

yes.

(Our answer to a promising idea.)

yes.

It's a simple answer to a
complex question.

For more than 60 years,
Brain Research Foundation
has accelerated the future of
neuroscience discoveries with
a simple yes.

Contents

2	Letters	14	Researcher and donor stories
4	BRF research areas	30	BRF donors
6	Donations fund research	37	Financials
7	The state of federal funding	40	BRF board of trustees, associate board, scientific review committee, staff
8	BRF grant making process		
10	BRF grant recipients		

To Our Brain Research Foundation Friends



The word on the cover of this annual report is a simple, positive word of support. The science we support is not simple but the idea behind our vision is: to advance the understanding of the brain by funding groundbreaking research. And for

the past 62 years, Brain Research Foundation has been saying “yes” to innovative neuroscience.

I hope you enjoy reading our annual report. We have highlighted some amazing stories of strength and determination. It’s because of our remarkable trustees, donors and scientists that my enthusiasm for this organization intensifies every year. I’m so proud to be leading a foundation that continues to grow and build on its impressive history. This longevity has everything to do with the passion of people who support us.

Brain Research Foundation always looks toward the future, toward new discoveries. We support the innovative neuroscience today for new treatments and eventual cures in the future. 2014-2015 was an extremely productive time for the Foundation.

- . BRF contributed more than we ever have for research and educational programs —nearly \$3.8 million.
- . BRF increased the size and grant period of our Fay/Frank Seed Grants to two-year grants, totaling \$80,000 each.
- . BRF continued to ensure that every dollar donated is used directly for research and educational programs.

I want to say thank you to all of our committed supporters. These accomplishments are not possible without our dedicated Board of Trustees and passionate donors. We know that your way of saying “yes” to us is by donating. Your confidence in us drives our work. It is our motivation and it renews our dedication to uncovering the mysteries of the brain.

While we are extremely proud of these accomplishments, there is still so much more to be done. More than ever, private funding of neuroscience is extremely vital to jumpstart pilot research projects that will advance our understanding of brain function. While the federal government is the largest funder of scientific research, its budget is still far less than needed. In fact, due to the Sequestration (which is set to last through 2021), the budget for the National Institutes of Health (NIH) was cut 5% or \$1.55 billion. This means that medical breakthroughs will likely be delayed. Not only will hundreds of grants not be funded but the budgets of existing grants will be decreased.

Brain Research Foundation plays a critical role as the venture capitalists of neuroscience. Our Scientific Review Committee helps identify the best “start-up” research projects to fund: the projects that will have the biggest return on investment. We strive to say “yes” to even more innovative projects and we imagine a future where limited resources do not stand in the way of hastening research discoveries.

The answers are out there. We just need to help uncover them. Let’s continue that challenge together.

A handwritten signature in black ink that reads "Terre A. Constantine". The signature is fluid and cursive, with a long horizontal flourish at the end.

Terre A. Constantine, Ph.D.
Executive Director, CEO

This is the last time I write to you as Chair of Brain Research Foundation. I want to tell you how privileged I feel to have served this great organization for the past two years.

Many wonderful milestones have occurred since our last annual report. We celebrated our 60th anniversary and raised over \$1 million in honor of that milestone. We funded 25 Fay/Frank Seed Grants and six Scientific Innovations Awards. We continued our educational outreach programs with our work on the role of physical exercise in preventing cognitive decline, and took important steps to expand BRF's reach from a local organization to one with national scope and recognition, by funding cutting-edge neuroscience research at major universities throughout the United States. We hosted a symposium that brought together some of the nation's top scientists to discuss gene-environment interactions in developmental psychology and their role in intervention research. And throughout it all, we continued to steward your donations with great effectiveness, and can continue to report that 100% of your contributions go directly towards research.

Unfortunately, this year we also lost our beloved co-founder, Bill Fay—always young-at-heart—who passed away at age 97. His belief that we would one day find cures for disabling brain disorders remains a cherished tenet that BRF lives by. All who worked with Bill over these many years will miss his warmth, enthusiasm and wisdom.

My sincere appreciation goes to our Board members, officers, committee chairs, the members of our Scientific Review Committee and our Associate Board. Special thanks also to the staff of the BRF, who provide the day-to-day support to keep the Foundation running so smoothly, to Dr. Terre Constantine (BRF's Executive Director and CEO) for providing expertise and leadership, and to our Development Director, Sandra DiPasquale, for her excellent work.

But my biggest thanks are for you, our friends and donors, who believe so deeply in the work of the Brain Research Foundation. I hope you find this Annual Report interesting and inspiring. Most of all, I wish you and your loved ones good health and a wonderful New Year.

Sincerely,



Richard Kohn
Chair



We fund the most compelling issues in neuroscience research.
Listed below are some of them.

ALS (Lou Gehrig's disease)	Dementia	Nicotine addiction
Age-related macular degeneration (AMD)	Depression	Obsessive-compulsive disorder
Aggressive disorder	Down syndrome	Panic disorder
Alcoholism	Drug addiction	Parkinson's disease
Alzheimer's disease	Dystonia	Pervasive developmental disorders
Anorexia nervosa	Eating disorders	Pick's disease
Anxiety disorders	Epilepsy	Post Traumatic Stress Disorder (PTSD)
Arteriovenous malformation	Fragile X syndrome	Prion disease
Asperger syndrome	Frontotemporal lobar degeneration	Restless legs syndrome
Attention deficit disorder	Guillain-Barré syndrome	Rett syndrome
Autism	Hemifacial spasm	Schizophrenia
Batten disease	Huntington's disease	Sleep apnea
Bell's palsy	Learning disability	Spinal cord injury
Bipolar disorder	Lewy body dementia	Spinal muscular atrophy (SMA)
Brain aneurysm	Manic-depressive illness	Stroke
Brain development	Meningitis	Substance abuse disorders
Brain tumors	Mental retardation	Tay-Sachs disease
Bulimia	Migraine headaches	Tourette syndrome
Cerebral palsy	Motor neuron disease	Transient ischemic attack (TIA)
Charcot-Marie-Tooth disease	Multiple sclerosis	Traumatic brain injury (TBI)
Conduct disorder	Muscular dystrophy	Trigeminal neuralgia
Creutzfeldt-Jakob disease	Myasthenia gravis	Tuberous sclerosis
Dandy-Walker syndrome	Narcolepsy	

yes.

BRF supports research to better understand all aspects of the brain.

Brain Research Foundation funds the best neuroscience research to advance our understanding of the brain. We don't focus on one neurological disease or disorder over another.

We support the most promising ideas and the most creative neuroscientists.

Because there is still so much to learn about the brain and how it functions, researchers continue to face many fundamental questions. Answers will come through innovative, early-stage research. This is methodical work that requires probing minds, bold ideas, and persistence.

BRF continues to meet the challenge.

yes.

100% of your donation went directly to research.

Like every organization, the BRF has operating expenses that must be paid. Because we managed those expenses carefully and paid them with investment earnings, 100% of your donations went directly to research.

Smart, efficient team

The Foundation has always been managed by a smart, hardworking staff. Day-to-day operations are well-organized and efficiently-run. Staff efforts are amplified two ways.

Our dedicated **Board of Trustees** provides ongoing oversight, fundraises, and helps expand the Foundation's profile among civic and corporate leaders.

The **Scientific Review Committee**, a panel of prominent neuroscientists, orchestrates the peer review process. Committee members donate many hours to scrutinize requests for funding—approximately 100 letters of intent for seed grants and 40-45 proposals for larger awards every year—and recommend which studies the BRF should support.

Excellent stewardship

We respect all our donors and steward every gift. **Charity Navigator**, the nation's premier charity evaluator, has awarded the BRF its coveted 4-star rating for sound fiscal management and commitment to accountability and transparency. Through our adherence to best practices and cost-effective policies, we are able to direct every dollar of every gift to research.

And without BRF, many promising ideas would go unfunded.



Government funding in decline

More and more, researchers depend on funding from the BRF and other private donations to support research which fuels neuroscience advances. That's because federal funding for research and development as a percentage of the total budget continues to decline.²

Innovators at a disadvantage

With fewer dollars to award, government grants go to the scientists and projects judged most likely to succeed. This approach makes it extremely hard for investigators who are working to develop substantial data and establish a track record for success. And these are the scientists who often generate the most innovative and compelling research ideas.

BRF grants are crucial

The application process for federal government grants is highly competitive and favors established over new investigators. The vast majority of proposals are declined. Funding for innovative research is extremely limited.³

- **The National Institute of Aging, which funds research on diseases like Alzheimer's and dementia, can fund only 6% of scientists that apply for research funding.**
- **The average age at which investigators obtain their first substantial government award is 42 for Ph.D.s and 44 for M.D.-Ph.D.s.⁴**
- **In a recent survey, 50% of top researchers said insufficient funding had caused them to abandon an area of investigation "central" to their lab's mission.⁵**

In order to receive funding in such a competitive landscape, researchers depend on much needed seed grants, like those the BRF provides, to begin to prove the viability and importance of their work. The findings our seed grant recipients have generated pave the way to larger grants that enable them to continue their research.

¹ Neuroscience Funding Through NIH, Society for Neuroscience, n.d.

² Massachusetts Institute of Technology. The Future Postponed: Why Declining Investment in Basic Research Threatens a U.S. Innovation Deficit. A Report by the MIT Committee to Evaluate the Innovation Deficit. April 2015.

³ National Institutes of Health. Office of Extramural Research (OER)/Office of Planning, Analysis and Communications (OPAC)/Division of Statistical Analysis & Reporting (DSAR). Funding, Success Rates. http://www.report.nih.gov/success_rates/index.aspx. Accessed June 3, 2015.

⁴ Rockey, Dr. Sally. "Our Commitment to Supporting the Next Generation." NIH Extramural Nexus. National Institutes of Health, <https://nexus.od.nih.gov/all/2012/02/03/our-commitment-to-supporting-the-next-generation/>. Published February 3, 2012. Accessed September 3, 2015.

⁵ Basken P, Voosen P. Strapped Scientists Abandon Research and Students. The Chronicle of Higher Education. <http://chronicle.com/article/Strapped-Scientists-Abandon/144921/>. Published February 24, 2014. Accessed June 19, 2015.

yes.

Accomplished researchers compete for BRF funding. We say yes to the most innovative proposals.

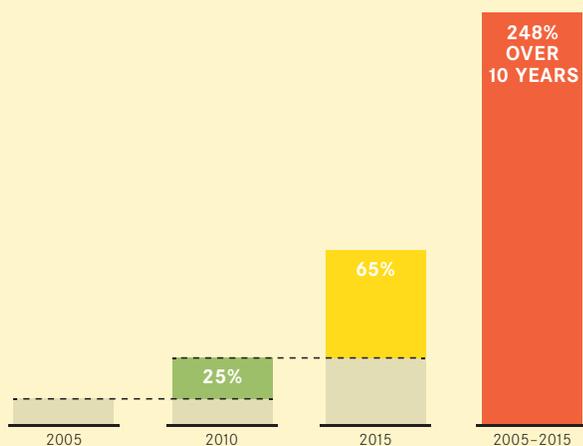
BRF Scientific Innovations Awards

provide \$150,000 over two years to help established and productive neuroscience investigators sustain innovative research projects that have the potential to yield significant findings and deepen our understanding of the brain.

BRF Fay/Frank Seed Grants

provide \$80,000 over two years to help gifted neuroscientists progress through the critical, early stages of research, giving them time to conduct experiments designed to make the case for project hypotheses and generate data necessary to compete for additional large-scale funding from other sources.

PERCENTAGE INCREASE OF BRF AWARDS 2005–2015



BRF GRANTS AND AWARDS REPRESENT AN INCREASINGLY IMPORTANT SOURCE OF SUPPORT FOR NEUROSCIENCE RESEARCH AND THE INVESTIGATORS WHO PURSUE IT. AS FEDERAL FUNDING ACROSS THE SPECTRUM OF BRAIN-RELATED ABNORMALITIES REMAINS STATIC OR CONTINUES TO DECLINE, **TOTAL DOLLARS AWARDED BY THE BRF HAVE INCREASED 248% OVER THE LAST DECADE.**

Brain Research Foundation grants and awards are offered on a competitive basis. Each year BRF invites qualified research centers in the United States to apply.

Candidates must be nominated. Each candidate for a BRF grant or award is nominated by his or her institution and must submit a detailed research proposal.

Qualified proposals must pass peer review. Proposals that meet grant or award requirements move forward to peer review, a process that determines their relative scientific merit.

BRF's Scientific Review Committee, a panel of experienced neuroscientists representing multiple disciplines, conducts the review process using rigorous protocols like those of the National Institutes of Health.

Reviewers independently evaluate and score the proposals, then share their findings. Through scientific deliberation they reach consensus on which proposals merit funding.

yes.

On average, BRF grantees go on to secure \$20 in future funding for every \$1 they receive from the Foundation. We are proud to support their work.

2014 SCIENTIFIC INNOVATIONS AWARDS

Epilepsy, optigenetics, Parkinson's disease

Christopher I. Moore, Ph.D.

Brown University

Department of Neuroscience

BL-OG: Selective, minimally invasive and activity dependent self-regulation of thalamic bursting

Gene therapy, nanoparticles

W. Mark Saltzman, Ph.D.

Yale University

Department of Biomedical Engineering

Synthetic nanoparticles for gene editing in the brain in utero

Autism, neuropsychiatric disorders, schizophrenia

Anthony Zador, M.D., Ph.D.

Cold Spring Harbor Laboratory

Department of Neuroscience

BOINCing PTEN-associated neural circuit pathology

2015 SCIENTIFIC INNOVATIONS AWARDS

Autism spectrum disorder

Guoping Feng, Ph.D.

Massachusetts Institute of Technology

Department of Brain and Cognitive Sciences

Disruption of the Shank3 gene in a primate model for studying ASD

Autism, Alzheimer's disease, learning and memory

Kristen M. Harris, Ph.D.

University of Texas at Austin

Department of Neuroscience

Synaptome of a Memory

Motor neuron circuits, movement

Thomas M. Jessell, Ph.D.

Columbia University

Department of Neuroscience & Biochemistry and

Molecular Biophysics

The Functional Logic of Inhibitory Microcircuits

2014 FAY/FRANK SEED GRANT AWARDS

Attention deficit hyperactivity disorder (ADHD), brain cancer, brain development, schizophrenia

Demet Arac-Ozkan, Ph.D.
The University of Chicago
Department of Biochemistry and Molecular Biology
Structural and Functional Studies of Adhesion GPCRs in the Central Nervous System

Epilepsy, tuberous sclerosis complex

Helen S. Bateup, Ph.D.
University of California, Berkeley
Department of Molecular and Cell Biology
Modeling neurodevelopmental disorders with genetically defined human neurons

Obsessive compulsive disorder (OCD)

Stephanie C. Dulawa, Ph.D.
The University of Chicago
Department of Psychiatry and Behavioral Neuroscience
Functional characterization of genes associated with Obsessive Compulsive Disorder using mouse models
Women's Council Seed Grant

Autism, cognitive disease, schizophrenia

David J. Foster, Ph.D.
Johns Hopkins University
Department of Neuroscience
High-density neural recording of dysfunctional memories in animal models of mental disease

Parkinson's disease

Daniel K. Leventhal, M.D., Ph.D.
University of Michigan
Department of Neurology, Biomedical Engineering
In vivo optogenetics to distinguish learning from performance effects of dopamine on fine motor skills

Itch perception

Qin Liu, Ph.D.
Washington University in Saint Louis
Department of Anesthesiology
The Molecular and Neural Basis of Itch Sensation

Alzheimer's disease, Down syndrome, epilepsy

Xuelin Lou, M.D., Ph.D.
University of Wisconsin-Madison
Department of Neuroscience
The nano-meter scale organization and function of phosphoinositide signaling at central synapses

Neuron activity, optical imaging

Evan W. Miller, Ph.D.
University of California, Berkeley
Department of Chemistry
Optical Integrators for Monitoring Activity in Circuits and Cells

Imaging, learning and memory, neuronal plasticity

Wei Min, Ph.D.
Columbia University
Department of Chemistry
Optical imaging of new protein synthesis in living neurons and brain tissues

Alzheimer's disease, nanodevices

SungWoo Nam, Ph.D.
University of Illinois, Urbana-Champaign
Department of Mechanical Science and Engineering
Gel-like Nano-devices for Non-invasive, Electrical and Chemical Recording of Neural Activities

Stroke, traumatic brain injury (TBI)

Julie A. Siegenthaler, Ph.D.
University of Colorado,
Department of Pediatrics
Activation of fibrotic scar forming cells following traumatic brain injury
Associate Board Grant

Autism, epilepsy, schizophrenia

Susan M. Voglmaier, M.D., Ph.D.
University of California, San Francisco
Department of Psychiatry
A Novel Approach to Regulate Glutamate Signaling in Neuropsychiatric Disease

Anxiety, autism, epilepsy, schizophrenia

Clarissa L. Waites, Ph.D.
Columbia University
Department of Neuroscience
Regulation of neurotransmitter release and synaptic vesicle recycling by protein ubiquitination
Jacob Jameson Huzenit Memorial Seed Grant

Cell-type specificity, neural development

Eugene W. Yeo, Ph.D.
University of California, San Diego
Department of Cellular and Molecular Medicine
Global analysis of transcriptome diversity at the single-cell level in human neurons

2015 FAY/FRANK SEED GRANT AWARDS

Neurodegenerative diseases, neuropathy

Anjon W. Audhya, Ph.D.
University of Wisconsin-Madison
Department of Biomolecular Chemistry
Endoplasmic reticulum structure and function in neuronal maintenance

Understand brain function and neuronal networks in real-time

Lee C. Bassett, Ph.D.
University of Pennsylvania
Department of Electrical & Systems Engineering
Nanoscale Optical Neuronal Recording using Nontoxic Quantum Probes

Neurodegenerative diseases, traumatic brain injury (TBI), brain tumors

Beata Chertok, Ph.D.
University of Michigan
Department of Pharmaceutical Sciences
Microplatform for minimally-invasive spatio-temporal modulation of immune dynamics in the brain

Neuropsychiatric disorders, autism, schizophrenia, epilepsy, healthy brain function

Michael J. Higley, M.D., PhD.
Yale University
Department of Neurobiology
Determining the cell-autonomous role of GABAergic inhibition in visual processing

Epilepsy, seizures

Michael B. Hoppa, Ph.D.
Dartmouth College
Department of Biology
Ion channel trafficking at the axon initial segment and neural excitability

Schizophrenia, autism, and Alzheimer's disease

Matthew J. Kennedy, Ph.D.
University of Colorado
Department of Pharmacology
Controlling synaptic function with light

Brain tumor, glioblastoma

Albert H. Kim, M.D., Ph.D.
Washington University at St. Louis
Department of Neurosurgery
Therapeutic epigenetic reprogramming of brain cancer stem cells using microRNAs

Autism-related disorder, mental retardation

Chia-Yi Kuan, M.D., Ph.D.
Emory University
Department of Pediatrics
Neuropathology and Experimental Therapy of Creatine Transporter (CrT) Deficiency

Addiction, drug use

Stephan Lammel, Ph.D.
University of California, Berkeley
Department of Molecular and Cell Biology
Identifying input-specific mechanisms underlying drug-evoked plasticity in the dopamine system

Parkinson's disease

Alexandra B. Nelson, M.D., Ph.D.
University of California, San Francisco
Department of Neurology
Optogenetic Dissection of Brain Circuits Causing Levodopa-Induced Dyskinesia
Women's Council Seed Grant

Down syndrome

Bing Ye, Ph.D.
University of Michigan
Department of Life Sciences Institute, and Department of Cell and Developmental Biology
Mechanisms underlying the brain disorder in Down syndrome

yes.

Research is a collaborative process.

Each year, BRF is able to fund more research because generous donors say yes to gifted investigators.

With our deep gratitude, here are a few of their stories.



Imagine a miniscule device surfing your blood stream on its way to a specific cell in your brain where your immune system needs help to fight a tumor. Imagine the device arrives, releases a packet of helper molecules and genes, and simultaneously disintegrates. The helpers wait for a signal. Imagine the signal comes and the helpers go to work, healing your brain.

Ten years ago, Beata Chertok, Ph.D., imagined she could find a way to treat brain tumors without surgery. It all started when she read a letter.

The letter was written by a mother after her 18-year-old son's sixth surgery for brain cancer. Each procedure had each left the boy more incapacitated. The mother begged neuroscientists to find a better way to treat a brain tumor.

That letter became Dr. Chertok's research agenda. Through nanotechnology, she developed a model for magnetically targeting protein therapy to brain tumors and demonstrated its performance in rodents. Next, Dr. Chertok developed a first-time microplatform responsive to both magnetic and acoustic signaling and demonstrated it could deliver genetic therapies to tumors. In doing so, she discovered the role that brain immunity plays in tumor progression.

Her subsequent work designing genetic immunotherapy agents brought Dr. Chertok still closer to answering the mother's plea for her son and set the stage for the study she will soon undertake with support from the BRF.

Injectable microbubbles

There are a number of formidable challenges to delivering drugs intact to a precise location, the brain-blood barrier to name one. In addition, once the drugs arrive, in order to do its share of the work, each drug component must be activated at a separate time and on a strict schedule.

Dr. Chertok was awarded a BRF seed grant to determine the feasibility of a new "microbubble" delivery system that she designed. The microbubble device will be tested in a series of experiments with rodents.

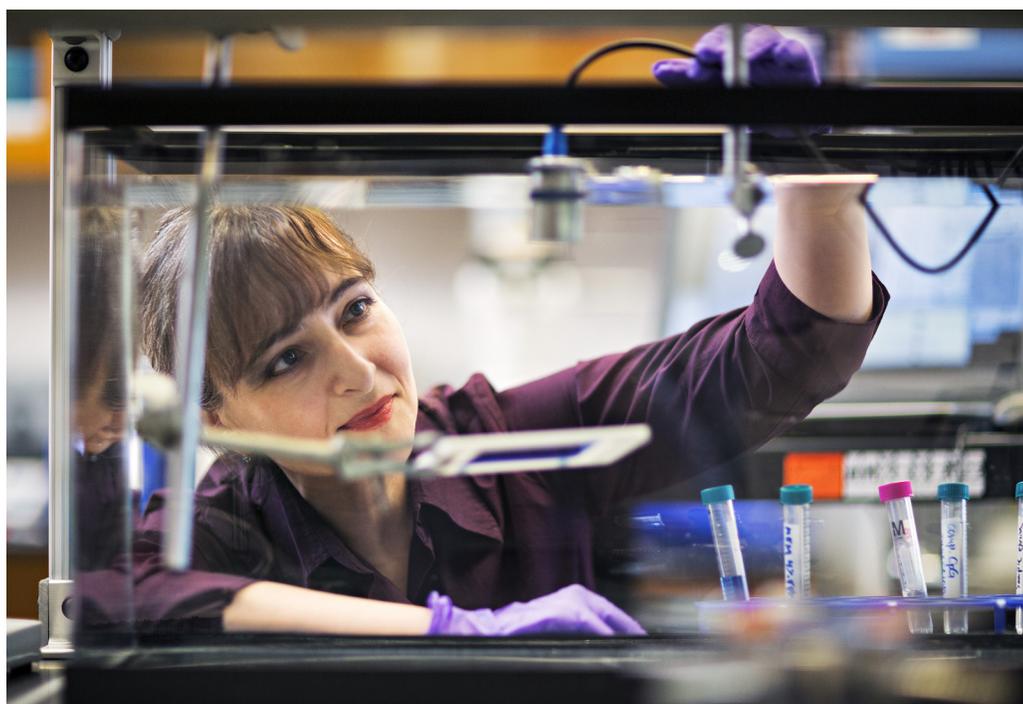
She hopes the device can safely deliver to a pre-set treatment location a packet of drugs—genes, proteins and small molecules—to improve brain immunity. Not an easy task.

Controlled by ultrasound

Ultrasound is the key. It will be used to "steer" the microbubble through the blood stream to a specific location in the brain; trigger its collapse and the release of the drug packet; and then activate each drug component at the split-second moment it is needed. Tumors in the test animals will be examined after treatment to determine the effects of the therapy.

Far-reaching potential

Dr. Chertok's study may lead to injection therapies for brain tumors, neurodegenerative diseases, like Parkinson's disease and ALS, as well as traumatic brain injuries. BRF is proud to support such innovative research.



2015 Fay/Frank Seed Grant recipient Beata Chertok, Ph.D., is assistant professor of pharmaceutical sciences and assistant professor of biomedical engineering, University of Michigan. Her research could revolutionize how we treat brain tumors, neurodegenerative diseases, and traumatic brain injuries.



“What is exciting about the BRF is that they look at things holistically and support research in different areas. Between my family, myself, and my friends, we’re dealing with autism, epilepsy, panic disorders, Alzheimer’s disease, brain cancer. The list is much longer if I include the people I met while recovering.”
—Matt Rahn

When Matt Rahn was introduced to BRF three years ago it was all about his family. His immediate concern was for his twin sisters who might be at risk for early onset Alzheimer's disease. Matt and his sisters knew all too well what that might mean, having seen their mother struggle with the disease. Since then, Matt's involvement with brain disorders has gotten even more personal.

Family concerns

Matt Rahn is about as close to the work of the Brain Research Foundation as one person can be.

For 12 years he and his twin sisters have experienced the anguish of seeing their mother become progressively diminished by early onset Alzheimer's disease. For the past five years or so, he's been helping his sisters face growing concerns that they might also develop the disease as they near the age at which their mother was diagnosed.

Over and above the neurological health of his mother and sisters, for the past two-plus years Matt has faced his own challenges.

Three more lives interrupted

Matt's brain tumor surgery was seven years behind him. He was doing very well at a prestigious consulting firm, proud to be on track to become a partner. Best of all, Matt and his wife were just getting to know their 2-month-old daughter. Then he began having seizures that tests linked to another brain tumor.

Matt's second surgery caused a debilitating stroke. Doctors said Matt would have to commit to more than just a serious rehabilitation effort. They found the tumor was cancerous, stage 3.

Radiation and a year of chemotherapy and strenuous physical and occupational therapy has produced fine results, but everything has shifted.

So many people to help

Matt has had plenty of surprises since he was first diagnosed. He never realized, for example, how many in his circle of friends, colleagues, and acquaintances have been touched by neurological issues. As a result, Matt has become increasingly aware of the pressing need for continued research on multiple fronts.

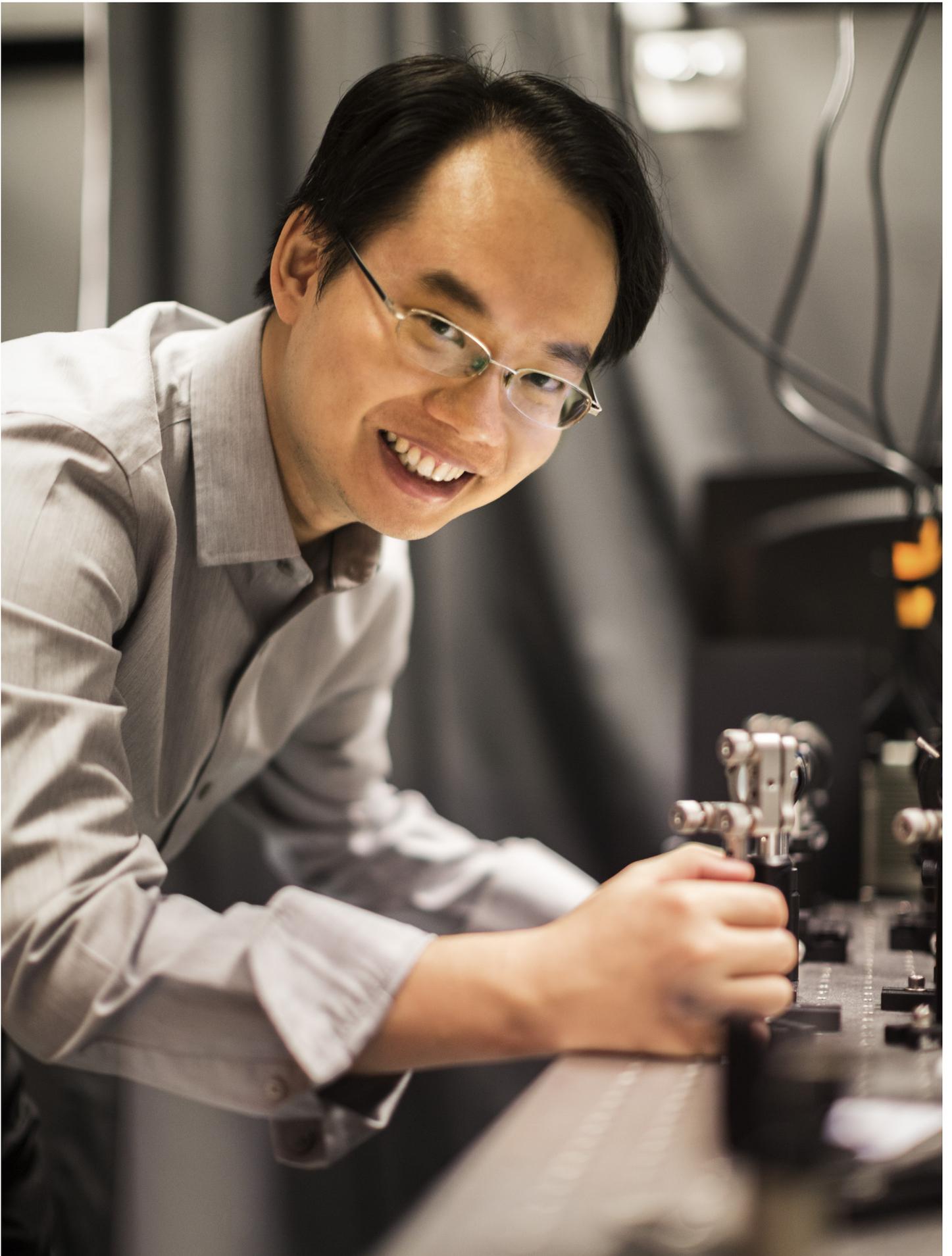
He hopes his continued support for the BRF will help and he appreciates that 100% of his contributions go to fund research—nothing siphoned off to pay for overhead.

Investing in innovation

Matt also likes the Foundation's commitment to supporting new investigators and new approaches. "If researchers don't get early funding to run limited tests, they can't get bigger grants. It's exciting to know that my donation functions like investor capital to drive more research," he said.

When he was an advisor to many well-regarded firms, Matt saw many organizations held back because their people worked in silos, focused solely on one piece of the enterprise.

"True innovation doesn't come from thinking linearly," Matt said. "Innovation comes from very smart, passionate people thinking creatively. I tell my friends, ad nauseam, that the BRF is going after innovative ideas. That's exciting."



Protein metabolism plays a key regulatory role in the nervous system, in both health and disease. Learning and memory functions in particular require ongoing synthesis of new proteins. With a grant from Brain Research Foundation, researchers at Columbia University are learning more about this crucial and mysterious process.

The nervous system is a very busy place. Wei Min, Ph.D., and colleagues are trying to determine specifically how busy protein molecules are, and exactly how they function.

Dr. Min's study is focused on overcoming technological barriers to observing protein synthesis, and learning more about cellular activity in the part of the brain, the hippocampus, that regulates short- and long-term memory.

Technology breakthrough

Extensive efforts have been made in the past to use a variety of imaging technologies to learn more about protein synthesis in the brain. All have fallen short.

For his study, Dr. Min proposed using a newly developed, but untested imaging technique to observe protein synthesis in newborn mice. If successful, the technique that he designed would facilitate an entirely new body of knowledge.

Highly revealing

His team is already able to directly observe, with unprecedented resolution, the dynamics of protein synthesis in living neurons. The detail able to be seen and documented includes space- and time-specific data that are crucial to understanding metabolic activity.

Although the study is still at an early stage, Dr. Min said the team is somewhat surprised by what they have so far observed. When complete, the study will yield new information about how the process occurs down to the level of fine dendritic structures in live neurons as well as in brain tissues.

Implications for many

Dr. Min expects this new imaging technique will help neuroscientists develop new insights relevant for multiple neurodegenerative diseases, including Alzheimer's, Parkinson's, and Huntington's disease.

In addition, the technique may offer a way to study autism, which is known to be related to too much protein in specific types of cells. Dr. Min's study may also give neuroscientists a way to better understand abnormal metabolism in brain tumors. This is the type of impactful research leading to more advancements that the BRF is eager to support.

2014 Fay/Frank Seed Grant recipient Wei Min, Ph.D., is an assistant professor in the department of chemistry at Columbia University, New York City. The goal of his research is to give neuroscientists a powerful tool to study the intricate dynamics of protein synthesis, which play a crucial role in regulating learning and memory.

The human brain needs a steady supply of oxygen. After four minutes without oxygen brain cells begin to die. After five minutes, permanent injury begins to set in. Doctors call it anoxic brain injury.

Sadly, the Anderson family can tell you all about it.

It was the perfect summer afternoon, another fun family outing for Beth and Keith Anderson and their youngest son, Owen.

Owen Anderson was like every other exuberant preschooler in the pool that day—laughing, splashing around, goofing with his friends, putting on a show for his parents. Then everything went wrong.

A tragic turn

Suddenly, Owen was being pulled out of the pool, his body limp. After 20 minutes of CPR, he was rushed to the local hospital then life-flighted to the largest pediatric hospital in the region. Four specialists met with Beth and Keith to review Owen's MRI.

The picture they painted was grim. Six months later Owen came home, unable to walk or talk, unable to eat on his own.

Long journey

It's been four years since the accident and Owen has come a long way. But he's had to work hard. Very hard.

Owen has seen doctors throughout the country, and has moved through a variety of drug treatments. The countless hours he's devoted to therapy continue to climb. Physical therapy. Occupational therapy.

Speech therapy. Hippotherapy (which uses horseback riding and its carefully graded motor and sensory input to improve neurological function and sensory processing).

Supporting research

Keith and Beth have been working hard, too, not only by caring for Owen and helping him through his recovery, but also by championing his cause and raising funds for research.

Last summer Keith and a group of friends completed a 460-mile bike ride across the state of Iowa to raise awareness and contributions for brain research. Their effort convinced other friends to pledge their support. As a result, Team Owen inspired gifts to the BRF totaling more than \$20,000.

It takes a family

In addition to Owen, the Andersons have two more sons, ages 19 and 17, and a daughter 14. Beth credits them with playing a huge role in Owen's recovery. "They come to many of Owen's therapy sessions, they play with him, they encourage him, and they love him. Owen's face lights up at the sight of each of them. I am amazed at how this experience has made them better, more empathic people."

Body language

Owen's physicians told the Andersons that most likely Owen would reach his full recovery after two years. Beth said that although progress is slow, Owen is proving them wrong.

"This past year, Owen started standing independently and scooching himself across the floor. Recently, he has been able to walk just by holding his physical therapist's hand. So many of the families we've met have been dealing with their children's injuries for far longer than we have and they agree that progress and improvements can still be seen years later."

The Anderson family remains committed to Owen and to doing what they can to support further neuroscience research.

"The opportunity to shed light on more than one brain disorder played a large part in our choosing the BRF." Keith said. "Everybody knows somebody who can benefit from future discoveries, whether for Parkinson's or brain cancer, or for a little guy who almost drowned."



“Owen loves being around other children. He loves playing with them and just watching them. Even if he can’t join in, he loves to watch the kids who are running around on the playground. He kicks his feet and laughs. Sometimes I think Owen thinks he’s running, too.”

—Beth Anderson



“When you see kids with brain injuries and look into their eyes, you can tell there’s a spark there—someone who wants to come out again and unfortunately cannot. Owen has trouble moving his hands and arms, but he understands everything we say, everything going on around him. We couldn’t sit back and wait for research to catch up. It’s been very moving for us to support the BRF.”

—Keith Anderson



Can a neurobiologist reconfigure functional motor circuits in the spinal cord of a patient who has suffered a traumatic spinal cord injury? Can motor circuits be rewired to delay or prevent the impact of degenerative diseases like ALS? It won't be easy, and it may not happen soon, but Dr Thomas Jessell has plans to make it possible.

For 30 years Thomas Jessell, Ph.D., has been probing how nerve circuits function in the spinal cord. He's continuing the journey with support from the Brain Research Foundation.

What types of molecules are at work in the embryonic nervous system and how do they come together as a functional system? How do subclasses of neurons choose specific pathways to send and receive messages and selectively connect with target cells? These are microcosmic questions that Dr. Thomas Jessell and his research team are pursuing to find macrocosmic answers.

Ultimately, he intends to define how motor circuits are constructed and how they function in enough detail to create what he calls a molecular wiring diagram: a diagram that one day could guide a neurologist in reconfiguring a patient's motor circuits after traumatic spinal cord injury. Further down the road, similar diagrams might be used in the treatment of schizophrenia or attention deficit hyperactivity disorder.

Groundwork in place

Dr. Jessell and his team have designed methods for manipulating of two types of neurons that create nerve circuits that allow signals to travel to and from the spinal cord; these are called excitatory and inhibitory interneurons. The team has also found a way to assess changes in the body, in cell function, and behavior when neural circuits are not functioning normally.

Important hurdle in sight

Next, with support from the BRF, the team will look more closely at inhibitory interneurons—the structure of the motor circuits they form, how the circuits function, and what happened when they malfunction. If successful, this will be the first research that provides an in-depth understanding of the construction and behavior of inhibitory microcircuits controlling movement.

Getting there

This study involves innovative and as yet untested experimental theoretical techniques. A series of molecular genetic and cell biology experiments with mice will focus on documenting the molecular diversity of the developing spinal cord. This is a challenging undertaking since Dr. Jessell sees the possibility of 100 subtypes of inhibitory interneurons at work each with different input and output relationships for perhaps 50 distinct motor pools each with its own micro-circuit architecture.

Future potential

The knowledge that Dr. Jessell hopes this study will yield would make a significant contribution to deciphering the logic that underlies how cells exchange information in the human central nervous system. Long term, in addition to paving the way to possible treatments for traumatic spinal cord injuries, the findings may help explain the origins and progression of both neuropsychiatric and neurodevelopmental disorders.

2015 Scientific Innovations Award recipient Thomas M. Jessell, Ph.D., is professor of neuroscience, and biochemistry and molecular biophysics at Columbia University, New York City. Dr. Jessell is flanked by two key members of his lab, postdoctoral fellow Jay Bikoff, Ph.D., and laboratory technician Carolyn Diaz.

The mentoring that experienced scientists like Dr. Jessell provide for new investigators is crucial in the development of the next generation of researchers able to continue the process of advancing neuroscience.



Kelly Vandermel was in utter shock when her husband, Erik, suffered a fatal brain aneurysm. But she wasn't at all surprised when her teenage daughters came to her with a plan to honor their father's memory by helping others affected by neurological issues. Now Justine and Julia design affirmation bracelets and sell them online with all proceeds donated to the BRF.

"My mother taught me if you have two of something you should give one away. And if you have one of something and someone else needs it more, give that away, too."

—Kelly Vandermel

Difficult times

In October 2012, Erik died without warning from a massive brain aneurysm. Shock turned to panic when Kelly became concerned that Julia and Justine might be at risk, too. Luckily, testing proved otherwise.

Reaching out

The family was still grieving when Justine and Julia approached their mother with a plan to help others in their father's honor. Inspired by the support their friends had offered while grieving Erik's death, the sisters wanted to create a line of affirmation bracelets

that would encourage others touched by neurological challenges, and sell them online to raise funds for research.

Some might think their proposal a lot to take on for two high schoolers. Kelly, who knew what her daughters were capable of, was immediately on board.

After considering a variety of organizations, all agreed: the BRF was the perfect fit. "We were impressed that 100% of every donation goes to research. I don't know of any other organization able to say that," Kelly said.



Doctors said Erik's brain aneurysm had probably been with him since birth, and it was unlikely that Julia and Justine were at risk. Kelly wanted to be sure, so she arranged complete brain scans for her

daughters. She said she got her first night's good sleep after seeing the scans and hearing the radiologist say, "They are perfect." From left, Justine, Kelly, and Julia Vandermel

“Both my husband Erik and I were raised to help others. We gave of our time, of our money, and taught our girls from an early age the importance of giving back. He would be so proud and so happy to know that we are supporting research to help so many people with so many different neurological issues.”
—Kelly Vandermel



Supporting research and researchers

By supporting the BRF Julia, Justine, and Kelly are able to honor Erik’s memory and also honor the many people close to the family who are affected by neurological disorders. Not to mention the millions of others who stand to benefit from the research BRF funds. And there is still so much to learn.

As Kelly put it, “The brain is literally at the center of our existence and yet we know so little about how it functions.”

Her daughters agreed. “We want everyone to know more about brain research and its importance. Everyone has a connection,” Julia said. “I don’t think researchers get the credit they deserve. They devote their lives to learning, to help other people,” Justine

added. A fine example set by two young women in following their parents’ footsteps.

“I would like to believe that the foundation that Erik and I provided our daughters, and that I strive to maintain, gives them the strength they need to survive and thrive,” Kelly said.

2014 Fay/Frank Seed Grant recipient
Daniel K. Leventhal, M.D., Ph.D., is assistant professor of neurology at the University of Michigan Medical Center, a researcher, and a clinician who specializes in treating Parkinson's disease. Because of support from the BRF he is looking for a better understanding of how dopamine controls motor function. Insights from this study may lead to new dopamine replacement therapies that will better manage the symptoms of Parkinson's disease.



For more than 40 years dopamine replacement therapy has improved motor function for people with Parkinson's disease, but how or why is still a mystery. If more were known, therapy could perhaps be fine-tuned to give people living with Parkinson's more control over their movements and a better quality of life.

Tremors, slowed movement, a shuffling walk, impaired balance. These are some of the characteristic symptoms of Parkinson's disease, a disabling condition that progressively diminishes a person's motor control.

All too familiar

Parkinson's disease strikes about one in every 100 persons over age 60¹—more than 500,000 people in the U.S. alone based on 2010 census figures.

Failure to communicate

The disease causes neurons in a part of the brain to deteriorate or die. As these neurons fail, the brain produces less dopamine, a chemical that carries messages associated with motor control.

Dopamine replacement medication makes it easier for many with Parkinson's to move through their lives, at least for a while. Taken over long periods these drugs often become less effective and can cause a range of serious side effects.

Neuroscientists have two competing hypotheses on how dopamine aids movement in the moment (performance) or movement in the future (learning). Each hypothesis points to a different way that current dopamine replacement therapies might be altered to achieve better results.

Research now underway with support from the Brain Research Foundation may confirm one of the two theories, or lead to a new understanding of dopamine deficiency in people living with Parkinson's disease.

Turning cells on and off

A team at the University of Michigan led by Daniel Leventhal, M.D., Ph.D., is conducting a series of experiments to observe rodents performing skilled reaching movements (very similar to how humans reach) with and without dopamine at work to facilitate delivery of motor control signals.

As the animals reach for food, individual dopamine cells will be turned on or off by light pulses timed to the millisecond. At the same time, a high-speed camera linked to software that reconstructs 3D images will record the animals' movements. The resulting images will allow the team to analyze how movement is affected by the presence or absence of dopamine.

More precise observation

Different from previous investigations, this study will document and analyze the movement of individual paw digits. Dr. Leventhal said the team has already seen

evidence that this refinement is important to understanding how dopamine figures into both performance- and learning-related motor control.

Parkinson's and beyond

Dr. Leventhal expects his study will validate one of the competing hypotheses for refining dopamine replacement therapy—or some combination of the two—to better treat Parkinson's disease and manage its complications. In addition, he said the team's findings may lead to new options for treating other movement disorders linked to dopamine such as dystonia and attention deficit hyperactivity disease. Good news for millions more people.

¹de Lau, L.M. & Breteler, M.M. Epidemiology of Parkinson's disease. *Lancet Neurol* 5, 525-535 (2006)

thank you.

We're honored by the trust our donors have placed in the BRF and the generous support they have offered to advance neuroscience.

In Memoriam William E. Fay, Jr. (1917–2015)



Co-founder and Chairman Emeritus of the Brain Research Foundation William E. Fay Jr. died January 7, 2015 at the age of 97.

Bill's energy and generous spirit were hallmarks of his success in business, as Executive Vice President for Smith Barney & Company and later as an independent consultant as well as his success in helping to build the Brain Research Foundation.

Bill came to the BRF through his search for help for his youngest daughter, Lisa, who had epilepsy. After countless visits with doctors all over the country, the Fays met a neurologist who had developed a new treatment that provided some relief of Lisa's symptoms, but little more.

After so many conversations with neurologists, Bill was struck by how many hypotheses—and how few facts—he had heard about brain function. He could see that without a broad and sustained research effort, reliable treatments for a whole range of brain disorders were a long way off. Someone needed to make brain research a priority.

That someone was Bill Fay.

Bill stepped forward and said yes. Yes, I will make people aware of the urgent need for early stage neuroscience research. Yes, I will offer my leadership to raise funds for research. Yes, I will advocate for aggressive scientific inquiry that will expand knowledge and contribute to innovative treatment strategies for the entire spectrum of brain issues.

Through the years, Bill's willingness to say yes helped make the Brain Research Foundation a vibrant and effective organization at the forefront of neuroscience research. His legacy will help generations of people whose lives are touched by brain disorders, disease and injury.

On behalf of the neuroscience community—researchers, clinicians, and everyone touched by neurological disorder, disease, and injury—we extend our condolences to the Fay family.

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There are many ways that individuals are contributing to Brain Research Foundation. We've recently experienced an increase in matching gift contributions through workplace giving programs. And instead of making a donation in a lump sum once a year, some donors are making smaller monthly contributions via the BRF website. We are also receiving donations through various online giving and "crowdrise" platforms, while other donors choose to raise awareness and significant funds by competing in races and soliciting donations from friends and family through websites such as Everydayhero.com.

With so many ways to donate to so many worthy charities, we are very grateful that you chose us.

Thank you for your continued support.



Letter from the Treasurer

Brain Research Foundation continues to fund ground breaking research thanks to the increasingly generous contributions of our donors and our superior investment performance. During the last two years, more than 100% of our annual donor contributions have been used to fund research and educational programs in neuroscience. Our recently completed strategic plan established the objective of 100% of annual donations being used to fund research and we are proud of having achieved these results in each of the last five years.

BRF continues to fund the most innovative neuroscience research in the most beneficial ways to advance the understanding of the brain. In 2015, based on the recommendations of our Scientific Review Committee, we decided to make our seed grants two-year grants instead of one-year. This will allow the scientists more time to generate results. In addition, we increased the grant to a total of \$80,000.

As we review all of our programs, we funded about \$3.8 million of projects in the last 2 years. That amount exceeded our contributions by \$1.7 million, thus meeting our objective of investing at least 100% of our annual support in worthy neuroscience programs. We are proud of our ability to be good stewards of our donor dollars.

We have included a summary of our income and major expenses and a condensed balance sheet for fiscal years 2014 and 2015. We encourage you to review our audited financial statements on our website or contact the BRF office.

The Board of Trustees and staff continue to work hard to sustain your support to fulfill our mission. As we start our 63rd year, we look forward to building our donor base and funding more researchers who are focused on improving life through innovative neuroscience research.

Sincerely,

A handwritten signature in black ink, reading "Peter J. Eschenbach". The signature is fluid and cursive, with a long, sweeping tail on the final letter.

Peter J. Eschenbach
Treasurer

Financial Statements

Statement of Activities and Changes in Net Assets

Highlights of Income Statement year ended June 30, 2015 and 2014

	2015	2014
Beginning Net Assets	\$ 16,624,522	\$ 15,001,271
Contributions	892,526	1,133,821
Interest and dividends	536,660	487,106
Net realized and unrealized gains on investments	476,084	2,350,942
Total	\$ 18,529,792	\$ 18,973,140
Expenses		
Program services	\$ 2,016,414	\$ 1,855,491
Supporting services	522,017	493,127
Total	2,538,431	2,348,618
Total net assets	\$ 15,991,361	\$ 16,624,522

Statement of Financial Position

As of June 30, 2015 and 2014

Assets	2015	2014
Cash	\$ 80,659	\$ 133,776
Current prepaid expenses and deposits	-	24,152
Investments	16,573,568	16,755,247
Contributions receivable	127,500	-
Property and Equipment - Net	3,525	4,346
Other assets	5,200	5,200
Total assets	\$ 16,790,452	\$ 16,922,721

Liabilities and Net Assets	2015	2014
Liabilities		
Accounts Payable and Accrued Expenses	\$ 134,091	\$ 8,199
Grants Payable	665,000	290,000
Total liabilities	\$ 799,091	\$ 298,199

Net Assets		
Unrestricted	\$ 9,596,535	\$ 10,222,366
Unrestricted - Board-designated	4,103,058	4,055,227
Temporarily restricted	791,768	846,929
Permanently restricted	1,500,000	1,500,000
Total net assets	\$ 15,991,361	\$ 16,624,522

Total liabilities and net assets	\$ 16,790,452	\$ 16,922,721
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