostic Tools/Early Intervention Next-Generation Therapies

Akira Fushiki, Ph.D. (Dopamine System) Basic Research

Xiaojing Gao, Ph.D. (Biomolecular Circuits) Basic Research Next-Generation Therapies New Technologies John B. Issa, M.D., Ph.D. (Interval Timing) Basic Research New Technologies

Christina K. Kim, Ph.D. (Neural Encoding) Basic Research Mew Technologies

**Bianca J. Marlin, Ph.D.** (Epigenetic Inheritance)

Clare E. Palmer, Ph.D. (Neurodevelopmental Pathways)

Nathaniel S. Rieger, Ph.D. (Stress Response) C. Basic Research

Pamela L. Scorza Bianchotti, Ph.D. (Epigenetic Inheritance) C. Diagnostic Tools/Early Intervention

Ikuko Smith, Ph.D. (Dendritic Pathogenesis)

Sofia Soares, Ph.D. (Learning, Cognitive Flexibility)

Meiyan Wang, Ph.D. (Astrocytes and Inflammation)

Yang Zhou, Ph.D. (Epigenetics and Neurodevelopmental Disorders) **Basic Research** 

#### **OTHER DISORDERS**

Epilepsy Changuk Chung, Ph.D.

Jonathan A. Coleman, Ph.D.

Fragile X Syndrome Shannon Farris, Ph.D. Basic Research New Technologies

Anubhuti Goel, Ph.D.

Gender Dysphoria Akhgar Ghassabian, M.D., Ph.D. III Basic Research

Iliana Irini Karipidis, Ph.D.

Tourette Syndrome Emily Julia Ricketts, Ph.D. INTERNATION Next-Generation Therapies

Max Tischfield, Ph.D.

### 2021 Young Investigators Institutional Affiliation at the Time of the Grant

(in alphabetical order)

Aix-Marseille University/CNRS, France

Albert Einstein College of Medicine

Amsterdam University Medical Centers, The Netherlands

Beth Israel Deaconess Medical Center

Boston College

Boston University

Brigham and Women's Hospital (3)

Brown University

Center for Clinical Intervention and Neuropsychiatric Schizophrenia Research, Denmark

Center for Neuroscience and Cell Biology, Portugal

Centre for Addiction and Mental Health, University of Toronto, Canada

Charité University Medicine Berlin and Freie Universitat Berlin, Germany

Children's National Hospital

Cold Spring Harbor Laboratory

Columbia University (5)

**Cornell University** 

Dell Medical School, University of Texas at Austin

Duke University

Emory University School of Medicine (2)

Feinstein Institute for Medical Research/ Northwell Health

Georgetown University

Georgia State University

Harvard University (8)

Harvard Medical School

Hebrew University, Israel (2)

Icahn School of Medicine at Mount Sinai (5)

INSERM, France

Institute of Functional Genomics, Université de Montpellier, France

Institute of Science and Technology, Austria

Johns Hopkins University School of Medicine

King's College London, UK (3)

Laureate Institute for Brain Research

Leiden University, The Netherlands

Lieber Institute for Brain Development, Johns Hopkins University

Ludwig Maximillian University, Germany

Massachusetts General Hospital (3)

McGill University, Canada

McLean Hospital (3)

Medical University of Vienna, Austria

Michigan State University

New York University (2)

New York University School of Medicine

Northwestern University

Radboud University, The Netherlands

Rutgers University (2) Research Foundation for Mental Hygiene, Inc./ Nathan Kline Institute (5) Rowan University St. Louis College of Pharmacy and Washington University in St. Louis Salk Institute for Biological Studies (2) Santa Clara University SRI International Stanford University (6) Stony Brook University Taipei Medical University, Republic of China Technion-Israel Institute of Technology, Israel The Rockefeller University (3) University Hospital Würzburg, Germany University of Basel, Switzerland University of Calgary, Canada University of California, Berkeley University of California, Irvine University of California, Los Angeles (5) University of California, Riverside University of California, San Diego (4) University of California, San Francisco (4) University of California, Santa Barbara University of Illinois at Chicago (2) University of Illinois at Urbana-Champaign University of Iowa University of Lausanne, Switzerland University of Maryland

University of Massachusetts Medical School (2) University of Minnesota 3 University of North Carolina at Chapel Hill University of Oregon University of Pennsylvania University of Pittsburgh (5) University of Southern Mississippi University of Sydney, Australia University of Turin, Italy (2) University of Utah (2) University of Washington University of Wisconsin University of Wisconsin-Madison University of Wyoming University of Zurich Brain Research Institute, Switzerland Vanderbilt University (3) Vanderbilt University Medical Center Virginia Polytechnic Institute and State University Vrije Universiteit Amsterdam, The Netherlands Wayne State University Washington University School of Medicine Western Carolina University Yale University Yale University School of Medicine

### The Klerman & Freedman Awards

#### The 2021 Klerman & Freedman Awards

AUGUST 2021



The Brain & Behavior Research Foundation honored and recognized the exceptional work of six outstanding young researchers who have previously received awards through the BBRF's Young Investigator Grant program with its annual Klerman & Freedman Prizes for exceptional clinical and basic research in mental illness.

The Klerman and Freedman prizes recognize innovative thinking and remarkable talent across the field of neuropsychiatry. These prizes pay tribute to Drs. Gerald L. Klerman and Daniel X. Freedman, whose legacies as researchers, teachers, physicians and administrators have indelibly influenced neuropsychiatry.

Their outstanding contributions to the field of brain and behavior research continue to inspire scientists who knew them, as well as those who are just entering the field.

The prizewinners were selected by committees of the Foundation's Scientific Council.

#### ANNUAL KLERMAN PRIZE FOR EXCEPTIONAL CLINICAL RESEARCH



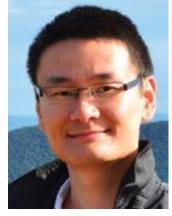
**Nicholas L. Balderston, Ph.D.** University of Pennsylvania Center for Neuromodulation in Depression and Stress

#### **HONORABLE MENTIONS**

**ANNUAL FREEDMAN PRIZE** 

FOR EXCEPTIONAL BASIC RESEARCH

Meaghan Creed, Ph.D. Washington University Pain Center, Department of Anesthesiology Washington University in St. Louis



Hengyi Cao, Ph.D. Feinstein Institutes for Medical Research, Northwell Health West China Hospital



**Denise Cai, Ph.D.** Icahn School of Medicine at Mount Sinai



Nolan R. Williams, M.D. Stanford University Director, Brain Stimulation Lab Director, Interventional Psychiatry Clinical Research



**Tomasz J. Nowakowski, Ph.D.** *The University of California, San Francisco* 

#### HONORABLE MENTIONS

## STRIVING TOWARD CURES THROUGH RESEARCH

### Scientist Spotlight with: Nicholas L. Balderston, Ph.D.

2021 BBRF Klerman Prize for Exceptional Basic Research 2018 BBRF Young Investigator Award (YI)

Nicholas Balderston's lab uses experimental design, psychophysiology, neuroimaging, and neuromodulation to explore the mechanisms that mediate the expression and regulation of anxiety. His work focuses on two primary objectives. The first is to model specific symptoms of anxiety in healthy individuals, and target these symptoms with cutting-edge noninvasive neuromodulation techniques. The second is to develop and conduct randomized-controlled clinical trials in patients with anxiety, using treatment protocols developed in healthy volunteers. This approach is designed to translate the scientific knowledge gained from heathy volunteer studies to real-world treatments capable of improving the lives of people with anxiety disorders. The ultimate aim of his research is to provide the foundation for novel neuromodulatory treatments for individuals suffering from severe anxiety.

### WHAT IS THE CURRENT STATE OF YOUR BBRF FUNDED RESEARCH?

I am currently in the final stages of the project proposed in my 2018 BBRF YI award. It has led both to my position at the University of Pennsylvania, and to the award of an NIMH K01 career development award.

#### HOW DO YOUR INTERACTIONS WITH PEOPLE LIVING WITH MENTAL ILLNESS AFFECT YOUR RESEARCH AND VICE-VERSA?

My primary area of research is understanding the expression and regulation of anxiety. During the last 18 months, the political climate and global pandemic have led to a profound increase in anxiety that is felt across the board. It is a reminder that as mental health professionals, our contributions are more important than ever.

### WHAT HAS BBRF SUPPORT MEANT TO YOUR CAREER?

The research supported by my 2018 BBRF YI led to the publication of several high-impact research manuscripts, provided key pilot data for my K01 career development award, and was a major factor in the hiring decision that led to my position at Penn. It is safe to say that the BBRF support has been instrumental in launching my career as an independent investigator.

#### IN THE BEST POSSIBLE SCENARIO, HOW WOULD YOUR WORK IMPACT THE PEOPLE LIVING WITH MENTAL ILLNESS AND THEIR FAMILIES?

In the best possible scenario, my work would provide the foundation for novel neuromodulatory treatments for individuals suffering from severe anxiety.

"Winning the Klerman Prize is an incredible honor, and a reminder of the importance of the work to be done. More broadly, receiving support from BBRF has been instrumental in launching my career as an independent investigator and has facilitated my ability to push toward translating my basic scientific findings into potential new treatments for people with anxiety disorders."

### Scientist Spotlight with: Meaghan Creed, Ph.D.

2021 BBRF Freedman Prize for Exceptional Basic Research 2018 BBRF Young Investigator Award (YI)

Dr. Meaghan Creed seeks to optimize neuromodulation therapies for disorders of reward processing, specifically for affective symptoms of chronic pain and substance use disorders. Deep brain stimulation (DBS) is a surgical therapy whereby current is passed through electrodes implanted into specific brain nuclei. While the indications for DBS are expanding, the mechanisms by which DBS induces its effects in the context of affective symptoms are not well understood at the cellular, synaptic, or circuit levels, making it difficult to optimize.

#### WHAT IS THE CURRENT STATE OF YOUR BBRF-FUNDED RESEARCH?

We seek to leverage insight from optogenetic circuit dissection studies to understand how basal ganglia circuit function is altered by the comorbid experience of chronic pain and addictive substances, then to apply cell-type specific pharmacology and electrophysiology to rationally design neurmodulation protocols that can alter circuit function to normalize symptoms of impaired reward processing. Our published work has characterized the role of non-canonical ventral pallidal neurons in reward seeking.

#### HOW DO YOUR INTERACTIONS WITH PEOPLE LIVING WITH MENTAL ILLNESS AFFECT YOUR RESEARCH AND VICE-VERSA?

During my doctoral training, I worked at the Centre for Addiction and Mental Health in Toronto, at a site where the primary activity was inpatient and outpatient treatment for substance use and mood disorders. The continuous first-hand patient interactions during my early research years was really powerful and instilled the importance of doing research that may meaningfully improve treatment outcomes, with goals that patients would support. "It's an honor and incredibly humbling to be selected for this award, particularly from this impressive cohort of BBRF Young Investigators. Support from my BBRF grant has allowed our lab to reach out in a completely new technical direction. It's my goal to help develop neuromodulation protocols to increase treatment options for patients and to develop an improved understanding of the neurobiology underlying specific symptoms, which may help predict and optimize patient responses to different therapeutic strategies."

### WHAT HAS BBRF SUPPORT MEANT TO YOUR CAREER?

Having support from the BBRF has given us the flexibility and resources to directly tackle one of the more highrisk, potentially high-reward steps toward this goal that would not have been possible otherwise.

#### IN THE BEST POSSIBLE SCENARIO, HOW WOULD YOUR WORK IMPACT THE PEOPLE LIVING WITH MENTAL ILLNESS AND THEIR FAMILIES?

In the best possible scenario, my work would provide a strategy that could be used to bridge the gap between our rapidly growing understanding of the neural circuit mechanisms underlying specific symptoms of chronic pain, mood and substance use disorders and tangible neuromodulation therapies for these disorders. Developing neuromodulation protocols to treat symptoms of these disorders would increase treatment options for patients, while an improved understanding of the neurobiology underlying specific symptoms may help predict and optimize patient responses to different therapeutic strategies.



## STRIVING TOWARD CURES THROUGH RESEARCH

## 2021 INTERNATIONAL MENTAL HEALTH RESEARCH VIRTUAL SYMPOSIUM

For the past thirty years BBRF has held our Symposium as a live event in New York City. Once again in 2021because of COVID-19 we held our symposium virtually which allowed event attendance by a much broader audience.

This year's program was reflective of the greatly accelerating pace of discovery in mental health research as well as the expanded range of studies the Brain & Behavior Research Foundation has grown to support.

The nine Brain & Behavior Research Foundation 2021 Outstanding Achievement Award winners shared new breakthroughs and insights on autism, depression, schizophrenia, bipolar disorder, and childhood psychiatric disorders, as well as cognitive neuroscience.

An overview of the entire Symposium was provided by Dr. Robert Hirschfeld, a BBRF Scientific Council member who has served as the moderator at the in-person Symposium since its inception more than 30 years ago.

The BBRF Outstanding Achievement Prizes acknowledge and celebrate the power and importance of neuroscience and psychiatric research in transforming the lives of people living with mental illness.

The symposium is available to watch on the BBRF You Tube channel: https://www.youtube.com/c/BBRFoundation/playlists

#### **Presentations included:**

#### A Life in Moods

#### Kay Redfield Jamison, Ph.D.

*The Johns Hopkins Hospital* PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Making Friends With My Schizophrenia: A Lifelong Project

#### Elyn R. Saks, J.D., Ph.D.

University of Southern California Gould Law School PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Experts by Experience — Transforming Mental Health Worldwide

#### **Charlene Sunkel**

Founder/CEO, Global Mental Health Peer Network PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Luck, Chance, & a Cross-Cultural Exchange Between Psychiatry in the U.S. and China

#### John M. Davis, M.D.

*University of Illinois at Chicago* HONORARY PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Assessing Cognition in Older, Undereducated Individuals with Schizophrenia in China Michael R. Phillips, M.D., MPH

Shanghai Mental Health Center HONORARY PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Responding to Major Problems in the Field of Mental Health

#### Norman Sartorius, M.D., Ph.D., FRCPsych

NYU Grossman School of Medicine HONORARY PRIZEWINNER, BBRF PARDES HUMANITARIAN PRIZE IN MENTAL HEALTH

#### Living with Schizophrenia During the Covid-19 Pandemic

#### Ezra S. Susser, M.D., Dr.PH

Columbia University, New York State Psychiatric Institute BBRF LIEBER PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN SCHIZOPHRENIA RESEARCH

#### Global Mental Health and Stigma: Advancing Science by Reaching the Most Vulnerable Groups with Psychosis

#### Lawrence H. Yang, Ph.D.

School of Global Public Health, New York University BBRF MALTZ PRIZEWINNER FOR INNOVATIVE AND PROMISING SCHIZOPHRENIA RESEARCH

#### Cognitive Impairment and Functional Disability in Bipolar Disorder — How Can We Optimize Outcomes?

#### Katherine E. Burdick. Ph.D.

Brigham and Women's Hospital Harvard Medical School BBRF COLVIN PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN MOOD DISORDERS RESEARCH

#### Neuropeptide Y in Normal Brain Function and in Mood Disorders

#### Aleksander Mathé, M.D., Ph.D.

Karolinska Institute BBRF COLVIN PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN MOOD DISORDERS RESEARCH

#### Circadian Genes, Rhythms, and the Biology of Bipolar Disorder

#### Colleen McClung, Ph.D.

University of Pittsburgh School of Medicine BBRF COLVIN PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN MOOD DISORDERS RESEARCH

#### The Development, Consequences, and Prevention of a Defensive Mindset

#### Kenneth A. Dodge, Ph.D.

Duke University BBRF RUANE PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN CHILD & ADOLESCENT PSYCHIATRIC RESEARCH

#### From Clinical Trials to Population Health: Closing the Mental Health Gap and Meeting the Needs of Children and Families

#### John T. Walkup, M.D.

Ann and Robert H. Lurie Children's Hospital of Chicago

Northwestern University Feinberg School of Medicine

Johns Hopkins University BBRF RUANE PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN CHILD & ADOLESCENT PSYCHIATRIC RESEARCH

#### From Knowledge to Action: Roles of the Primate Prefrontal Cortex

#### Elisabeth A. Murray, Ph.D.

National Institute of Mental Health BBRF GOLDMAN-RAKIC PRIZEWINNER FOR OUTSTANDING ACHIEVEMENT IN COGNITIVE NEUROSCIENCE

#### Preconfigured Dynamics in Our Brains

#### György Buzsáki, M.D., Ph.D.

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### We would also like to thank our 2021 Sponsors.

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### The Pardes Humanitarian Prize in Mental Health

Bestowed annually since 2014, the Pardes Prize recognizes a person(s) or organization whose humanitarian work is transformative and of great magnitude, changing the lives and bringing the joy of living to those facing challenges to mental health.

It was established to honor those who comprehensively care, teach, investigate, work, and passionately advocate for improving the mental health of society and have had a powerful impact on reducing the pain inflicted by psychiatric illness.

The recipient of the Pardes Humanitarian Prize in Mental Health is chosen by a distinguished international Selection Committee from nominations solicited worldwide. The Prize focuses public attention on the burden of mental illness on individuals and on society, and the urgent need to expand and enhance mental health services in the United States and globally.

The Pardes Humanitarian Prize is named in honor of Dr. Herbert Pardes, the first recipient of the award.

The 2021 winners are:



**Kay Redfield Jamison, Ph.D.** For her profound contribution to mental health awareness as an advocate drawing on her own struggles with bipolar disorder.



**Elyn R. Saks, J.D., Ph.D.** For her pioneering work as both a therapist and legal advocate for the mentally ill while living with schizophrenia.



**Charlene Sunkel** For helping to empower other people who live with mental health problems.

Three 2021 Pardes Honorary Prize Recipients were also announced and acknowledged for their groundbreaking work in mental health. They are:



John M. Davis, M.D.



Michael R. Phillips, M.D., MPH



#### **PREVIOUS PRIZE WINNERS**

#### 2020

Myrna M. Weissman, Ph.D. & Sir Michael Rutter, FRS *Honorary Tribute: E. Fuller Torrey, M.D.* 

#### 2019

William T. Carpenter, Jr., M.D. Honorary Tribute: Cynthia Germanotta & Born This Way Foundation

#### 2018

Judge Steven Leifman Honorary Tribute: Suzanne and Bob Wright

#### 2017

Doctors Without Borders/ Médecins Sans Frontières Honorary Tribute: Constance E. Lieber

#### 2016

Vikram Patel, Ph.D., F.Med.Sci. & Charles F. Reynolds, III, M.D. *Honorary Tribute: Senator Edward M. Kennedy* 

#### 2015

Beatrix (Betty) A. Hamburg, M.D. and David A. Hamburg, M.D.

Honorary Tribute: Rosalynn Carter

#### 2014

Herbert Pardes, M.D.



Norman Sartorius, M.D., Ph.D., FRCPsych

In 2021 the Pardes Humanitarian Prize in Mental Health was sponsored in part by Janssen Research & Development, LLC, one of the Janssen Pharmaceutical Companies of Johnson & Johnson.

#### Meet the Scientist Webinar Series

Dr. Jeffrey Borenstein hosts the free monthly "Meet the Scientist" webinar series where leading brain and behavior researchers discuss their current work on the latest in new technologies, early intervention strategies and next-generation therapies for mental illness. Each hour-long webinar includes time for researchers to answer questions posed by the online participants. This popular series offers the public access to some of the world's top scientists who discuss their cutting-edge research.

All webinars are available for viewing on the BBRF website.



ADHD: Controversy, Key Research Findings, Rising Prevalence, and Promise Tuesday, January 12, 2021

Stephen P. Hinshaw, Ph.D. University of California, Berkeley; University of California, San Francisco



How Brain Circuits Function in Health and Disease: Understanding Brain-wide Current Flow Tuesday, February 9, 2021

Kanaka Rajan, Ph.D. Icahn School of Medicine at Mount Sinai



Sensory Challenges and Anxiety in Children with and without Autism Tuesday, March 9, 2021

Kimberly Carpenter, Ph.D. Duke University School of Medicine



Addiction: Science Drives New & Novel Treatments Tuesday, April 13, 2021 Yasmin Hurd, Ph.D. Icahn School of Medicine at Mount Sinai



Using Rapid-Acting Brain Stimulation for Treatment-Resistant Depression Tuesday, May 11, 2021 Nolan R. Williams, M.D.

Stanford University Medical Center



What We Are Learning About Brain Biology and Borderline Personality Disorder Tuesday, June 8, 2021 Anthony C. Ruocco, Ph.D., C.Psych University of Toronto



Cognitive Impairment in Psychosis: What It Is and How It's Treated Tuesday, July 13, 2021 Amanda McCleery, Ph.D. The University of Iowa



Self-Control Gone Awry: The Cognitive Neuroscience Behind Bulimia Nervosa Tuesday, August 10, 2021

Laura Berner, Ph.D. Icahn School of Medicine at Mount Sinai



**PTSD: Identifying Risk and Current and Future Interventions** Tuesday, September 14, 2021

Victoria B. Risbrough, Ph.D. Professor in Residence, Department of Psychiatry, University of California, San Diego



Early-Life Risk for Pathological Anxiety Tuesday, October 12, 2021

Ned H. Kalin, M.D. Hedberg Professor and Chairman, Department of Psychiatry, University of Wisconsin



**Developing New Treatments for Mania Using Brain-Based Risk Markers** Tuesday, November 9, 2021

Mary L. Phillips, M.D. Professor in Psychiatry and Clinical and Translational Science, University of Pittsburgh School of Medicine



OCD: Using Genome Data to Predict Risk, Symptoms and Treatment Response Tuesday, December 14, 2021

**Gwyneth Zai, M.D., FRCP(C), Ph.D.** Assistant Professor, Division of Brain & Therapeutics, Department of Psychiatry, University of Toronto

# Healthy Minds

### With Dr. Jeffrey Borenstein



Living With Bipolar: A Conversation With Maurice Benard

"One in five people is affected by a mental illness, and we are seeing increases in depression and anxiety during these unsettling times. The goal of Healthy Minds is to inspire conversations about mental illness, provide understandable information and resources for viewers, and demonstrate that with help, there is hope." – Dr. Jeffrey Borenstein

**Healthy Minds with Dr. Jeffrey Borenstein** aims to remove the stigma of mental illness and demonstrate that with help, there is hope. The series features inspiring personal stories from people who have experienced mental health issues, as well as the latest information from experts on new approaches to the diagnosis, treatment, and prevention of mental illness.

"Healthy Minds" is available on PBS stations around the U.S. and online at PBS.org. Here's the link: https://www.pbs.org/show/healthy-minds-with-dr-jeffrey-borenstein/ Previous seasons can be found online at: www.bbrfoundation.org/healthyminds-tv

The Emmy nominated series is produced by the Brain & Behavior Research Foundation, presented by Connecticut Public Television (CPTV), and distributed by the National Educational Telecommunications Association (NETA). Funding is provided by the American Psychiatric Association Foundation, the Bank of America Charitable Gift Fund, and the John & Polly Sparks Foundation.



In 2019, the **Moritz Hilder Innovative Brain Research Fund** was established by the Trustee of the Jane Hilder Harris Trust with an endowment gift of \$3.5 million. It was created to preserve and honor the memory of Moritz Hilder, the father of the late Jane Hilder Harris.

This generous endowment will be held in perpetuity to advance medical research with the objective of gaining a basic understanding of post-traumatic stress disorder (PTSD) and its prevention, treatment and cure. Primary emphasis will be given to research involving innovative concepts where, although there may be a high risk of failure, the rewards of success would be substantial, and to researchers who typically would not be in a position to secure funding from more traditional funding sources.

The Moritz Hilder Innovative Brain Research Fund is held in a professionally managed, separate endowment fund. On an annual basis, 5% of the endowment fund will be expended to support PTSD research. A special committee of the BBRF Scientific Council will select which BBRF Grants will be funded by this Endowment. In 2021, the Endowment provided \$190,000 for the first year of funding of six PTSD research projects.

We are deeply honored to have received this generous and impactful gift.

# THANK YOU TO OUR DONORS

Your support this year enabled us to fund more than \$16 million to scientists looking for better treatments, cures, and methods of prevention for mental illness.

Since 1987, in partnership with you, our donors, BBRF has awarded more than \$430 million to fund more than 6,200 grants to more than 5,100 leading scientists around the world.

With your help BBRF has been able to foster new research pathways that will lead to transformative breakthroughs. We deeply appreciate your support and commitment to advance psychiatric research.

### BENEFITS OF BECOMING A RESEARCH PARTNER

Barbara Toll BBRF Board Member & Research Partner

Many BBRF donors have a very personal interest in brain and behavior research. They know from often difficult, first-hand experience the devastation mental illness can bring upon family and friends, and they know that research will ultimately bring about better understanding and treatments.

Our **Research Partners Program** offers donors the opportunity to personally select and support scientists based on various criteria, including, but not limited to, illness specialty area or specific institutions, or a combination of these. Researchers are selected by the donor (our Research Partner) after members of our all-volunteer Scientific Council have conducted an independent peer review of the submitted applications and have made their recommendations for grant awards. The **Research Partners Program** enables donors to choose among the best and brightest scientists and the most promising, cutting-edge proposals in mental illness research.

The results from these studies often provide the pilot data needed to apply for much larger federally funded grants (from the National Institute of Mental Health and the N.I.H., for example).

To date the BBRF **Research Partners Program** has funded more than 1,500 research grants.

To learn more about the Research Partners Program, please contact us at **646-681-4889** or **researchpartner@bbrfoundation.org**.

Visit us at bbrfoundation.org/ researchpartners.

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Dahlia Levine Sophie Levine Daniel Levy on his 80th Birthday The Levy's granddaughter, Ella, on becoming a teenager The Levy's granddaughter, Esme, on her 10th Birthday The Levy's granddaughter, Jordyn on her 18th Birthday Taylor A. Levy on her 7th birthday Kara Lilliestierna Stephanie Linderoth June Lindsey Kevin Link Lisa Andy Liu Donald and Robin Lloyd Laura Lockhart Barbara A. Lohmeier Jennie Lombardino Brittney Long Jonathan Long Alexander D. LoPrinzi Rebecca Love Dr. Lucas Melissa Ludke **Destiny Luttrell** Daniel Maahs Theodore Madden Justin Magleby Victoria Mah Mike Mahardy Kevin P. Maher Thomas J. Maier Matt Maldonado Joshua Malilay Janelle Malta Wilson Eugene (Gene) J. Mancino Chathan Mangat Johnny (Manz) Manziel Sofia Marin Elizabeth Marrinan Stephen M. Marshall Adrienne Martain Black **Emily Martin** Winsome B. Martin Katie Martin Scott Marilyn Martin Wallace Habib Mas **Ruby Masterson** Shelby Mastovich Mason S. Maulsby, M.S., APRN Bill Maupin

Carol A. May's beloved son The Maybank Family Allan McCall Allan T. McCall Danielle McCole Joe McCoy Rebecca K. McDougall Irelyne McGee Liam McGinnis Mike McGinty Carolyn Kelly McGowan Rafferty McKeen Kathleen McKenna Veronica McKevitt Marlea G. McKinstry The McMinn Family Kevin McNelis Harley McRae Patrick McWilliams Pedro F. Medina-Pardo Meghan Elizabeth Gete Mekonen Rachel J. Mendez Renee Mikkelson Christopher and Lynette Miley Jacey Miller Lucas Miller Melissa M. Miller Parker Mizerak Gary Montgomery Tiffany Moore Mary Ellen Moran Matthew Moran Heather Moreau Provencal Dr. Andrew L. Morrison Bradley D. Morrison Jennifer Morse Emilly Moskowitz Matthew Moskowitz Bridget Mouchon-Humphrey Anne K. Muellerleile Gina Mulfinger Robert P. Muller Sean and Lindsay Mulligan Jasmine Munoz Patrick T. Murphy Tyla Murphy Andrea Murray Heather Mushock Andrew Nadeau Grace Nagaur Lauren Nahas Ratish Nair Martha Nangle

lesse Nashan Ross Nataline Ionathan Navarrette and Marianna Vitkun The Neely Famiy Taylor Neher Susan Neill Colby Dominic Nelson Neuroscientists Lucas Newman Steven Niedbala (PaulLethargy) Kim Nishida Noah from the No Future Bound Instagram group chat Richard Noortman and the Voiceless Initiative lane Norris Jenna Nosal Stephen J. Novak Evan Nudi Andrew Thomas Nutt Josh Nyman Kyle Oates Molly O'Brien Arron N. O'Callaghan and Sean D.O. Smith Julie Ocean Of all who suffer Addison Oguntala Heather O'Leary Cooper Mark Olfson, M.D., M.P.H. Kristin Olson Livi Onozo Arlie Opal Janna Victoria Orr Nieves A. Ortiz John and Mary Pat Osterhaus Alex O'Toole Alfredo Ovalle lacob Oveson Sam Panzer and Daniela Baughman-Panzer Dr. Herbert Pardes and Dr. Nancy Wexler Sydney Parker Cara Partovich Louis (Chip) I. Pasche IV, M.A., LPC Nicole Paskalides Anthony Passaretti's dearest friend Louis W. Patko **Timothy Pattyson** Nicholas (Nick) Pelletier losiah Pena Dr. David Penn-Soskin **Elaine Perales** 

Luis Perez Jilly Perlberger Hollmann Amy Perrino Luciene R. Pfefferkorn for her caring attention to mental illness Vinh Kien Phan Grant Phillips Jeffrey Phillips Kate Piatti Brendan Pierce Joe Pietromonico Chrissy Polans Jacob Pong James and Donna Potter Adrian Preda, M.D. Marla S. Press Samantha Priebe Lauren Proulx Conforti Andrew Pruce Josie Lynn Pruitt PS Umair Quazi Romana Rajput Jasmine Ralph Rebecca Ramsey Randy (The Rocket) Hridya Rao Phillip Rather Ryan T. Rauscher Kat Raveling Susmita Rayamajhi Reddit Secret Santa Madeline Reed-Johnston Katie Reis Ruthie Ren Thoraya Rey Andy Reynolds Terry Richards Nathan Richardson E.J. Richmond Mike Rickert Geoff Ridder Brian Rinkowski, Jr. Stephanie Riven and Roger Goldman Devys Rivera Min Jung Ro Chelsea Robbins Sean Roberts and Andrea L. Barsk **Emily Robertson** Casey Jeanette Robinson Pamela K. Rocca Kimberly A. Rock Flavio F. Rodea

Alex Rodriguez, Jr. Elizabeth Rodriguez Meghan Rokita Rolling Triplets in Farkle (dice game) Robert Ronis, Ph.D. Kenzie Rose Melissa Rose Mycah Rose Mario and Linda Rossi Dr. and Mrs. Richard Roth on celebrating 50 years of wedded bliss Faith Rothblatt Nancy Roylance Gregg Rubin Ueli Rutishauser, Ph.D. Dan Ryckert Nicole M. Ryziw Patricia Rzasa-Blum Ionathan S. Muhammad Saadi Sandra Sabatini, Psy.D., Ed.D. Kirby Sack Properties, Inc. / Paul Sack Properties II, Inc. Nick Saddig Marak Salamon Mark and Bridget Salce Mary C. Salpukas Jeffery M. Salsbury Haleigh Elyzabeth M. Sanchez Glory A. Sandberg, M.D. Catherine (Candy) Santello Garcia Sarah Ann Mark Sather Mark A. Satterthwaite, M.D. Braden Sauer Nancy Schaezlein-Zipse's beloved daughter Michael Schemansky Paula Schlesak Aiello Kai and Malia Schmelzer Stacey Schmidt Pam Schroeder Stacy Schulman-Riordan Russell Scott Dr. Benjamin S. Scruggs Kit Seeds Warren W. Sejud Sema Fulloa Severino The Severs' beloved daughter Kathy Shaughnessy Dudich Susan Shedd Jay Shetty The sick and the suffering

Lilian Sicular Claire Sigal Silent Sufferers Dr. and Mrs. Mark Silver Geoffrey A. Simon and Andrea R. Graham Joseph and Amanda Simon Tyler Skye Danielle S. Smiley Alyssa Smith Eddie Smith Eugene Smith Kyle Smith and family Liv Smith Richard and Sue Smith The Reverends Toni Ruth and Wesley Smith Kathryn A. Snow, LCSW Bobbie Snyder Mark Solomon Jakob Solorio Kerri D. South and Courtney D. Goeltzenleuchter Alan J. Spandorf Kathryn (Kay) D. Speckman Robert A. Spigler Kelda J. Spreiregen Dawn Spunzo Olivia Stafford Tita Stafford Andreea M. Stanica David J. Starck Marianda Stasinopoulou Lynne Stein, M.D. Johanna Steinmetz-Cummings Ranjana Sterling Eve Stern Ryan A. Stern Ila Steving Leslie Stewart-Hood Dr. Abby MacCauley and Mr. Christopher Stocks lean L. Stone Gregory Strauss, Ph.D. Meg Strelow Frank Strootbandt Kaitlyn Rose Strope Malina Suity's co-worker and Charity Secret Santa Mary Summers Lorenzo C. Supino Peter J. Tarr, Ph.D. Debra L. Tebrich Jack and Holly Teitsma

Ten At A Time William Theos James C. Thies Jamie Thomae Sarah Thomas Tory Thomas **Barry Thomasson** Nichole Threadgill Kristen Tibbs Stacy Tison Kirin Tiwary Bosworth M. Todd, Jr. Susan Tompkins Una Torbika Linda M. Tortorice Feliz Tovar Nazir Trapp Amy Trappey Sophia K. Treantafeles Tina Turnbull John Tyler and Caroline Kelly Melody Udell Martin Ureel Lisa Uriell Jenna Vandenberg Amy VanderZanden Barbara Venendaal Yosses Jacobella Venezia Luongo Luanne Venney Mazzioni Jessica L. Vera Deandra Vetter Vijayaellemma Michael Vinson-Elliott Jillian Vocke Carl Vogtsberger Michael Vollmar, M.D. The Kind folks of the W.W. Patreon Server Julia Clare Wagner Katherine (Katie) L. Wagner Alex Walsh **Bethany Walters** Joice Wang len Ward Jennifer Ward Maci Ward Melissa E. Ware Kellie Warfield Jordyn M. Warrington Darrell Weakland Sarah Weber Mol Rod Wedemeier Dr. Jodi Weinstein Madelyn Weirich

Robert and Frances Weisman Myrna M. Weissman, Ph.D. and James C. Frauenthal, Ph.D. Kelsey Welk Connie Weller Nicholas Wells Rodney Wells and family Heather Nicole Wenning Linda Wester Christopher Whalen Matthew R. Wheeler Mr. and Mrs. R. Graham White III Perry White Drew A. White-Jacobson R. Todd Wickliffe Brooke Wilken Brooke Wilkin Daniel A. Will Christian Willenbacher William Aaron Williams Garrett R. Williams Lacey Williams Sarah Williams Wendy L. Wilson The Veteran members of the WLA VA MHICM program Mike Wolf Ashley Woodson Bailey Alexander Wrede Jeff and Leslie Wright Cherie D. Wrigley Dorothy J. Wysack Mike Yamanaka Allison Yee Ann Jung Yi Tracie Yonkman Shonda York-Nelson Amber Young Coleman Young Eleanor Zarski Ashley Zartman Molly Zaslow Alex Zeigler Levi Zelanko Yumei Zhang Qiqi Zheng Michelle Zielinski Craig Zuckerman Alexandra Zuk

#### **Memorial Tributes**

A loved one Kathy Abaray Randy L. Abbott John (Jed) B. Abrams Mary M. Abrams Patricia Acardi Elizabeth Adams-Addorio Florie Adiutori Max Agrest Helga Aktipis Gladys M. Albright-Fisher Anne Alexander-Pedersen All Native Youth who have died by suicide Janice M. Allison Che Alvarado Jose F. Amaya Marzieh Ameli Muhammad A. Ameli Vincent S. Amoroso, Jr. Shirley A. Anderson's twin sister, Sharon Susan (Sue) K. Anderson Geraldine (Jeri) Antle-Adams Martin H. Armel Annie B. Armstrong Willis F. Armstrong III Timothy W. Arnold Albert R. Arroyo Edward Arvey Laura Ascolese Helen Asher Allan G. Atherton, Jr. John Atterberry Dahl L. Atterbury John (Les) L. Austin David Ayres Michelle B. Randy Bacchus III Jimmy Bailey John D. Bailey, Sr. Gregory T. Bak Eileen Baldwin Anna Balek Scott Balgemann Lloyd A. Ballard Patricia A. Ballard Cynthia L. Barazowski-Kassel Neil Gregory (The Warrior) Barber Elizabeth (Betty) Bardsley Colin M. Barkley Margaret Barnes-Rehman Brandon L. Barnhouse Dorothy G. Barraclough Terrence Barraclough Robert |. Barrett Richard A. Bartlett Scott R. Bartlett Andrew (Buddy) Barz Wiedemann

Judith A. Baskin Shale Baskin Brian A. Bass Dr. Michael J. Bauer Ida Baum Michael T. Baumgardner Robert Baxa Tyler J. Becker Margaret Beebe-Nuckols Laurent Beeftink Barbara J. Beier Laura Beitler Alex (AJ) J. Belshe Richard Benabio, Jr. Brian J. Bengston Patricia A. Benning **Beverly Berg** Dr. Nicola Berlato's beloved friends Jamie Bernard David S. Berry Becki Bettencourt Brian A. Bezonsky Kevin M. Bezonsky Kalyan Bhandari Deepak Bhasin Lee A. Billman Stephen J. Binder Dr. Morton Black Neil C. Blanchette Joyce Blomker Carl P. Bloom Susan K. Blume-Babcock Howard T. Boasberg, Jr. Kirk D. Boise Brad Bolding Bradley (Brad) H. Bolding Oliver R. Bolger Aidan J. Bone Antoni (AJ) J. Bonnell Doreen L. Bonney Amy J. Boone David W. Borks Paula Bourgue Steve Bowers Steven M. Boylson Sean Brady Robert Branch Andre Brassard Christopher D. Brehl David Breuer Hans Breuer Catherine (Cathie) A. Brodie Rose Bromberg

Joseph F. Bronge III John W. Brooke Daniel S. Brown Bruce Brownlee William Bryan, Jr. Donald A. Budzinski, Sr. Kevin M. Buente Anna L. Bulgari Walter W. Bundschuh Peter R. Bunning Patricia A. Burdeshaw Andrew P. Burke Colleen M. Burke Matthew (Jim) J. Burns Kathryn P. Burrell Patrick T. Butters Michael J. Caeton Patrick M. Caires lesusita (Susie) Calderon Brendan J. Calvey Oscar Canavan Israel A. Caraballo, Sr. Robert Carcioppolo Curtis A. Cardwell Joyce Carter Suzanne L. Castellani Peter Castro Donna J. Caulfield Lorraine Cavallaro Noreen Charters Tavon M. Chelvarajan Cheryl Thomas D. Childers Isabel Chin Allison A. Chlan-Fellner Eric H. Choi Siddharth Choudhry Marley Chudnow Patrick O. Clancy Laura Clapp Ruth G. Clark Jenna Clemenz Mark A. Cochran Patrick Coffer Akilah (KiKi) B. Coleman Lynn Conaway Alexander B. Conley Gerald (Jerry) J. Connolly, Sr. Victor E. Conover Dr. Paul A. Constantine K. Wade Cook Ryan J. Cook Grace Cook-Blasingame David M. Cooke

Joanne Coons David Cooper-Claire Joseph C. Cotter Christopher M. Cowan Justin Cox Joseph (Joe) P. Creech Brenda G. Crenshaw Ionathan Culverwell Benjamin (Ben) A. Cunningham Noreen Cunningham Joan (Joanie) M. Curtin Thomas Dabrowski, Jr. Lance M. D'Alessio Colter Dallman Richard D. Daly Daniela Dave Terrence (King Terry) A. Davis lanice E. Day-Britton Jacopo De Moro A. Louise DeAngelis Dr. Margarida M. Dederick Mary M. Deely Gaspare (Gary) R. DeGaetano Daniel Deichmann Angela DeMartino Arvilla Denning Janice E. Denning Medha S. Deo Katherine Deschner Henry (Hank) J. Deutschendorf II Steven Deutschman Jack V. Devereaux, Jr. Emmy Dickey Nathaniel J. Dickinson Adam M. Dickler Harrison Diesel **Emily DiFlorio** Robert D'Innocenzio Kenneth Ditzel Brandon Dixon Ionathan E. Dixon Nicholas (Nick) A. Dobbert Ilva N. Dolce Cecile Dollison Gavin J. Domm Donna Una G. Donnelly Murray W. Dorin Eric T. Dorris August (Gus) E. Doskey Fae Dougan Rachel L. Drabenstott Grant Dreier

Lester P. Dreyfuss Deanne Drietz Mike Driver Lorraine (Lory) Dryden Michael Duffy Christopher R. Dugan Ronald S. Duman, Ph.D. Laura D. Duncan June E. Dupré Robert Duran Jonathan L. Dworkin Ronald P. Dyer Ronald (Ronnie) O. Edwards Suzhanna M. Elam, M.D. Ivan Elder Karl J. Emerick Jr. Marie A. Enderley Mary Entwistle-Libby Jason Ericksen Joseph Erickson-Goldsmith Raul Escobar-Fernandez Paul J. Esposito Judith K. Esse Catherine (Catie) A. Etier Justin B. Evarian Marian (Molly) P. Everdell Brian (Whitey) S. Evers Margaret Ewald Dr. Serge Eytan Benjamin C. Faetanini John E. Fahrnbruch Mary Ellen Falk Leslie E. Falzone Donnesh Farmanfarmian Garrett R. Farr Ann Feder Seymour Feinland Charles H. Feldman Elliot Feldman James (Alec) A. Fentum Anthony Ferrero-Rankin Jeremy C. Finch Marla Fine-Feinstein Catherine Finn Christina (Chrissy) R. Fischer Carrie F. Fisher Jonah H. Fite Michael K. Fitzgerald Raymond J. Flood, Jr. Jamie Flory Helen C. Fontana Jessica A. Forbes Geoffrey L. Foster

Maryann Fougere Jacob J. Fox Ionathan Fox Matthew T. Fox Danny Frawley Henrietta Freedman Rudolph Freedman Gail W. French Freud Harvey Friedenberg Benjamin M. Friedland Jason C. Frisco Eric A. Fritts Clarence Fritz Ruth (Schy) Scheible Funderburk Christopher Furay John A. Gahr, Jr. Brian Gallagher Austin Y. Gann Sean Gardner Joan M. Gargani Gregory D. Garson Benjamin E. Gast Andrei W. Gauger Lawrence (Larry) Gaughan Denise A. Gehrt Nancy Geller Quinn Gens John (Doug) D. Glenn Richard (Dick) T. Glenn Daniel J. Glorioso Brian D. Go Shirley Gold Elena Goldberg Herman Goldblatt Morton (Mort) Goldfield Susie Goldsmith's beloved nephew Joseph C. Gonzalez Ethel G. Gordon Ted A. Gorman Dr. Irving I. Gottesman Ellen Gottfried Adam J. Grainawi Annie Granger Carolyn Grant John Grant William F. Grant 1st and 2nd Bob Gray Linda F. Graybeal Eleanor Gray-Hankins Rose K. Greenberg Mark J. Greenlee Laura T. Gregory Matthew J. Gregory

Vincent (Vincenzo) J. Grimaldi Noah J. Grimes Suzanne R. Guerra Annie Guillory Amanda G. Gurley Iris L. Gushiken Charles (Charlie) W. Haeger Dana A. Hafertepen Darren Hagen John B. Haldeman Nicholas Hall Stephen B. Ham Kelly R. Hamers Christopher M. Hamilton Stanley (Troy) T. Hamlin Henry (Hank) Hanau Peter J. Hanna Lucille Hannon Matthew J. Hardin Jason R. Hargarten Maxwell R. Harmon Margaret Harrington Ellen E. Harris's beloved father Jordan E. Harris Lindsay L. Harris Gary E. Hart Rhonda C. Hart Victoria L. Hart Dr. S. Ann Hartlage Feltes Nancy A. Hartman Cynthia (Cindy) M. Harwell-Paar William M. Hashimoto Sarah Bell-Hawkins **Ronald Haves** Timothy Hayes Michael Heafield Kevin J. Heald Dianne E. Heckathorn Bradley R. Heilman Phyllis Held Scott L. Helt Beverley A. Hennigar Justin D. Hensley Justn Hensley Michael K. Herman Thomas (Tom) J. Hermsen Debbie L. Hess Grover Heyler Brian D. Hill Anthony Hillman Arthur W. Hills Daniel G. Hinden Mollie L. Hintze Jill Hirshberg

John R. Hoelzel, Sr. Dr. Carol A. Hogan Jack Holden Joel M. Holfarty Zackry H. Holland Mark Hollander Michael Hollyday Corinne H. Holt Bert Holtje Dr. Philip S. Holzman Sheldon K. Hooper Mark C. Hoover Diane Horner George C.B. Hosley Jacob Howes John D. Huberty Rennie E. Hughes Ben Hughlett Gregory J. Humes William (Billy) W. Humphrey Alan N. Hundert Stephen J. Imarata Naveed A. Igball Jane Irwin-Malinoff J.K.L. Vivian B. Jackson Lea E. Jacobs DJ Jaffe Farrokh Jahandari Prem Jajoo Fred James Sabrina I. James Nancy M. Jeffords-Goselin Thomas Jeffrey Alexander D. Johnson Arthur C. Johnson III Ernest (Ernie) B. Johnson Glenn Johnson Hannah Johnson Justin Johnson Michael D. Johnson Ryan P. Johnson Scott A. Johnson Maryann Johnston Malcolm Jones Nathan M. Joy Andreas (Dre) P. Kahan Joyce I. Kalman Anthony A. Kamanes Leif Kamara Sean B. Kamp Cheryl A. Kane Richard (Richie) J. Kane, Jr.

Robert J. Kannenberg Albert W. Kaplan Anna Karam Steven M. Karp Claude R. Kaufman laswinder Kaur Ram Kaur Peter Kay Fred J. Keen Jonathan Kellert William G. Kelly III Carolyn E. Kendall Michael F. Kenigsberg Corinne M. Kennedy Frances (Hazel) Kennedy Sarah Ketchum-Bradley Kevin Harry Keyzer Rashidul H. Khan-Shiply Paul Killea Charles C. Kimbro Doris Kimbro Stephani L. King-Chapman Denise Kinlaw Robert Kinn Jonathan S. Kinsley lill A. Kirby Trevor Kirchoff's beloved brother Eva Klahr Robert Klahr Elly Klamo Emmi Kleeman Alvin H. Kling Doris M. Knapp Alexandra B. Knöppel Diana Knowlen Allison (Alli) S. Kohl Peter C. Kohn Richard L. Komray Arty Kononchik Brennan M. Kornak Diane A. Koskinas John B. Kramer, Jr. Mark Kramer Patrick H. Krause Robert (Bob) F. Krebs Joseph J. Kroepil, Jr. Michael Krusell Nelson Kendal (Ken) A. Kucera Murry Kusmin Victor M. LaFata Stephanie Lambert's beloved son **Berenice Lancis** Gloria G. Landon

Lina M. Lanza Carole Jean Laping Mary Ann Lapinskas Noah Larkin-New Scott Larsen Garrett Larson Arlene M. Lasneski Charlene Lat Jenna R. Laubach Brendan L. Lauderdale Robert E. Lauer Justin A. LaVenter Megan Lavin Jerome (Jerry) C. Lawrence Emilia Lazar LCB leanne M. Lee Robert Lennon Meagan L. Leonard Allison Leong Alex Levich, Sr. Noah D. Levin Michael S. Levine Ally Levy's beloved granddaughter Dr. Eric A. Lewis Scott A. Lewis Jacob Lichtenstein Constance E. Lieber Samuel A. Lieber Stephen A. Lieber Darren I. Liess Donald A. Liess Jason N. Lighthall Chris Lightning Gail Liker Royce (Tres) D. Lillard III Hans K. Lindgren Calvin (Cal) J. Lippitt Michael J. Lippitt Roberta Lippitt Richard E. Little Lauren G. Liu Robert G. Livingston, Jr. Frank J. Lodanosky John (Jack) S. Logue II John D. Lopes Danielle M. Lorenz Zack Lorenz Victor G. Lottmann Basil L. Loudas Joanna Lowry Thomas A. Luby, Jr. Michael Lucente Heather A. Luedee-McNamee

John Lukanitsch Alfred J. Lundgren Mary Lou Lunney Mariah Lynch Barbara Lyons Matthew A. Lyons Matthew C. Lyons Corby Lyons-O'Connor John Macaluso Noel A. Machado Camille R. Mackey Marissa N. MacLaughlin Fern L. Mahan Roman Makuch Eileen M. Malaspina Robert T. Malison, M.D. Merrill M. Manning III Kamlesh Manocha Alan G. Marer Marcella (Marcie) R. Margel Ella Marino Frank Marino Kathleen A. Marnock Aaron R. Marriott Matthew Marshall lessica Martin Robbie Martin Robert (Bob) W. Martin Nicolás Martinez Nora Martinez Elizabeth Martino Erica A. Martoni Jean L. Mason A.R. Massah Marc Massery Dave Mateo Michael D. Mattoon Thomas Matye Travis Matye Stephen Maxsted John K. Maxwell, Jr. Dennis P. McAward Kevin P. McAward Devin McCafferty-Long Erik J. McCarthy Michael P. McClain Lynne McClure, Ph.D. Skye McCole-Bartusiak Mindy McConnell Tracie McDavid Dr. Duncan McDonald Sean McGarvey Elmer (Mac) H. McGilvray

Brian McGlinn John D. McGrath John R. McLain, D.C. Victor P. Medellin-Sterling Liam A. Meechan Ralph Melenson Christopher D. Melko Daniel Melone Elisabeth Z. Meyers **Daniel Michaels** Jeffrey A. Michalski Apphia Michelich Ronald Michelich Ruth Michelich Christopher F. Miehlisch Kelly Miller Lucille (Lucy) A. Miller Lori Miller-Levine Samuel H. Mintz-Straus Keith Mirailh Duncan N. Mitchell Jeanette Mogor Neil Molberger John Monaco, Jr. Gregory A. Monk Juan (Joji) Maniquis Montelibano leffrey D. Moon Evan S. Moore Jesse M. Moore Linda Moore's beloved nephew Richard A. Moore Jonathan (Jake) J. Moran Matthew P. Morgan Mary V. Mortelette Ellen Mosher **Rick Mosher** Stephen Mossman Richard D. Moszkowski Patrick R. Muldoon Kevin B. Mulhall Ronald P. Mullan Barbara J. Mullen Suzanne J. Mulligan (Suzie or Grandma loe) Marguerite Mullis Wyatt L. Murchison Lisa (Tish) P. Murphy Charles L. Murray, Jr. **Dianne Murray** Lynn Murray Eleanor T. Myrato Eva M. Naiman John Naiman Shruti Narang

Near Adam Neely Ionathan Nelson Michael K. Nelson Paul Nelson Paul I. Nelson Debjani Neogi Kirk D. Newell Douglas A. Newman Shemal Nezhadian Kathleen Noakes Mary C. Noble Kerry Normandy-Dolberg Gary North Rev. Virginia (Ginny) Norton-Herring Hubert Nutt Andrew F. O'Connor Kelley O'Connor Dr. Herbert Kazuto Oie Kerry E. Olivier Dr. Mary (Kathy) K. O'Loughlin Solomon O'Lunigh Frances O'Neill Randall Oppenheimer Mitchell Orlowsky Matthew Ornstein Cameron R. Orr Lucille Owen Ken Packard Rosa Y. Padilla-Seville Barbara W. Page Stephen M. Pappas Pete Pasquale Karen N. Patel James Patterson Joseph (Joey) E. Pearlman Arthur Peck, M.D. Samantha (Sam) Saint Aubyn Peluso-Swartzlander James Peralta Lewis (Lou) E. Perdue Michael J. Perotto David J. Persik Gregory S. Persik Seymour Pestronk Cole Peterson William Brodie Phillips Kimberly C. Phillips-McQueen Sybil Pierce Jessica A. Piesman Piglet Helen Polisena Robert M. Pollack Violet Pool

Dr. Alex Porter Catherine (Cathy) D. Potter George C. Powell, Sr. Rosemarie T. Princiotta Harold Pruett Wilma J. Quade Dylan Quast Fiza Quraishi Ramez E. Qureshi Marcia L. Rackley Arthur J. Radin, C.P.A. Matthew R. Radula Evelyn R. Rafferty James Rafferty Hotan Rafiee J.T. Ragg Sean Raidley Lisa M. Raimondo-Nowell Sidharth Ramakrishnan Emerald Randolph Brendan (Kira) Rasenberger Thomas (Tommy) Bloom Raskin Stephen Rather Cassandra (Cassie) N. Ray Evan G. Rea Nicholas Redondo IV Harold Reid Laurel H. Reid Steven (Stevie) R. Reid II Norman Reisman Samuel (Sam) D. Rendall Michael Reschke Chris Reuter Maria de los Angeles Rey Laura J. Reynolds-Farmer Jonathan P. Rhodes John J. Rice, M.D. Scott T. Richards Caasi A. Rich-Vogel Priscilla Riddick-Trotter Rocco (Rocky) R. Rinaldi Dorrit L. Rippchen Janet K. Ritterling Bernice Rivkin's beloved brother Jacob (Jake) A. Roberson Robert Lauren Robinson-Kieves Joseph Rodriguez Paul E. Rogala Mark Rogosin Elizabeth Rolland **Richard Roman** Frank J. Romano

Alexis N. Romero Steven B. Rone, Jr. Steven B. Rone, Sr. Violet Ronne Brian Rorick Tommy Rorick Janet Rose Alan G. Ross Wayne Ross Christina Rossi Matthew S. Rothman Susan L. Rothman David H. Roy Ann M. Rozzo John G. Ryan Bertha B. Ryans Iohnathan Saab Florence Sadowski Daniel F. Sagalski Marcos Sanabria Catherine Sanacora Carol Sanchez Scott Sargent Dagmar J. Sarmiento Patricia A. Scarboro Trent Scharf Terry Scheffler Scott W. Scheurer Kenneth M. Schirmer Lee R. Schoolmeesters Richard P. Schroeder, Ir. James Schultz Mary E. Schultz Ellen Schusterman Jack Schwartz Michael L. Schwartz Keith D. Scofield Kelly Scruggs Ezra Seegull Timothy B. Sennott Gary S. Sevitsky Theodore Shafer Bruce B. Shaffer William D. Shannon Megan L. Sharp Margaret A. Shepard Marnie L. Shepherd Arlene M. Sheridan Edwin N. Sherr Harriet Shetler Sylvia Shick John O. Shulstad Robert (Bob) H. Shulstad David R. Sicular

David W. Silver Sheldon and Elaine Silverman Duncan N. Simic Benjamin Simmons-Courtney Kevin Simms Marcia Simon-Kaplan Jeff Singer John T. Sinnott Judith M. Sitzes Jane E. Slattery Peter W. Sloan Edward J. Smith Liv Smith's beloved brother, Kirby Mary Ann Smith William H. Smith II Mary Smith-Lawrence Gail S. Smuda Donald E. Snyder Carol A. Solverson **Charles Sommers** Nathan A. Soukup Mary Soyka Susan K. Soyka Peter Spacciapoli Louis A. Spadaccini Mary Sparks-Wooten Gena Spaulding Kathleen D. Spirlong John A. Spoerl Jeffrey T. Sramek Doretha St. Clair **Russell Stamile** lan |. Stancato Jesse Standley Franz (Shuse) C. Stangl III Jared Stapert John A. Stapleton Jonathan Starets Gregory L. Starling Tyler R. Starling Theodore S. State Ann O. Staton Ann Stehle Hildegard Steinbeck Edward G. Steinmetz, Jr. Floyd G. Steinmetz Jeffrey W. Stevens William J. Stone Karen A. Strewler Viola Strohmeyer Mary J. Strub-Caulkins Rose Ann Stueck Kenneth E. Stutzman Kristin M. Sullivan

Anthony M. Supino, Esq. Shelley H. Surpin Stephen Sutton Kathryn E. Suydam Frances Sweeney Martin P. Szuba, M.D. Andrew Taddy Shobhit Taneja H. Vonn Taylor Tyler J. Tebrich Charles S. Testa Camilla (Cammie) L. Thompson Megan Thurkins' beloved great-grandfather, Fulton Nicholas Tindall Hilary Tisch Harry (H.L.) L. Todd Ethel M. Toepel Arthur (Denny) D. Toll Gordon Tomalty Ellen Toolanen Benjamin J. Toso Jenifer S. Towle James W. Townsend Mario A. Tozzi, Jr. **Richard Trommer** Paul A. Truman Donald Trybula Amanda Tucci **Regina Tucker** Robert T. Tucker Colette Turk-Elliott William J. Turner, M.D. Adele C. Tursone Joseph Tursone Colby Twinam Juliette N. Tyler Tommi Tynjälä Logan Upton Steven A. Van Lew Alton L. Vance II Charles Varkoly John M. Vergo **Rick Vestal** Harriet Vicente Allen E. Vincent Keith A. Vinskofski Jillian Vocke's beloved father Mike Vogel Jessica Vollman Gregory Von Burg Paul Von Burg Riley P. Wachhorst

Diane M. Waechter Bob Wagner William F. Wagner, Jr. Ioshua Wallach Ann M. Wallbillich-Tanfani Colleen M. Walsh Judy A. Walsh Thomas Walsh Diana Wanger-Anderson Andrew W. Ward Kenneth R. Warning Janice Weaver Florence L. Weil Daniel S. Weiss Victor Weiss III Vivian Jean (Viv) Weiss James C. Welbourne William (Bill) R. Welch Kathi L. Weldin Thomas J. Wendt Marilyn Werbel Josh Wertz Robert M. Wetzel Allan Wexler Joseph Wharton lim Wheat Thomas C. Whisler Timothy L. Whitmer Dan Wicker, Jr. Michael G. Wieman Mark Williams Shawn B. Williams Lynn Williams-Figg Martin S. Willick, M.D. Joseph Wills II Margaret Wills Sherre Wilner Edwin (Eddie) L. Wilson III Marlene I. Wilson Richard K. Wilson Timothy (Timo) Wilson Tyrell Wilson Betty J. Winberg Elizabeth Windsor Barbara A. Winkler-Monsanto, M.D. Mike Winn Michael S. Winton Douglas Wistner Ernestine (Tina) Withers Sarah M. Wohlert Clare E. Wojtusik Cheryl E. Wolfe June Wolfe Farrell J. Wolfson

Ivan Wood Mary Ann Workens-Stahl G. Richard Worrell Keith C. Worrell Christiana Wright Robert (Bob) S. Wunsch **Bismark Yaport** Andrew Yelenosky Milton H. Zara Anna Zarski Peter W. Zartman Tyler Zgombic Edward N. Ziegler Gladys P. Ziegler Barry L. Zimmerman John F. Zoraian Herman A. Zullow

# **Financial Summary\***

### **Consolidated Statement of Financial Position**

		DECEMBER 31, 2021	DECEMBER 31, 2020
ASSETS			
Current Assets			
Cash and cash equivalents		\$16,218,222	\$19,030,200
Investments, at fair value, current portion		16,798,962	14,009,510
Contributions receivable		281,162	121,723
Pledges receivable, current portion		210,000	210,000
Prepaid expenses and other assets		175,982	85,114
	Total Current Assets	33,684,328	33,456,547
Assets held in charitable remainder trust		2,127,513	1,762,985
Fixed assets, net		10,152	18,376
Pledges receivable, net, less current portion		190,015	390,015
Investments, at fair value, less current portion		8,947,449	8,947,449
	Total Assets	\$44,959,457	\$44,575,372
LIABILITIES AND NET ASSETS			
Liabilities			

Accounts payable and accrued expense	S	\$243,940	\$96,430
Grants payable		19,354,810	25,723,635
Accrued compensation		40,007	37,651
Annuities payable		1,013,277	871,385
Charitable gift annuities payable		152,582	159,481
	Total Liabilities	20,804,616	26,888,582
Net Assets			
Without donor restrictions		14,145,437	8,075,882
With donor restrictions		10,009,404	9,610,908
	Total Net Assets	24,154,841	17,686,790
	Total Liabilities and Net Assets	\$44,959,457	\$44,575,372

\* The Foundation's complete audited financial statements are available on our website.

### **Consolidated Statement of Activities**

		YEAR ENDED DECEMBER 31, 2021	YEAR ENDED DECEMBER 31, 2020
SUPPORT AND REVENUE			
Contributions		\$14,201,498	\$13,994,067
Contribution of services		2,315,959	2,182,688
Bequests		2,563,135	5,369,469
Net realized and unrealized gains on investments		3,426,155	3,381,571
Net appreciation of assets held in charitable remainder trusts		364,528	262,564
Dividend and interest income		234,294	242,860
Total Su	pport and Revenue	23,105,569	25,433,219

EXPENSES			
Program Services			
Research grants and awards		9,805,853	18,628,508
Scientific advancement		2,396,220	2,192,755
Program support		2,125,712	2,101,324
	Total Program Services	14,327,785	22,922,587
Supporting Services			
Fundraising**		802,458	793,114
Administration**		1,507,275	1,501,199
	Total Supporting Services	2,309,733	2,294,313
	Total Expenses	16,637,518	25,216,900
Change in Net Assets		6,468,051	216,319
Net Assets, beginning of year		17,686,790	17,470,471
	Net Assets, end of year	\$24,154,841	\$17,686,790

\*\* All fundraising and administration expenses are funded by specially designated grants.



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