BROWN UNIVERSITY

ANNUAL REPORT 2009 - 2010


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Contents

FROM THE PRESIDENT

As the research initiatives highlighted in this report convey, in 2010 Brown continued to reap the benefits of enhancements made under the Plan for Academic Enrichment. Buoyed by the successful conclusion of the Boldly Brown campaign and an increase in external research funding, academic programs continued to expand opportunities for students and faculty.

In all our efforts to strengthen the University, we have made it a priority to create environments conducive to innovative work across the full breadth of the curriculum. Fruitful collaborations among faculty and students continued to yield discoveries, spawn new courses and projects, and lead to new interdisciplinary initiatives. The research collaborations described in the following pages provide a glance into some of these efforts.

Capital and technology improvements have played an essential role in creating and broadening such opportunities in research and teaching. Among the many projects we pursued in 2010 were renovations to 121 South Main to create a home for the new Institute for Computational and Experimental Research in Mathematics, the National Science Foundation's first such institute in our region. We began the transformation of the Metcalf complex as the new home for the Department of Cognitive, Linguistic and Psychological Sciences. In addition, the retrofitting of a landmark building in Providence's Jewelry District to house medical education for Alpert Medical School got underway.

Trustees, alumni and friends contributed funds for other important new facilities on the campus. The Stephen Robert '62 Campus Center, a long-anticipated contribution to the quality and cohesion of student life, opened at the beginning of this academic year. The Perry and Marty Granoff Center for the Creative Arts, designed by Diller Scofidio + Renfro, is now completed, and work has begun on a substantial addition to Brown's athletic complex that will group new swimming and fitness facilities with indoor and outdoor community spaces.

In partnership with IBM, we installed a supercomputer, the speed and power of which opens vast and exciting new research possibilities for faculty and students in all areas of study, many with the potential to contribute to human health and well-being. These efforts, like most of our research initiatives, enjoy the support of an array of funders and collaborators, from the National Institutes of Health and the National Science Foundation to corporations and our affiliated teaching hospitals.

A number of core initiatives continued at a robust level. We sustained our expanded commitment to financial aid for students at all levels and continued to admit undergraduate students on a need-blind basis. The international reach of the University continued to grow on multiple fronts, including through academic partnerships with additional institutions in China and India. Through research on issues of global importance, our faculty and students engage increasingly and productively in study and work that both contribute to knowledge and have practical applications for communities around the world.

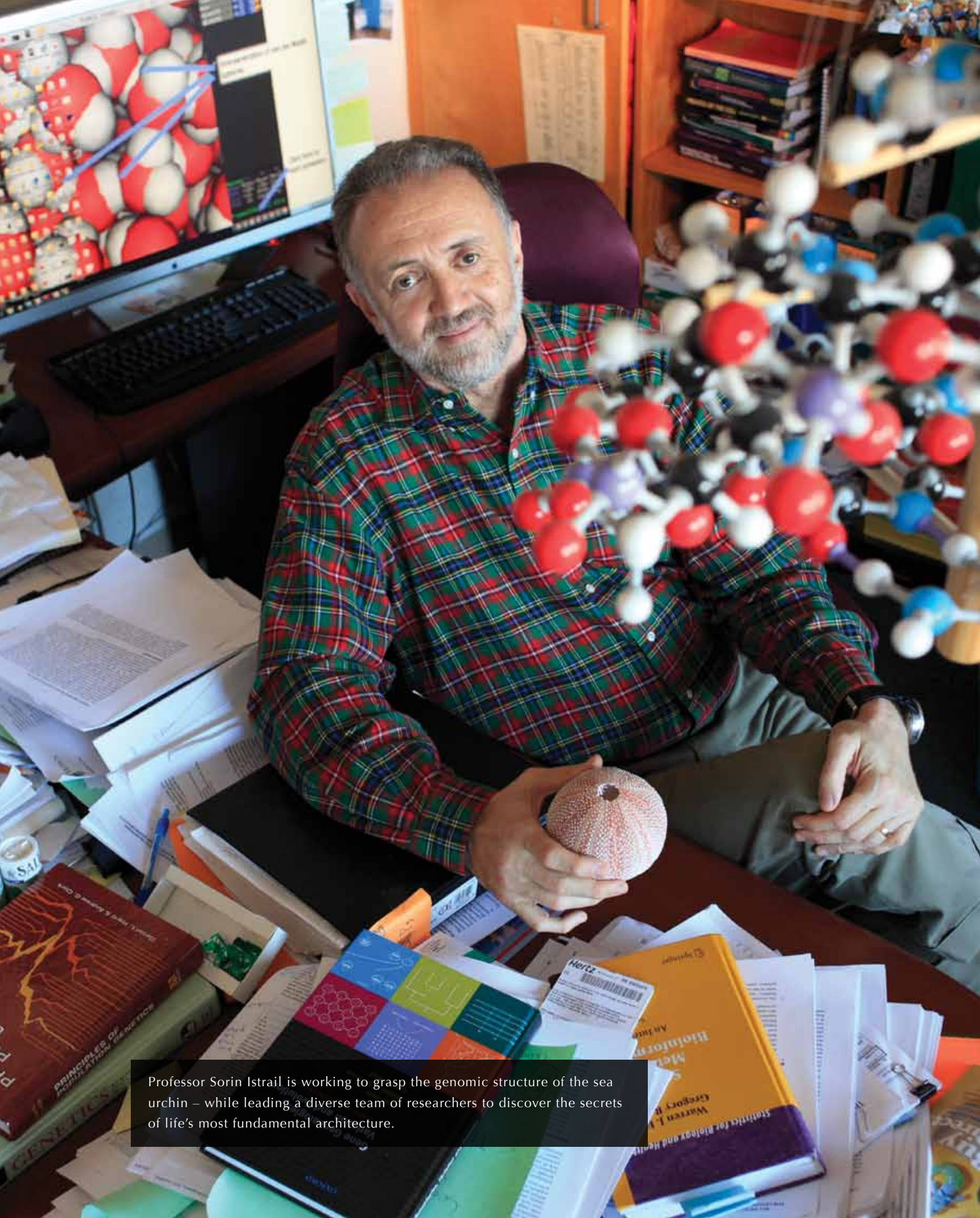
These efforts flourished in part because of the disciplined budget decisions we made to focus on our core activities during the economic crisis. While a salary freeze, layoffs, delayed hiring, and restructuring were difficult actions to take, the Brown community went to work and, together, made decisions that were right for preserving the strength of our educational and research mission. Of course, this discipline was afforded in part by the stellar performance of the Campaign, which has allowed us to increase the faculty by approximately 20 percent and support improved undergraduate, graduate and medical student financial aid. The 56 percent increase in research funding over the past eight years also helped tremendously during this difficult period.

Brown's endowment performed well in 2010, in the context of adjustments made in response to conditions in the previous fiscal year. We ended the year with a small operating surplus and a return of 10.2 percent on investments. The University's financial condition is strong and sustainable for the short and long term, ensuring Brown's standing today and well into the future.

The financial support of Brown alumni, parents, and friends has been essential in every aspect of the University's success in 2010. The Campaign for Academic Enrichment reached its fundraising goal of $1.4 billion nineteen months early, in May of 2009. The total exceeded $1.6 billion following December's formal conclusion of the five-year campaign. This achievement was made possible through the remarkable generosity of faculty, students, parents, alumni, friends, and Brown's Corporation members, led so ably by Chancellor Tom Tisch.

I look back with pride on the discipline and purpose the entire Brown community has demonstrated throughout this trying period. I look ahead with confidence that the choices we have made and the goals we have set for the future will stimulate Brown's continued distinction for decades to come.

Ruth J. Simmons



Professor Sorin Istrail is working to grasp the genomic structure of the sea urchin – while leading a diverse team of researchers to discover the secrets of life's most fundamental architecture.

Capturing the Essence of Life

A MULTIDISCIPLINARY TEAM OF SCIENTISTS MINES A WORLD OF DATA TO EXTRACT THE SECRETS OF LIFE'S MOST ELEMENTAL STRANDS

"The genome is a 'tween," says Sorin Istrail, Julie Nguyen Brown Professor of Computational and Mathematical Sciences and Professor of Computer Science, and director of Brown's Center for Computational Molecular Biology (CCMB). "It's soon to be a teenager."

As every parent knows, that's when things start to get complicated.

Locked within the world of data generated by the past decade's rapid progress in genomics are secrets that lie far beyond the imagination of Mendel and Darwin. Decoding that data – further revealing the fundamental physical architecture that influences growth and aging, mutation and reproduction, injury and illness, and other processes – may eventually yield new therapies born of new levels of understanding. Equally rapid advances in computation – technology that can contain the three billion letters of the human genome, for instance, and efficiencies that have made it economically feasible to work with huge data sets – have given us the tools to do the work.

"At the beginning of the new century, biology became a quantitative science. Computation is now part of biology. We are swimming in data."

Sorin Istrail
Julie Nguyen Brown Professor of Computational and Mathematical Sciences and Professor of Computer Science, Director of Brown's Center for Computational Molecular Biology

The floodgates of possibility have been flung open.

At the CCMB, a cluster of 1,000 microprocessors is working 24/7 to sift, organize, and analyze data in support of scores of research projects. The Center is harnessing the power of leading-edge computational technology to explore a range of biological processes, properties, and diseases – from the genomics of human cancers to the genetic activity of bacteria. The CCMB core faculty – the group of five scientists with faculty appointments in Applied Mathematics, Computer Science, and Ecology and Evolutionary Biology, together with the co-founders of the CCMB initiative, Professors Franco Preparata and David Rand – are leading the work in collaboration with more than twenty other faculty members and dozens of undergraduates, grad students, and post-doctoral fellows.

The CCMB builds on Brown's longstanding strength in computational biology – the University hosts the world's oldest undergraduate

program in the field, launched in 1997 – and leverages its collaborative ethos at a time when traditional boundaries between disciplines are disappearing.

"At the beginning of the new century, biology became a quantitative science," says Istrail. "Computation is now part of biology. We are swimming in data."

"THE DIRECTION OF MY RESEARCH IS TO UNDERSTAND NATURAL SELECTION, BOTH HOW ADAPTATION HAS AFFECTED OUR GENOME AND HOW GENETICS AFFECTS DISEASE."

SOHINI RAMACHANDRAN
Assistant Professor of Biology

The CCMB team originally consisted of two senior faculty members, Istrail and Professor of Applied Mathemetics Charles (Chip) Lawrence, a pioneer in computational biology whose research focuses on the application of Bayesian algorithms that he and his colleagues developed, leading to biological insights on transcription regulation and identification of regulatory motifs in cells and proteins. The two then recruited three exciting young researchers to complete the CCMB core faculty roster.

LOOKING FOR THE CANCER "SWITCH"

Assistant Professor of Biology Sohini Ramachandran and Assistant Professor of Computer Science Ben Raphael, both members of the CCMB core faculty, are wrestling with large data sets – what Ramachandran describes as "looking for both strong and hidden signals in very large matrices" – to understand cancer at the genetic level.

Ramachandran, an evolutionary biologist, has long been interested in studying DNA sequence variations called single nucleotide polymorphisms (SNPs) and the snapshot they offer of humanity's expansion out of Africa millions of years ago – forming an immutable, fundamental record of human history, and now potentially providing insight into the future of the species. "We can assign the ancestry of an individual based on genetic data," she says. "Now the direction of my research is to understand natural selection, both how adaptation has affected our genome and how genetics affects disease."

A vital application of the work is Ramachandran's collaboration with colleagues at St. Jude Children's Hospital, where the push is on to understand why course of illness and treatment outcomes vary for children with cancer across different ethnicities. "Caucasian and African-American children with leukemia are less likely to relapse than Hispanic children," she says. "Leukemia has an 80 percent cure rate, but the prognosis after relapse drops dramatically. We're working with St. Jude researchers to discover how genotype data from their patients is correlated with outcome of therapy."

Raphael, a computer scientist, is working with the national Cancer Genome Atlas to look for common gene mutations in thousands of people with cancer – work that could eventually result in new drug targets, personalized therapy, and other approaches to treatment. "We're analyzing large groups of patients with cancer to try to find out if there are sets of genes that are mutated frequently among these patients," says Raphael. "The way to look at these mutations is not one gene at a time, but in the

context of what's known about the signaling and regulatory pathways within cells. In order to be successful, a cancer cell needs to break several of these pathways."

Working under a grant from the National Science Foundation, Raphael and Professor of Computer Science Eli Upfal – along with a team of undergraduate and graduate students – recently developed algorithms to analyze genetic changes in three hundred patients with ovarian cancer. In earlier work they focused on brain and lung cancer patients.

GETTING TO KNOW THE INVERTEBRATE BESIDE YOU

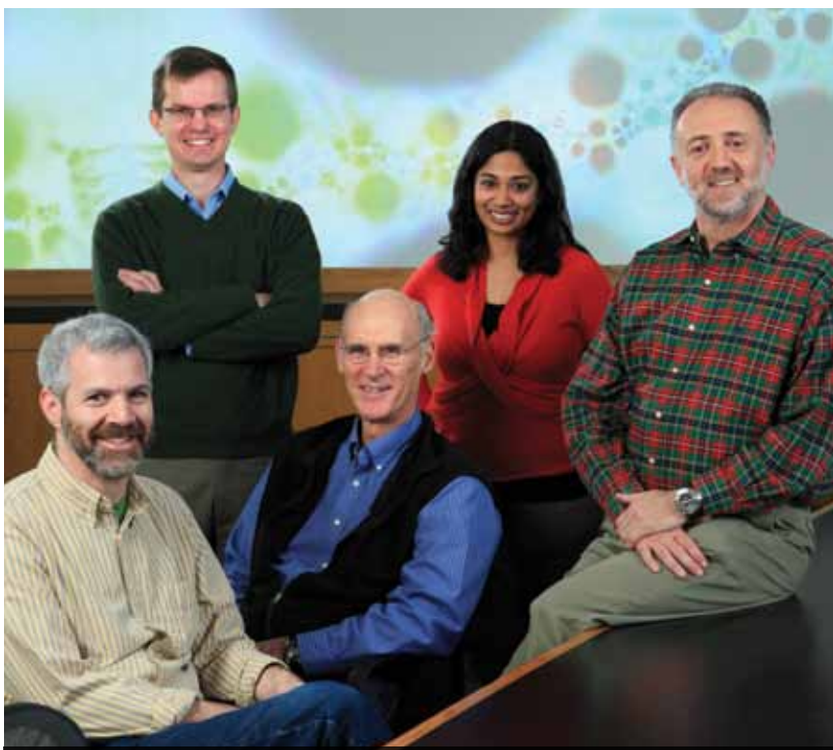
At the CCMB, human genomics is not the only game in town.

In addition to directing the Center's operations, Istrail – who came to Brown after playing various key leadership roles at Celera Genomics during the period when the company was completing the sequence of the human genome – is studying the regulatory genome of the sea urchin, an organism whose genome is remarkably similar to that of humans. For the past decade, his team has been working closely with a research group at the California Institute of Technology led by Professor Eric Davidson, the leading molecular biologist of gene regulatory networks.

"In front of every gene, there are hard-wired instructions for the gene's regulatory circuits – whose design principles are not known," Istrail explains. "For three years, I had a small army of undergraduate biology students annotators, working together with my PhD students to build the cis-Lexicon database of the regulatory regions of transcription factors and other regulatory genes. The goal of the project is to break the 'genomic cis-regulatory code,' that is, to infer the design principles of the DNA regulatory regions of genes." Using customized software developed in his lab, the cis-Browser, they are building what Istrail calls "a Google-like map of the [sea urchin] cis-regulatory genome."

Assistant Professor of Biology Daniel Weinreich, a CCMB core faculty member based in the Department of Ecology and Evolutionary Biology, is working on an even smaller scale – one with potentially broad applications. There are 100 million-fold more microbes on the planet than humans, and Weinreich uses them to study evolution. Using the bacterium *E.coli*, he is studying a range of topics – from the evolution of genes that result in drug resistance to the ways in which organisms respond to thermal changes in the environment.

"Evolution is a force to be reckoned with," says Weinreich, "it will not be stopped."



CCMB faculty (l-r) Daniel Weinreich, Benjamin Raphael, Charles Lawrence, Sohini Ramachandran, and Sorin Istrail are bringing expertise in evolutionary biology, applied mathematics, and computer science to explore deep questions of life and destiny.

Professor Joseph "Butch" Rovan and students (*top, l-r:* Stephan Moore, graduate student; Mark Cetilia, graduate student; *middle, l-r:* Dylan Nelson, '11; Caroline Park, graduate student; Jacob Richman, graduate student; *bottom, l-r*: Bevin Kelley, graduate student; Mat Becker, '12; Jordan Bartee, graduate student), are redefining and making music through creativity, collaboration, and advanced computer technology.

MUSICIANS EXPLORE THE DNA OF SOUND THROUGH COLLABORATIVE COMPUTING

Night is falling on Providence's East Side. The tall windows of Steinert Practice Center reveal a slice of winter sky – peaks of rooftops, silhouettes of branches, ambient light from the street below.

Downstairs, a mezzo-soprano practices scales. Upstairs, in a second floor rehearsal space illuminated only by the glow of laptop monitors, eight people – seven undergraduate and graduate music students and an undergraduate geological sciences concentrator – sit in a circle, furiously drumming on their keyboards with laser-like focus. Their teacher roams the room, adjusting the speakers that line the perimeter, thinking and listening.

As the last light of sunset fades, the space explodes in a tornado of electric sound – by turns dissonant and melodic, loud and soft, with periodic hums and silences. Sometimes it's lovely. Sometimes it's painful. Sometimes it's like communication from a distant galaxy. Sometimes it's like a huge, cosmic hearing test.

This is sound distilled to its essential elements.

The sound is generated by the students, as they rapid-fire zeros and ones into their computers, combining binary code with advanced computational technology to create an audio manifestation of the silent world of data. Blue graphs of sound waves flow across the bottom of each laptop monitor.

LISTENING TO DATA

Each of the students has written a personalized software program – a *patch*, in the lexicon of the class – which creates a distinctive sound, a ping or a chirp or a chime or a barking dog or a doorbell or a tropical bird call or a heartbeat, for his or her laptop. The laptops are also linked through a separate software platform developed by the course instructor, Associate Professor of Music Joseph "Butch" Rovan, for this exercise in "networked improvisation."

"Very often in the humanities and sciences, data is visually represented, and it's interesting to hear it represented through sound," says Rovan, a composer and performer who co-directs both Brown's PhD program in Computer Music and Multimedia and its Multimedia and Electronic Music Experiments (MEME), an interdisciplinary program within the Music Department that focuses on the creative use of emerging technology for real-time interactive performance and installation. Rovan served as product manager for MAX, OMS, and Musical Instrument Digital Interface (MIDI) hardware at Palo Alto-based electronic music pioneer Opcode Systems (later acquired by Gibson

"We all become part of a larger totality...it's as if we are all inside of a single instrument – an electronic, data-driven instrument – that we are, in a sense, playing together."

Joseph Rovan
Associate Professor of Music

Guitars) before accepting a series of academic appointments in the United States and abroad.

"The data doesn't arrange itself in tonal patterns, so this music isn't necessarily tonal, but textural," Rovan explains. "Timing discrepancies in the network create rhythmic patterns."

AN EXERCISE IN COLLABORATION

The students experiment with solo performances, with quartets, and with their full octet. They compare the sound images created through the use of state-of-the-art speakers, connected to the laptops, with the ones that emanate from their less powerful built-in speakers. They ask and answer questions in rapid succession.

"What happens to the sound when you walk around with your laptop?"

"What happens if you just send *zeros*?"

"What if you send a *one* every millisecond?"

"What if we change the frequency of the resonators?"

Graduate student Jacob Richman places his laptop in an open piano at the side of the room and sits down at the bench to augment the sound of his patch with vibration and external sound created by a traditional musical keyboard. "What happens when you add piano chords?"

The students can remotely control each other's laptops, creating a reciprocal, constantly changing harmonic structure, and the collective effect can also be manipulated through central controls. It's a powerful exercise in trust, agility, and improvisation – much like having another musician appropriate one's instrument, mid-concert, and play a composition that is being written in real-time.

"It's a very collaborative thing," says Bevin Kelley, a PhD candidate, electronic musician, and multimedia composer who joined the MEME program in 2009. Kelley notes that Rovan started the class with an old-fashioned improvisational jam on traditional instruments, in order to foster a collaborative ethos among the eight.

COMPUTING IN THE SERVICE OF COMPOSITION

MEME links the Brown and Rhode Island School of Design digital media communities in a range of projects that blur the boundaries between computer music, installation, video, theater, and dance. Faculty, students, and staff work in a resource-rich environment that encompasses five computer music studios, including a recording studio, several small project studios, and an electronics lab – using tools that analyze and synthesize sound, designing sensor hardware that can capture gestures and movement, and writing custom software for interactive performance. "I always like to say 'it's not the gear but the ear'," Rovan says of the computer music studios in Steinert, where the composition students do much of their work.

"What we're after with this kind of music making," Rovan continues, "is a heightened awareness of sound and its role in musical expression. We try to teach this through developing a composer's computational skills."

Networked improvisation, he says, is a particularly intense version of this kind of learning, in which students become aware not just of sound but also of the most basic aspect of music making – communication through time. Networks can heighten the awareness of time, in fact, as performers become responsive to the natural delays that occur when data travels between computers.

When connected through the network, "we all become part of a larger totality," says Rovan. "It's as if we are all inside of a single instrument – an electronic, data-driven instrument – that we are, in a sense, playing together. The network connection becomes a model for a new kind of social construct that is very important to our current generation of students."

Professor Kenny Breuer and Professor Sharon Swartz are blending engineering and biology to illuminate the mysterious intricacies of bat flight.

Icarus Deconstructed

BIOLOGISTS AND ENGINEERS USE ADVANCED TECHNOLOGY TO PARSE THE CHOREOGRAPHY OF BAT FLIGHT

Flight – the stuff of dreams, an ancient human obsession. An interdisciplinary group of scientists, led by Professor of Biology Sharon Swartz and Professor of Engineering Kenny Breuer, has come together at Brown to discover the essence of flight through high-tech analysis of how bats fly.

Except for early work with primates and a brief detour into the world of flying squirrels, it's always been about bats for Swartz, an evolutionary biologist.

"I wanted to study a system in which evolution had pushed things to the limit, and flight is the ultimate in terms of physical demands," she explains. "Flight has evolved only four times – in insects, in pterosaurs, in birds, and in bats, which are thought to have evolved from nocturnal gliding mammals, like flying squirrels."

Swartz had been studying the structure of bats' wings for years – including those of the giant flying foxes of Australia, which have wing spans of up to six feet – when Breuer arrived on campus in 1999. Swartz immediately sensed a potential collaborator in Breuer, who had an extensive background in fluid mechanics and aerodynamics but had not yet discovered a specific interest in bats.

He was soon converted.

"Bats are the only mammals capable of powered flight," says Breuer. "It's such an interesting question: What benefit does bat morphology confer to flight?"

The two began to partner – first as advisors to a graduate student with interest in both evolutionary biology and engineering, and then on research. Today, they lead a team of about 20 other faculty members, post-doctoral researchers, graduate students, and undergraduates in computer science and applied mathematics, as well as in biology and engineering, who are developing hypotheses, conducting experiments, inventing software and hardware, and crunching data to illuminate the flight ways of bats.

DECONSTRUCTING FLIGHT

Bats are the ultimate flexible fliers of the natural world.

Like no other winged creature, they can fly close together in swarms, catch prey on the wing, maneuver through dense foliage, avoid obstacles, and make 180-degree mid-flight turns at high velocity. Although endowed with other physical characteristics that make all that possible, such as echolocation in some species, the extraordinary agility and power of bat flight is largely attributable to wing design.

Unlike insects and birds, which have rigid wings with only one or a few joints and a limited range of motion, bats' wings are designed to allow great freedom of movement. The wings

are made of a thin, compliant skin membrane draped over a flexible, jointed skeleton.

"The nature of the bone material is very distinctive," says Swartz. "It's a mix of mineral and protein, which decreases a lot as you move out to the wingtips – making the wings lighter and lighter, almost floppy."

The name of the biological order of bats, *Chiroptera*, quite appropriately translates to "hand wing."

"This compliant trait of their wings is a very positive aerodynamic characteristic," says Breuer. "Bats are able to generate tremendous lift. The aerodynamics of bat flight is very complex. Our team is studying it by using high-speed measurements of the bat's wing and body motion while in flight."

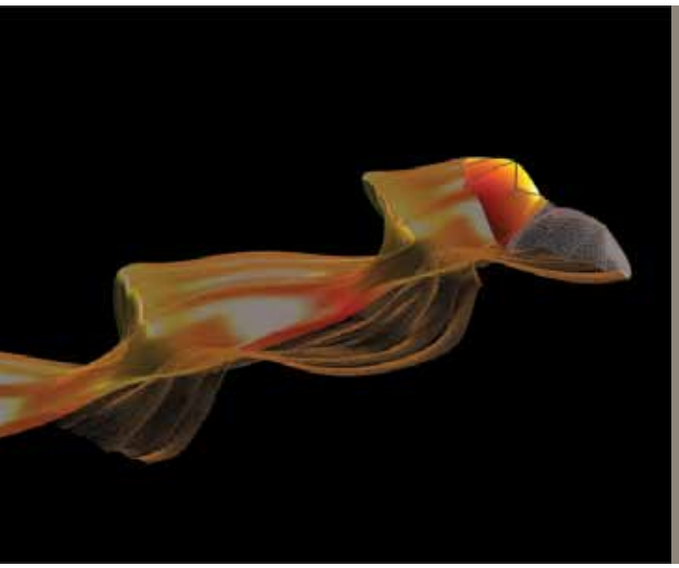
In order to capture the mid-flight experience, Breuer and his team release a bat into the glass-walled test section of a wind tunnel surrounded by high-speed video cameras. As the bat flies through a sheer cloud of atomized oil droplets, kinematic measurements are synchronized with Particle Image Velocimetry (PIV) measurements of the fluid velocity in its wake – together forming a snapshot of the lift and thrust mechanisms that bats use during flight.

"Not much is known about the aerodynamic behavior of bats," says Breuer. "For a long time, researchers thought it was impossible to measure the air velocity of bat flight. We've found a way to do it through quantitative mechanics."

"Bats are the only mammals capable of powered flight...it's such an interesting question: What benefit does bat morphology confer to flight?"

Kenny Breuer
Professor of Engineering

Captured by Breuer's cameras, the flutter of the bats' wings – which can look frenetic to the naked eye – is elegant, fluid, like swimming through air. ("I think they look like they're doing the butterfly," says Breuer.) The camera has



High-speed cameras capture the fluid elegance of bats in flight.

revealed that the motion is one of great complexity, made possible by the jointed character of the wings. As reported by Swartz and Breuer and their team earlier this year in *The Journal of Experimental Biology*, the bats leave four discrete whirling masses in their wake – with the strongest vortex coming from the wing's tip and sustained through each upstroke of the wings.

"This work has only been possible for the past few years," says Breuer. "The pulsed laser we use didn't exist five years ago, and we've introduced a new generation of software. Every piece of software used in our kinematics calculations was written by our team."

BUILDING THE ROBOTIC BAT

All bats are not created equal. Joseph Bahlman wants to find out what distinguishes the wing of one species from another.

"There are 1,232 different species of bats, with dramatically different wing shapes and sizes," says Bahlman, a graduate student in biology. "I'm interested in looking at whether different wing shapes are, for instance, better adapted for long-distance migrating or for maneuvering in cluttered terrain."

"All bats have essentially the same skeletal structure," says Breuer, "but the internal dynamics vary from species to species."

Bahlman has been studying live bats for some time. He has traveled to Costa Rica to research vampire bats, has studied bat skin extensively, and has contributed to Swartz and Breuer's wind tunnel experiments.

All this before he built the robotic bat wing.

Bahlman has been working on it for a couple of years – first using a CAD program to design the model, based on the dimensions and physiology of live bat wings, then using a 3D printer to create an image of the articulated skeleton of the wing, and finally fabricating membranes out of silicone rubber. The model aims to feature many accoutrements of animal flight. "We use cables to transfer motion from the motors to the bones, in much the same way that tendons transfer motion from muscles to bones in live animals," he explains.

Joseph Bahlman, graduate student

Bahlman now has the robotic wing instrumented to measure aerodynamic forces and mounted in the wind tunnel, where it will expand the group's understanding of bat flight through a series of new experiments.

"It's great to have so many collaborators and so many ideas and resources available," Bahlman says. "From the biology side, there are so many interesting questions, and from the engineering side there are so many techniques for generating answers."

"Increasingly sophisticated technology and new diagnostic tools have allowed physical scientists to begin to delve into the complex problems of the natural world," Breuer agrees. "It's very exciting work."

REVOLUTIONIZING FLIGHT

The team's work – which is funded by the National Science Foundation (NSF) and the Air Force Office of Scientific Research – could make a significant contribution to the future of aviation, say Swartz and Breuer.

Current aircraft are built on the bird flight model, with stiff wings. A departure from that design, incorporating the flexibility of bat wings, could spark a new generation of innovation in aviation – perhaps leading to the advent of tiny, unmanned airplanes agile enough to echo the acrobatic maneuvers of bats. These new levels of agile, unobtrusive flight could allow unobserved exploration of small spaces, dense foliage, and other challenging topography.

"The possibilities are endless," says Breuer. "Robotic flight vehicles and micro air vehicles, modeled on bat flight, could revolutionize our search and rescue and reconnaissance capabilities and dramatically improve our ability to take measurements and make other observations in tight spaces, such as caves."

"Millions of years of evolution have worked out a great design," says Swartz.

"Bats are able to generate tremendous lift. The aerodynamics of bat flight is very complex. Our team is studying it by using high-speed measurements of the bat's wing and body motion while in flight."

Kenny Breuer

Lauren Reimnitz ’11

THE BAT WRANGLER

When it comes to bats, Lauren Reimnitz ’11 waxes poetic.

“Their wing hair density is really cool,” she says, recalling her work with graduate student Jorn Cheney in Sharon Swartz’s lab. “Their wing hairs are like our inner ear hair cells … very neurological. Bats can sense how the air is flowing over their wings, and they have a larger density of hairs on the leading edge of their wings and along their bones.”

Reimnitz was a sophomore in Swartz’s Biological Design: The Structural Architecture of Organisms course when she was first bitten by the bat research bug. “I asked her if she had any space in her lab, and she invited me to start coming to weekly lab meetings.”

Eventually, Reimnitz started working with Swartz’s lab manager to care for the bats in their nectar-filled enclosure and transport them to the wind tunnel for their observed flights. “You have to wear protective clothing,” she says, “and if you want to catch them you have to wait until they’ve stopped flying and move fast to put the net over them.”

It’s a delicate maneuver, she notes. “You have to put your hand over them very carefully, making sure you have their wings securely within your grip. You have to protect their wings.”

As bats are sensitive to temperature, each one is transported within a series of enclosures – suspended in a cloth bag – which is in turn suspended in a styrofoam box.

Two years after starting to work in Swartz’s lab, Reimnitz is working on her own research project – collaborating with engineering postdoctoral fellow Attila Bergou to visualize bat flight in three-dimensional space through a technique called visual hull reconstruction.

“The bats will be spotted with some unobtrusive white paint, so that in the video we can find those points and equate them to mathematical equations and reconstruct their flight,” she says, noting that the team is currently in the construction phase. “We’ve made a three-sided box, and there will be three cameras. We’ll be using diffuse light, to minimize any shadows cast by the bat, and each frame we capture will allow us to figure out where the bat isn’t in three-dimensional space. It’s a technique that’s been used well in capturing insect flight motion, but has never been used to capture bat flight.”

Although Reimnitz imagines that she will always spend part of her time in the laboratory, she has other immediate plans. She’s off to veterinary school in a year.

“I really do love the physiological side of working with animals,” she says.

Professor Kenneth Chay is mining big data sets to answer big socioeconomic questions.

Digital Witness

EXPLORING THE IMPACT OF POLICY DECISIONS ON INDIVIDUAL LIVES, AN ECONOMIST TRACKS OUR COLLECTIVE EXPERIENCE THROUGH DATA

Kenneth Chay believes in evidence. In bulk quantities.

"Social science is at its best when it emulates science," says Chay, an empirical micro-economist and Professor of Economics. "To understand the causes of various behaviors and outcomes that we study as social scientists, we need to examine the validity of many competing hypotheses. To reach a definitive conclusion, to prove one hypothesis over another, you often need a very large data set. And the evidence has to be decisive. You have to test everything humanly possible."

Chay's research involves probing massive quantities of data – mostly derived from government databases and other public sources – to reveal answers to precise questions with real policy implications. He has analyzed the effect of the Clean Air Act on infant mortality, studied the impact of civil rights legislation on the convergence of mortality rates among black and white residents of Mississippi, and probed the efficacy of Medicare forty years on.

A common theme of the work is demonstrating how social, political, and economic forces affect health outcomes and life experiences – for instance, how access to care, through insurance or hospital desegregation, can impact a child's likelihood of dying in infancy or achieving academic standards, or the odds that an elderly person will survive a heart attack.

THE POLITICS OF ACCESS AND ACHIEVEMENT

Using two data sources, the National Assessment of Educational Progress and the Armed Forces Qualification Test, Chay demonstrated that a convergence in standardized test scores among black and white students, observed during the 1980s, followed incremental improvements in the early health of blacks born between 1963 and 1970 and that the greatest concentration of improvement was in the South. He concluded that integration of hospitals during the 1960s yielded early access to health care – with a life-changing impact on a generation of children.

> "Don't work on questions where you care what the answer is...whatever the answer is proven to be – that's your contribution to the dialogue."
>
> Kenneth Chay
> *Professor of Economics*

Another study examined the role of Title VI of the Civil Rights Act of 1964 – which made integration in hospitals a requirement for participation in the Medicare program – in reducing the black infant mortality rate in the United States after 1965. Data drawn from a county-level database for Mississippi, the state with the largest decline in infant mortality, painted a vivid picture. Fewer babies had died with conditions considered preventable with timely hospital care – for example, diarrhea and pneumonia – after hospitals in their communities had received certification for Title VI.

"Social science is at its best when it emulates science...to understand the causes of various behaviors and outcomes that we study as social scientists, we need to examine the validity of many competing hypotheses."

Kenneth Chay

In collaboration with Shailender Swaminathan, a post-doctoral fellow in the Department of Community Health and Alpert Medical School, Chay has also contributed insight into the impact of social status on mortality by studying an unlikely cohort – professional baseball players who are eligible for induction into the Baseball Hall of Fame. The data revealed that players who narrowly missed induction lived shorter lives than inductees – but that the longest-lived were those who missed induction by a wide margin. Chay and Swaminathan also analyzed educational attainment, body mass index (BMI) and race and ethnicity for the players in the study, and found that narrow non-attainment or delayed attainment of their ultimate goal translated to higher incidence of heart attack and stroke among the highly competitive group.

PROVING THE EFFICACY OF MEDICARE

Chay's largest study to date, also in collaboration with Swaminathan, uses ten different data sets – including census records, hospital utilization and discharge data, and mortality records from the United States and abroad – to look back at Medicare's impact on morbidity and mortality. It is the most comprehensive database ever constructed to study the issue.

Before the advent of Medicare in 1966, Chay notes, life expectancy among the elderly was lower in the United States than in Canada and several European countries where universal health care was already in place. American elderly are now living longer – and, he says, living better.

"Until now, Medicare's impact on morbidity and mortality has been thought to be relatively modest," says Chay. "But the data suggest that the program has actually been highly effective from the very beginning – costing less than $200 for every life year achieved by recipients right after implementation. And we've seen decreases in disability rates as well. We're not just adding years of miserable life."

Chay and Swaminathan's analysis showed that Medicare did increase hospital utilization and costs among the elderly, but at a lower rate than previously believed; that there were significant reductions in mortality after introduction of the program; and that the sharpest drops in

mortality occurred in acute causes of death, such as heart disease, with little or no change in cancer deaths.

"Before Medicare, a lot of people weren't receiving immediate care for conditions that respond most to rapid interventions, like heart attack and stroke," Chay explains.

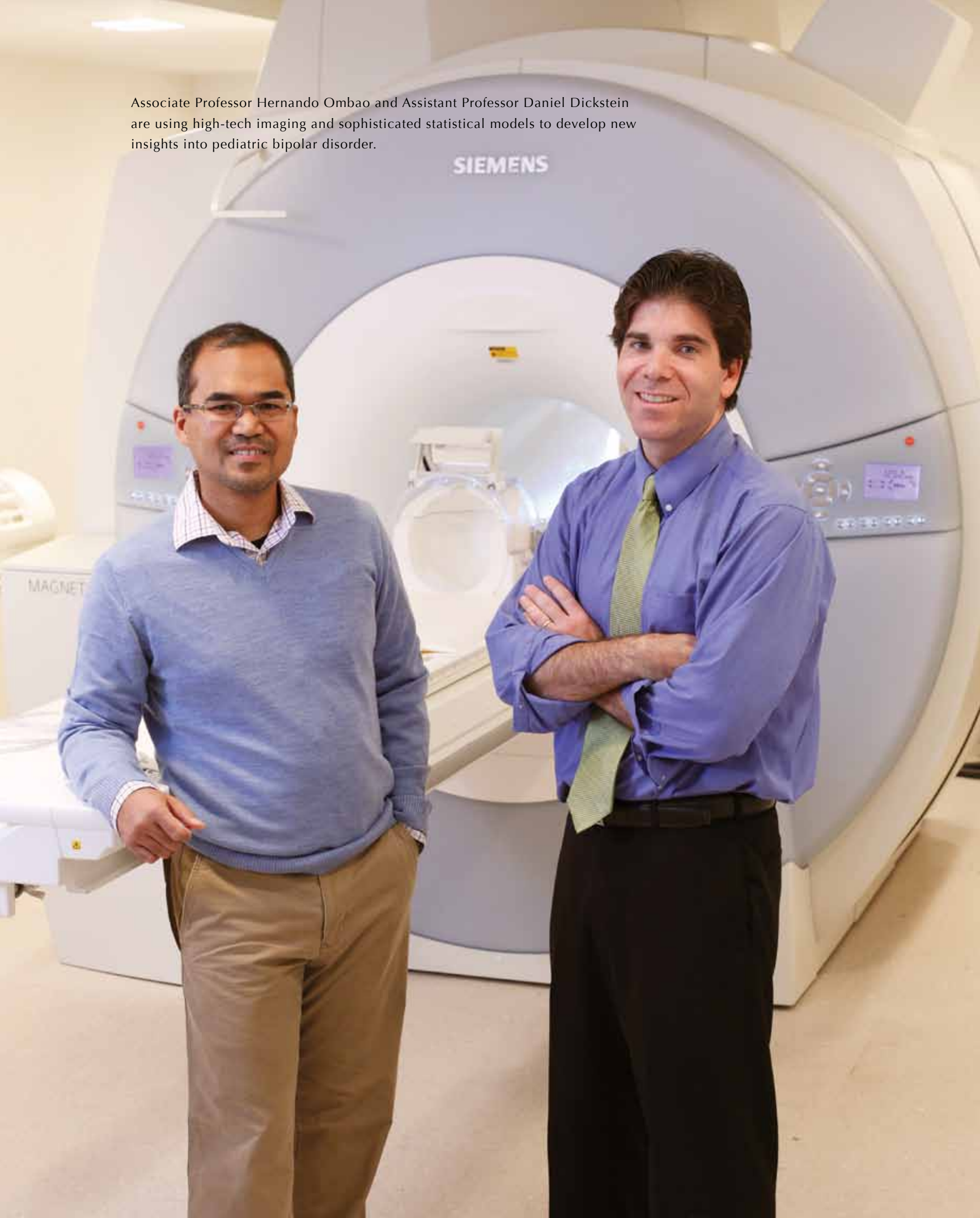
BALANCING PASSION AND OBJECTIVITY

"This work is very multidisciplinary, which fits well within Brown's ethos," says Chay, noting that his data are stored on servers based at the University's Population Studies and Training Center (PSTC), which draws on the expertise of faculty from diverse disciplines, including economics, anthropology, and sociology. Chay uses widely available statistical software ("I haven't had to write my own code in five years," he says) on the 16- and 8-cpu computational servers at PSTC and on his high-end Linux box.

The availability of powerful computational resources is a key factor in making Chay's research possible.

"It would have been hard to do this work ten years ago," he says, noting that his own career track parallels the explosion in computational technology. "My training happened just when storage and computing capacity started to go up – making it possible to answer the kinds of questions I'm interested in asking."

And when it comes to those questions, Chay says, it's essential to maintain scientific objectivity. "Don't work on questions where you care what the answer is," he says. "Whatever the answer is proven to be – that's your contribution to the dialogue."



Associate Professor Hernando Ombao and Assistant Professor Daniel Dickstein are using high-tech imaging and sophisticated statistical models to develop new insights into pediatric bipolar disorder.

Seeing the Realities of the Bipolar Brain

USING FUNCTIONAL MRI, A CHILD PSYCHIATRIST TEAMS WITH BIOSTATISTICIANS TO SEEK NEW AND MORE TIMELY METHODS FOR DIAGNOSING BIPOLAR DISORDER IN CHILDREN

Several days each week, in the after-school and early evening hours, children and their families arrive at Brown's Sidney E. Frank Hall for Life Sciences in search of answers. Assistant Professor of Psychiatry and Human Behavior Daniel Dickstein A.B. '93 M.D. '97 awaits them in the University's research-dedicated magnetic resonance imaging (MRI) facility.

They have come together on a high-stakes quest to find definitive biological and behavioral criteria by which bipolar disorder can be diagnosed in children.

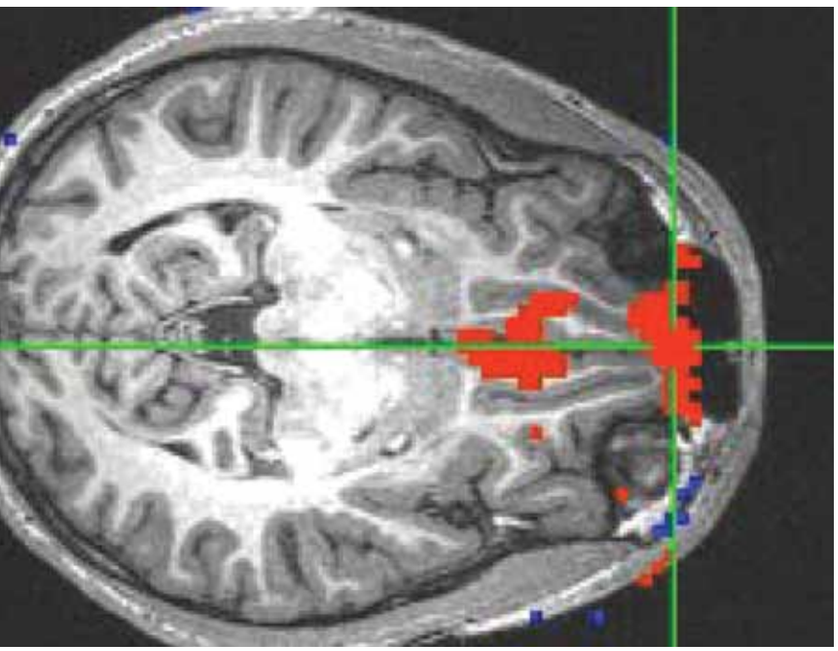
The child first gets familiar with what will happen in a "mock MRI," which looks and sounds like the real scanner, but has no superconducting magnet. Later, in the real MRI scanner, the child plays an interactive game while every two to three seconds, the machine snaps a picture of the child's brain activity. The images reveal what happens in the brain as the child engages in a task involving both cognitive and emotional elements. Additional scans probe spontaneous brain activity as the child is at rest, looking at the word "relax," to identify resting state functional connectivity (RSFC).

The results are added to a growing data set and analyzed by Dickstein and his collaborator, Associate Professor of Community Health (Biostatistics) Hernando Ombao, PhD, and his team of graduate students in biostatistics at the Brown Working Group on Methods for Space-Time Data.

Dickstein and Ombao recently completed the first study to leverage innovative RSFC methods to deepen understanding of fronto-temporal dysfunction in pediatric bipolar disorder. Using sophisticated statistical modeling, they showed that children and adolescents with bipolar disorder have intrinsic neural alterations in a fronto-temporal circuit. This same neural circuit has been shown by other studies to be implicated in memory and learning. Future studies will focus on how specific these brain changes are to bipolar disorder, as well as on changes wrought by age, gender, development, and treatment.

> "There is ample evidence that bipolar disorder has a lot to do with the hard-wiring of the brain, the inherent neural connections."
>
> Daniel Dickstein
> *Assistant Professor of Psychiatry and Human Behavior*

"There is ample evidence that bipolar disorder has a lot to do with the hard-wiring of the brain, the inherent neural connections," says Dickstein. "Many clinical symptoms of bipolar disorder suggest that the illness involves brain and behavior changes associated with cognitive flexibility – that is, the ability to respond to a changing environment. In my PediMIND Program (Pediatric Mood, Imaging, & Neuro-Development), we use special computer games, paired with and without MRI brain scans, to study cognitive flexibility in children and adolescents with bipolar disorder. If we can show that the brain's behavior is the result of pathophysiological change, we may be on the trail of a biomarker."



A functional MRI (fMRI) scan reveals brain activity of a child playing a specialized computer game.

TRANSFORMING CHILDREN'S LIVES

Among the very young, bipolar disorder shrouds itself in hard-to-categorize symptoms that may simply reflect mild hiccups in the natural emotional shifts that accompany growth and development, or may signal a range of other conditions, including generalized anxiety disorder, attention deficit hyperactivity disorder (ADHD), autism spectrum disorder, and oppositional defiant disorder. The most commonly presented early symptom: irritability.

Early diagnosis is critical. Chances of recovery decline with every year the condition goes undiagnosed and untreated. Bipolar disorder can wreak havoc in family dynamics, social development, academic performance, and virtually all aspects of a child's life.

Making the diagnosis in children and adolescents requires clinical skill to weigh information provided by parents, teachers, and the child him or herself. Parsing the disorder from related conditions, including ADHD, is challenging, especially in children too young to articulate their thoughts, feelings, and experiences. By the time diagnosis is made, symptoms have often escalated and families are engaged in a desperate struggle for peace and, in some cases, survival.

"We clearly need biological and behavioral markers – scans and tests – to help us aid in the diagnosis of bipolar disorder as early as possible," says Dickstein. "Such markers would not replace the judgment of clinicians, but rather augment it – just as is done in cancer diagnosis and treatment – with clinical intuition leading us to pursue testing."

"Right now, without such markers, it often takes ten to fifteen years after the symptoms start for a diagnosis of bipolar disorder to be made," says Dickstein. "Pairing such bio-behavioral markers with clinical history would thus truly transform children's lives."

CAPTURING KNOWLEDGE THROUGH DATA

A graduate of Brown University's Program in Liberal Medical Education (PLME) and its Alpert Medical School, Dickstein returned to the University in 2007 from Washington, DC, where he pursued research at the National Institutes of Mental Health (NIMH) and saw patients in private practice. Today, he conducts research and provides patient care at Bradley Hospital and the Bradley-Hasbro [Children's Hospital] Research Center.

Ombao and his group have worked with Dickstein to develop new ways of capturing the reality of bipolar disorder. "My collaboration with Professor Ombao and other campus-based researchers is critical to our ongoing work. Hernando's high-end modeling of our data has already yielded some innovative results," he says. "I'm confident that we're at the beginning of a long, productive collaboration."

In the first year of the NIMH BRAINS grant program (BioBehavioral Research Awards for Innovative New Scientists), Dickstein received an award for his project aimed at identifying bio-behavioral markers of converting from sub-syndromal "bipolar disorder not otherwise specified (BD-NOS)" to full-blown bipolar disorder.

Dickstein's BRAINS study partners with Brown's site of the COBY (Course and Outcome of Bipolar Youth), an NIMH-funded collaboration among Brown, the University of Pittsburgh, and UCLA. COBY has been following the psychiatric symptoms of 450 children and adolescents with both BD-NOS and full-blown bipolar disorder for the past 10 years. Results have shown that about 30 percent of BD-NOS children will progress to full-blown bipolar disorder.

Dickstein's BRAINS study harnesses the longitudinal data from Brown's site of the COBY study to identify biological and behavioral markers of converting from BD-NOS to full-blown bipolar disorder. Ombao and other colleagues from Brown, the Bradley-Hasbro Research Center, and around the country are participating in this work.

"We're thrilled to have such a great 'neural-network' of colleagues at Bradley, Brown, and beyond to help us on this scientifically important and clinically relevant project," says Dickstein. "Our work could have huge implications – real-world implications – for diagnosis and treatment of bipolar disorder in children."

BIOLOGY BY THE NUMBERS

While finishing her Master's degree in statistics at the *Centro de Investigaçiones en Matematicas* (CIMAT) in Mexico, Cristina Gorrostieta was drawn to Brown by the prospect of working with Hernando Ombao's international team of biostatistics student researchers. Appropriately, her first contact with the group came via computer.

"I visited Professor Ombao's web page, saw that we had similar interests, and e-mailed him to say that I'd like to do my PhD here," she remembers. After a rigorous application and selection process, she arrived on campus in 2008.

Cristina Gorrostieta

Using a fast laptop, connected to the servers hosted at the Center for Statistical Sciences, Gorrostieta is modeling data to compare brain activity in children with and without bipolar disorder. "Working in neurostatistics is very rewarding," she says. "It combines science and statistics, and allows me to apply my skills to something tangible."

The members of Brown's Working Group on Methods for Space-Time Data are as diverse as the projects they're working on, says Ombao, himself a native of the Philippines. "We have team members from Korea, the Philippines, Canada, China, and the United States, representing a range of disciplines, including biology, applied mathematics, and economics, as well as statistics."

The group is exploring a variety of topics under the broad umbrella of characterizing connectivity between units, both outside and within the brain – from linking air travel with epidemics by studying the experience of influenza in New York and Boston, to collaborating with neuroscientists to capture the ways in which different brain structures communicate with each other to execute tasks.

"There's still so much to be worked out," says Ombao. "How does one measure connectivity in the brain? How does one estimate brain connectivity efficiently in the presence of massive data? And how does brain connectivity relate to human behavior?"

Brown's New Supercomputer

14 TERAFLOPS: 'A COMPUTING SYSTEM FOR THESE TIMES'

Half a century ago – January 12, 1961 – the University dedicated the Brown Computing Laboratory on the corner of George and Brook streets. It was the epicenter of academic computing then, designed by Philip Johnson as a memorial to Thomas J. Watson, Sr., patriarch of the modern IBM, and built to house the University's new IBM 7070 mainframe. No other institution on the Eastern seaboard had a machine like the 7070; Brown's was the first.

For more than 20 years, most of the University's computing machinery – its mainframe, its nine-track tape drives, its high-speed sprocket-fed line printers, its first production laser printers, plotters, and terminal servers – fit comfortably inside the Computing Lab. Then came the era of distributed computing, which had no epicenter, and the dedication of Brown's new Center for Information Technology, also dedicated to Thomas J. Watson, Sr. The original Computing Lab was reassigned to the Division of Applied Mathematics.

NOW IT'S BACK TO ITS ORIGINAL PURPOSE, SERVING THE ENTIRE UNIVERSITY COMMUNITY

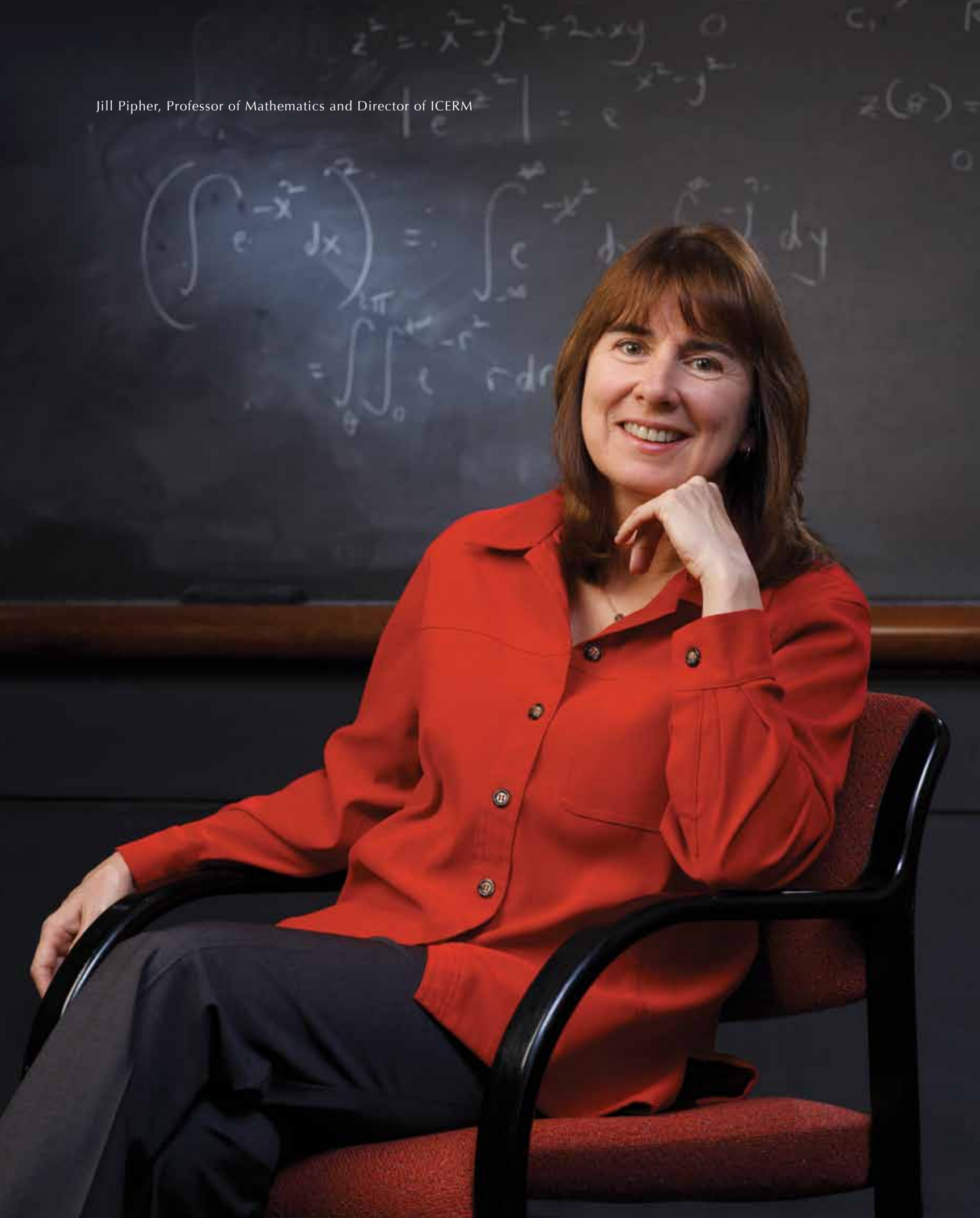
On November 20, 2009, Brown and IBM opened a new supercomputing center on the site. The new machine, capable of completing 14 trillion floating-point operations per second (14 teraflops), is Rhode Island's first true supercomputer, nearly 50 times faster than the best University machines. It is at the service of researchers at Brown, at Brown-affiliated hospitals, and beyond – anyone who needs to understand or interact with impossibly large and complex datasets:

- a sociologist who might superimpose several decades of census data onto a map of the nation and then animate it to watch the movement of people, jobs, age groups;
- a geologist who might create and walk across the virtual surface of a distant planet, using data from an orbiting spacecraft tens of millions of miles away;
- a computer vision researcher who might need to analyze 50 million digital photographs;
- a musician, sculptor, or performance artist who needs to capture, analyze and incorporate real-time movement data to create an interactive work of digital art;
- an economist who might need to test a global economic model;
- an archaeologist who wants to recreate a streetscape from an ancient city;
- a chemist who wants to view calculations of a chemical reaction in slow motion.

"The number of users is probably five times what it was a year ago, and they come from all over the institution," said Jan Hesthaven, the professor of applied mathematics who directs the Center for Computation and Visualization. "We thought that if we provided a substantial base, the faculty would come forward and add to it. This is exactly what has happened."

Specialized computing equipment acquired through research grants and contracts has roughly doubled the power and usefulness of the supercomputer in its first year. "It's not like a new microscope that is useful to certain areas," Hesthaven said. "It's more like a library, a resource that any research university must have."

Developing a single supercomputing center – a shared resource – "puts Brown a little ahead of the curve. Supercomputers are very expensive to run. They need power, cooling, and trained people to run them," Hesthaven said. "Figuring out how to do this centrally was essential for Brown. We have now developed a computing system for these times. It's a process many universities have not yet gone through."



Jill Pipher, Professor of Mathematics and Director of ICERM

ICERM: Where Mathematics and Computing Meet

DIVERSE DISCIPLINES CONVERGE ON CAMPUS AT NEW ENGLAND'S ONLY NSF MATHEMATICS INSTITUTE – BLENDING THEORY AND SOPHISTICATED COMPUTATIONAL METHODS TO YIELD EXCITING NEW APPROACHES TO MATHEMATICS

In January 2010, work crews began renovating the top two floors of 121 South Main, converting what had been a law firm's boardroom into a large lecture hall, rewiring offices, pulling cables, and making the entire site data-ready. In the fall of 2011, the facility will formally begin its new life as the Institute for Computational and Experimental Research in Mathematics (ICERM), the National Science Foundation's eighth mathematics institute and its first in New England.

"For decades, Brown has had a cutting-edge reputation in mathematics," says Jill Pipher, ICERM's director. "This institute is going to be a place with international visibility in the mathematical sciences."

Each of the NSF institutes has a particular theme or focus. ICERM will explore the interaction of mathematics and the computer, drawing on three of the University's strengths: the Department of Computer Science, the Department of Mathematics and the Division of Applied Mathematics.

"Our niche is the fusion of two tracks in mathematics – the theoretical approach and the computational simulation approach to problems. These tracks often develop side by side without much interaction," Pipher says. "What we're trying to do is bring researchers from these two groups together and change the dynamic of the mathematics field that way."

Computing brings much more than the power to manipulate and analyze large data sets. Many of the theorists, Pipher says, are discovering that computers can aid them in thinking about a problem, in designing experiments and formulating hypotheses. And theory, in turn, can help computational scientists separate signal from noise, determine the important structures within the data, and tune algorithms.

> "Our niche is the fusion of two tracks in mathematics — the theoretical approach and the computational simulation approach to problems."
>
> Jill Pipher
> *Professor of Mathematics*
> *Director of ICERM*

All eight NSF institutes incorporate a commitment to diversity and to providing opportunities for women and under-represented minorities. ICERM, Pipher says, has designed its activities with diversity in mind, inviting postdoctoral researchers and graduate students to participate in programs with senior researchers and providing summer research opportunities for undergraduates. "These programs offer the opportunity to go out and find people and to recruit them to the field."

History is on ICERM's side in that regard, Pipher says. Brown's first mathematics PhD was awarded to a woman, Rose Whelan, in 1929, when many of Brown's peer institutions were still decades away from admitting women to graduate programs.

ICERM's programs, from semester-long residencies, to week-long labs and workshops and public lectures, will attract hundreds of international researchers, from senior scholars to undergraduates, making Brown a new center for mathematics research in New England.

Brown's allocation of resources to the Department of Mathematics has been strong and consistent since 2000, making possible additional faculty hiring and development of departmental space and facilities in Kassar House. "This institute represents a triumph for the investments Brown has made in mathematics, especially over the last decade," Pipher says. "There has never been such a great spirit of cooperation and collaboration among math, applied math, and computer science as there is now."

121 South Main Street, Providence, new home of ICERM.

FACULTY AWARDS

Chinua Achebe
The David and Marianna Fisher University Professor and Professor of Africana studies
Dorothy and Lillian Gish Prize, 2010

Omer Bartov
John P. Birkelund Distinguished Professor of European History
Holocaust Educational Foundation's Distinguished Achievement Award, 2010

Michael Black
Professor of Computer Science
Koenderink Prize for Fundamental Contributions in Computer Vision

Clyde Briant
Otis Everett Randall University Professor of Engineering
National Academy of Engineering, 2010

Paul Dupuis
Professor of Applied Mathematics
Class of Fellows of the Society for Industrial and Applied Mathematics (SIAM), 2010

Paja Faudree
Assistant Professor of Anthropology
Fulbright Scholar Research Fellowship, 2010

Karen Fischer
Professor of Geological Sciences
Fellow of the American Geophysical Union and also selected as President-Elect for the Seismology section of the American Geophysical Union, 2010

Donald Forysth
James Manning Professor of Geological Sciences
American Academy of Arts and Sciences, 2010

James Head III
Professor of Geological Sciences
European Geosciences Union's Runcorn-Florensky Medal, 2010.

Maurice Herlihy
Professor of Computer Science
Fulbright Distinguished Chair in the Natural Sciences and Engineering, 2010-2011

Greg Hirth
Professor of Geological Sciences
President-Elect for the Tectonophysics section of the American Geophysical Union, 2010

Sorin Istrail
Julie Nguyen Brown Professor of Computational and Mathematical Sciences
Professor Honoris Causa from Alexandru Ioan Cuza University, 2010

Karl Jacoby
Jacoby Professor of History
Wheeler-Voeglin Award from the American Society for Ethnohistory for the best book of Native American History, 2010

George Karniadakis
Professor of Applied Mathematics
Class of Fellows of the Society for Industrial and Applied Mathematics (SIAM), 2010

Catherine Kelleher
Senior Fellow at the Watson Institute
Hubert H. Humphrey Award in Recognition of Notable Public Service by a Political Scientist, 2010

Philip Klein
Professor of Computer Science
Association for Computing Machinery (ACM) Fellow, 2009

David Konstan
John Rowe Workman Distinguished Professor of Classics
American Academy of Arts and Sciences, 2009

Catherine Lutz
Thomas J. Watson, Jr. Family Professor of Anthropology and International Studies
The Society for the Anthropology of North America's Distinguished Career Award, 2010

David Mumford
Professor Emeritus of Applied Mathematics
National Medal of Science, 2010

Tara Nummedal
Associate Professor of History
John Simon Guggenheim Memorial Foundation Fellowship, 2011-2012

Carle Pieters
Professor of Geological Sciences (Research)
G.K. Gilbert Award, Geological Society of America, 2010

Ben Raphael
Assistant Professor of Computer Science
Sloan Research Fellowship, 2010

Johanna Schmitt
Stephen T. Olney Professor of Natural History
American Academy of Arts and Sciences, 2010

Eli Upfal
Professor of Computer Science
Chalmers Jubilee Distinguished Visiting Professor, 2010

Keith Waldrop
Brooke Russell Astor Professor of Humanities
National Book Award in Poetry, 2009

Lingzhen Wang
Associate Professor of East Asian Studies
National Endowment for the Humanities Fellowship, 2010-2011

Carolyn Wright
Isreal J. Kapstein Professor of English
Nominated for the National Book Award in Poetry, 2010

Professor Emeritus **David Mumford** receiving the **National Medal of Science** from President Barack Obama.

'I FOUND THIS TREMENDOUS SENSE OF COLLABORATION'

Pursuing the beauty and satisfactions of mathematics can be a very solitary proposition. The path often leads away from common ground, grows narrow and steep, and soon the mathematician can be immersed in complexities that are not entirely understood even by close faculty colleagues.

That is not what David Mumford found at Brown. Mumford, who received the National Medal of Science from President Barack Obama in the White House on November 17, 2010, had been making a transition from pure mathematics to applied mathematics courtesy of a multi-institutional Army research grant. "I got to know many of the applied mathematicians at Brown, and they introduced me to a whole range of new ideas. Brown, as I discovered, was very different."

Mumford joined the Division of Applied Mathematics at Brown in the fall of 1996 as a University Professor. He was immersed in complexities, to be sure, but he did not find that narrow, solitary path; he found its polar opposite.

"As soon as I got to Brown I rapidly made friends in a dozen departments, not merely pure math and applied math, but in engineering, in computer science, in cognitive science, in neuroscience, all over the map. And I found people interested in vision specifically, which was the area I had been trying to understand mathematically," says Mumford. "I found this tremendous sense of collaboration. I really had a wonderful time with seminars and collaborations, working with people from all these different departments."

His research collaborations, President Simmons noted, were a catalyst "to fields of inquiry that have blossomed at Brown – brain science, computer vision, neurobiology, cognitive science, the biology and psychology of perception."

2010 FINANCIAL REPORT AND OPERATING PERFORMANCE

Fiscal year 2010 was encouraging in many ways – our endowment posted solid returns, support from our donors remained strong, and the University generated a small operating surplus – but also a difficult one as we managed through the persistent impact of the global recession.

ENDOWMENT PERFORMANCE

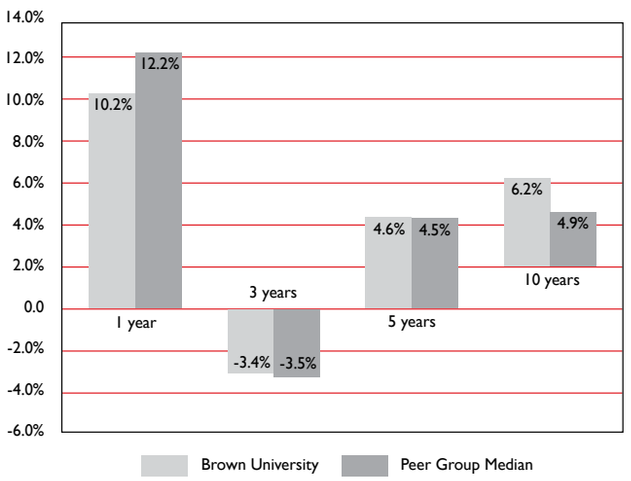
For the fiscal year ending June 30, 2010, the Brown endowment earned a 10.2 percent investment return. During the fiscal year, the endowment paid out $134 million for operations, and the University received $56 million in gifts to endowment. As a result, the market value of the endowment was up 6.9 percent, from $2.039 billion at the start of the fiscal year to $2.180 billion at the end, an increase of $141 million.

We began FY10 with a relatively conservative asset allocation that was put in place during the prior year in response to the global financial crisis. The economic uncertainty and the freezing of credit markets in 2008 highlighted the importance of liquidity; the University took a number of steps to address risk proactively, electing to reduce significantly the endowment's equity exposure and increase the allocation to cash and fixed income investments. These steps ensured that funding was available to meet the demands of the University operating budget and the University's funding obligations to private equity investments. This was financially prudent, but the decision had an impact on Brown's one-year performance during FY10 compared to peers. In bull markets, the University's heavily hedged portfolio tends to lag peers with more sizeable allocations to long equities.

The fiscal year 2010 results, however, tell only part of the story. Longer-term results for Brown's endowment remain comparatively strong, which is especially important given the role of the endowment in supporting the University in perpetuity. Over the last ten years, Brown has outperformed the return of the 50 largest higher education endowments, achieving an annual average return of 6.2 percent while the median return for our peers was 4.9 percent annually. As shown in the graph, over the past three, five, and ten years, Brown has performed consistently better than the median return of that peer group.

Over a slightly longer time horizon – the past 15 years – with the help of strong investment returns, generous alumni donations, and

Brown vs. Peer Institutions Average Annual Compound Returns
Periods ending June 30, 2010



prudent spending policies, the endowment increased from $688 million to $2.180 billion. During that period, Brown earned an average annual return of 9.5 percent, and gifts to endowment totaled $700 million.

Brown uses both qualitative and quantitative approaches in the process of determining its asset allocation, incorporating informed judgment as well as rigorous modeling and testing. Brown's portfolio continues to be well diversified, and the University's long-term investment policy is reviewed and revised as necessary every few years. Over the long term, the Brown endowment is positioned to produce competitive returns, but with less volatility than peer institutions. At June 30, 2010, the long-term investment pool had 87 percent invested in equities (18 percent in public equity, 4 percent in equity-like credit, 34 percent in hedged strategies, 19 percent in private equity, and 11 percent in real assets), 14 percent in fixed income, and less than 1 percent in cash.

Asset Allocation as of June 30, 2010	
Public Equity	18.4%
Equity-Like Credit	4.3%
Hedged Strategies	33.9%
Private Equity	19.2%
Real Assets	11.2%
Total Equity	**86.9%**
Fixed Income	**13.0%**
Cash	**0.4%**
Total Portfolio	100.0%

The University's endowment spending policy balances the need for current income with the equally important goal of preserving the endowment's value in order to provide funding for future generations. University policy limits annual spending ordinarily to between 4.5 percent and 5.5 percent of the average market value over the three prior calendar years. On average, the spending policy is designed to achieve a payout of 5 percent over time, but it provides flexibility by allowing adjustments in spending to lag behind adjustments in market value.

For fiscal year 2010, the University set the spending rate at 5.5 percent of the three-year average, the top of the policy range. The endowment provided $134 million to support the University's operating budget, which was equivalent to about 6.6 percent of the endowment's market value at the start of fiscal year 2010. This high payout rate provided Brown with both the time and the resources to adjust to the new economic reality of constrained resources.

Even with the high spending rates in 2009 and 2010, Brown's endowment spending averaged 4.8 percent of current market value during the last decade. For FY11, the payout was reduced by 20 percent. As a result, the payout in the current year is 5 percent as of June 30, 2010.

FUNDRAISING RESULTS

In October 2005, Brown launched Boldly Brown: Campaign for Academic Enrichment, with a goal of raising $1.4 billion by December 31, 2010, including $600 million for endowment, $540 million for immediate programmatic support and $200 million for facilities. By May 2009, nineteen months before the end of the campaign, Brown reached its overall campaign goal of $1.4 billion. These

results are a testament to the deep loyalty to Brown and generosity of spirit among its alumni, parents and friends. By the end of fiscal year 2010, more than 64,000 alumni, parents, friends, corporations, and foundations had contributed $1.54 billion, or 110 percent of the campaign goal, through Boldly Brown.

During fiscal year 2010, cash contributions for immediate use, for facilities and to the endowment totaled $166.8 million. More than 31,300 members of the Brown community contributed nearly $36 million to the 2009-2010 Brown Annual Fund. Since President Simmons' arrival in the summer of 2001, the University has experienced exceptional increases in annual giving: the Brown Annual Fund has more than doubled, and the number of donors has increased by almost 75 percent.

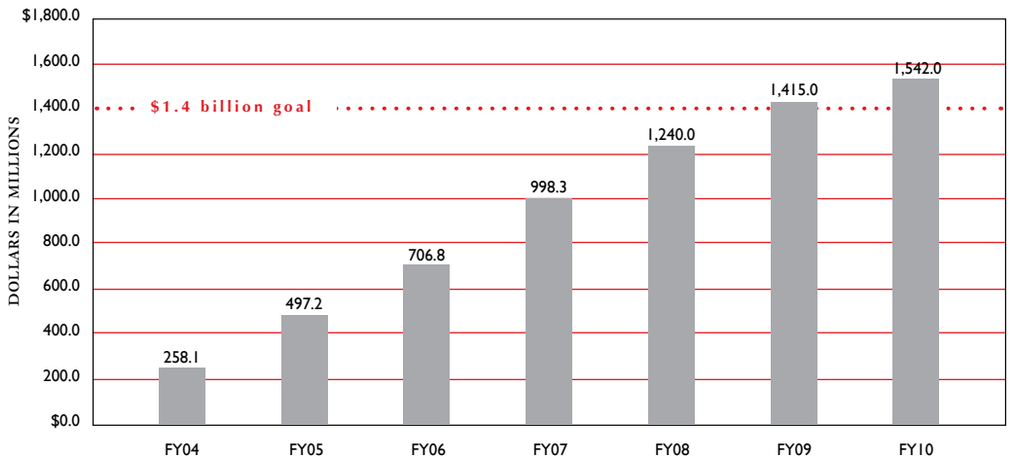
Significant gifts and pledges made during fiscal year 2010 supported a wide range of University priorities, including undergraduate scholarships, new endowed professorships, the Stephen Robert '62 Campus Center, the Metcalf renovations, the new Katherine Moran Coleman Aquatics Center, the Humanities Initiative, the University's collaboration with the Marine Biological Laboratory in Woods Hole, and renovations of the first floor of the Rockefeller Library.

Although the campaign had attained its overall goal, intensive fund-raising efforts continued through December 2010, with Brown raising more than $1.6 billion and completing funding for several campaign priorities.

CAPITAL INVESTMENTS AND CAPITAL PLANS

To achieve the objectives of the Plan for Academic Enrichment, particularly with regard to expanding the size of the faculty and establishing new multidisciplinary centers, the University continues to invest in facilities and campus infrastructure. Brown has put a significant emphasis on repurposing and renovating existing buildings as a way to meet critical facilities needs more quickly, and

Cumulative Gifts and Pledges to the Boldly Brown Campaign



with less debt service than new construction. In fiscal year 2010, the University invested more than $92 million in its facilities, focusing on renovations for several major projects and undertaking new buildings only when fundraising made it possible with significant gifts in hand.

In August 2010, Brown completed a $20-million renovation of the Faunce House building, originally constructed in 1904, to create the new Stephen Robert ’62 Campus Center. Considered by many to be the “heart” of Brown’s College Hill campus, the new Center features a glass archway leading to a visitor’s center, expanded dining facilities, and new areas for students to gather, study, and socialize. The need for an updated campus center was identified in the Plan for Academic Enrichment, which placed a premium on creating an environment to enhance student life on campus and fostering interaction among the members of the Brown community.

Construction of the Perry and Marty Granoff Center for the Creative Arts, a unique architectural environment designed for collaboration and excellence in all of the arts, began in June 2009. The building opened in January 2011. Brown alumni and parents have raised funds for the full project amount, including an endowment for the building’s ongoing operation and maintenance. The 35,000-square-foot facility, which will cost about $40 million, will feature a 200-seat recital hall and 35mm screening facility, production spaces and studios, “smart” classrooms, an art gallery, and an outdoor amphitheater wired for sound and video, allowing outdoor performances, film screenings and installations.

The Robert Campus Center project is just one of Brown’s recent efforts to preserve the University’s significant historical buildings through renovation and restoration. In recent years, the University has completed renovation projects to repurpose existing buildings, to meet academic space and facility needs, including Rhode Island Hall (the new home of the Joukowsky Institute of Archaeology and the Ancient World); Mencoff Hall (a historic building used for administrative purposes, now housing the Population Studies and Training Center); Pembroke Hall (new home to the Cogut Center for the Humanities and the Pembroke Center for Teaching and Research on Women); Smith-Buonanno Hall (a former gymnasium renovated for classroom space and academic use); and J. Walter Wilson Hall (a life sciences laboratory building now dedicated to student services).

Perry and Marty Granoff Center for the Creative Arts

During 2010, Brown broke ground on several critical renovation and construction projects:

- the transformation of a 134,000-square-foot former jewelry factory into a state-of-the-art Medical Education Building for the Warren Alpert Medical School of Brown University, scheduled for completion in August 2011;
- the renovation of the 74,000-square-foot Metcalf complex of buildings to become the new home for the Department of Cognitive, Linguistic and Psychological Sciences, expected to open in fall 2011;
- and a major new addition to the University's athletics complex – the Katherine Moran Coleman Aquatics Center, the Nelson Fitness Center, the David J. Zucconi '55 Varsity Strength and Conditioning Center, and the Ittleson Quandrangle – on and near the site of the former Smith Swim Center, scheduled to open in March 2012.

In keeping with Brown's commitment to energy efficiency, all these new or renovated facilities have been designed to limit greenhouse gas emissions by reducing energy consumption to between 25 and 50 percent below the standard required by state code. Each project meets at least a silver standard in the U.S. Green Building Council LEED® certification program, which grants points based on: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design. Three of the projects are expected to achieve gold LEED® certification: the Granoff Center for the Creative Arts, the Medical Education Building, and the Robert Campus Center. The renovation of Rhode Island Hall has already been certified gold.

As part of our campus-wide energy efficiency investment program, Facilities Management oversees more than 150 projects of various sizes and scopes aimed at reducing energy consumption. In the past year, the University invested

Stephen Robert '62 Campus Center

$1.8 million in these projects, achieving a reduction of approximately 2,000 metric tons of Carbon Dioxide Equivalents (MTCDE). Over the life of the program, we have invested approximately $4 million dollars, resulting in a total reduction of 15,000 MTCDE, or 21 percent below FY2007 levels.

PLANNING FOR FY10 AND FY11

In developing the University's operating budgets for fiscal years 2010 and 2011, we anticipated lower than planned revenue across nearly all of the University's revenue sources and took steps to realign our expenditures to available resources. We were guided through this process by several overarching principles: to preserve and, if possible, enhance our core academic programs and the student experience; to think strategically about how Brown is organized and how to provide efficient support that is responsive to the needs of our community, and to develop plans that are in accordance with our values as a community.

The Brown community addressed the immediate problems of the recession by taking actions to reduce our capital plans, freezing salaries, slowing the pace of faculty hiring, realigning administrative functions and maximizing income from auxiliary sources of revenue, ultimately identifying more than $75 million in savings and additional revenue. All told, some 150 people from across the University participated in an organizational review effort that helped Brown rethink its administrative structure to gain efficiency and effectiveness. Achieving that target required us to make some difficult and painful choices, including the elimination of about 8 percent, or 200, of our administrative and support positions. Regrettably, the targeted reductions included some layoffs. Our operating expenses for FY10 included some significant one-time restructuring costs for a voluntary staff retirement program and severance payments.

Our planning is now focused on building on Brown's strengths to generate incremental revenue for FY11 and beyond that will allow us to sustain and improve our position as an outstanding research and teaching university.

FY10 FINANCIAL STATEMENTS

The pages that follow present Brown University's audited financial statements. These statements reflect the University's financial condition at the close of fiscal year 2010 in accordance with generally accepted accounting principles. This narrative presents a brief summary of the information in the financial statements.

As shown on the Statement of Financial Position, at June 30, 2010, the University reported total assets of $3.729 billion, liabilities of $857 million, and net assets – total assets minus liabilities – of $2.872 billion. Net assets increased by $148 million, or 5.4 percent, from 2009, reflecting the rise in value of the University's endowment and additional investment in plant through new construction and renovations.

The University's assets primarily consist of investments; land, buildings, and equipment, net of depreciation; contributions receivable; other receivables; and cash or cash equivalents. Total assets increased by $331 million to $3.7 billion in fiscal year 2010, largely due to the performance of our investments and increased investment in plant. Brown's investment portfolio – the endowment plus short-term investments net of investment-related liabilities

– increased $247 million, or 10.7 percent, from $2.309 billion on June 30, 2009, to $2.557 billion on June 30, 2010, net of distributions for operating purposes and the receipt of new gifts to endowment. The value of Brown's land, buildings, and equipment increased during the year from $778 million to $820 million due to improvements to campus infrastructure and investments in facility renewal for both academic and student services buildings.

Liabilities at the end of the year totaled $857 million, with bonds, loans and notes payable the biggest component. Total debt as of June 30, 2010 was $609.2 million, an increase of $117 million from the prior year. In August 2009, Brown issued $100 million of 10-year taxable debt to ensure that the University has sufficient cash reserves for the next 5 to 10 years. Brown's average cost of debt for the fiscal year was 4.5 percent. Moody's and Standard and Poors reaffirmed our ratings of Aa1 and AA+, respectively, and gave Brown a "stable" outlook for the future.

As shown on the Statement of Activities, the change in net assets from operating activities, which includes interest and depreciation expenses, was a positive $2.6 million. Total operating revenues increased by 6 percent to $661 million, primarily the result of increases in net tuition revenue, grants and contracts, and contributions. Total expenses, including interest and depreciation, increased at just 3.5 percent to $659 million.

The University derives its operating revenue from five main sources: student tuition and fees (net of scholarships and fellowships), grants and contracts, contributions, endowment income, and sales and services of auxiliary enterprises (such as dining and housing).

Student tuition and fees (not including room and board) continue to represent the largest portion of income, totaling $214.1 million, up 6.1 percent from the prior year. This large increase was due to a planned increase of about 125 students in undergraduate enrollment. Tuition, room and board for 2009-2010 increased by 2.9 percent from the prior year. Scholarships for undergraduate and graduate students, which are shown as an offset to tuition and fees, totaled $106.5 million, an increase of 6.3 percent from the 2009 level of $100.2 million. Brown continues to ensure that its financial aid programs remain competitive and that the best students from lower- and middle-income families can attend Brown without the burden of assuming college debt. Students from families with incomes of less than $100,000 do not have loans as part of their financial aid packages, and most parents who earn less than $60,000 are not expected to make a financial contribution to fund their child's Brown education.

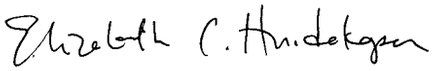
Brown received a total of $149.5 million in direct and indirect support from external sponsors of research grants and training programs, an increase of 11.7 percent from the prior year. The University received approximately $10 million in grants in fiscal year 2010 from federal stimulus funds in the American Recovery and Reinvestment Act. The total included $36.5 million in reimbursements from sponsors for facilities and administrative costs (also called indirect cost recovery). Endowment income distributed for operating support increased by just 1.1 percent to $134.5 million. The amount distributed in fiscal year 2010 represented 6.6 percent of the endowment's market value at the start of the fiscal year.

Operating expenditures, excluding interest and depreciation, totaled $583 million in fiscal year

2010, up about 3 percent from the previous year. With interest and depreciation added in, operating expenditures totaled $659 million.

Salaries, wages, and benefits, which account for more than 60 percent of total expenses, increased overall by 3.7 percent, primarily due to the expenses of the voluntary staff retirement program. Without those costs, spending on salaries, wages, and benefits would have stayed essentially at 2009 levels. Due to energy savings and lower unit costs for oil and gas, the cost of utilities decreased by about 10 percent, from $21.5 million to $19.4 million. The University has been aggressive about locking in energy prices when rates are favorable. As a result, the University expects its energy expenses for the next several years to remain very close to FY10 levels. Interest expense totaled $24 million, an increase of more than 28 percent due to the interest on the new $100 million of taxable debt. Interest rates on Brown's variable rate demand bonds and its commercial paper programs remained extremely low. Interest expense was just 3.6 percent of Brown's total expenses. Finally, plant and equipment depreciation totaled $51.8 million.

The harsh financial realities of the last two years have left an enduring mark on Brown, and we know that constraints on our resources are likely to be a continuing challenge. But the Brown community – faculty, staff, students and alumni – is as committed as ever to sustaining our tradition of excellence, enhancing our reputation for innovation in education, and advancing our place among the world's great universities.



Elizabeth C. Huidekoper
Executive Vice President
for Finance and Administration

ABOUT THE UNIVERSITY'S FINANCIAL STATEMENTS

Consistent with the financial accounting standards for not-for-profit organizations, Brown University presents three required financial statements. The statement of financial position (page 45) shows the University's total resources and financial obligations at the end of the fiscal year, with comparable balances from the prior year. The statement of activities (pages 46-47) presents a summary of operating revenue and expenditures for the year and the results of non-operating activity. This statement has been expanded to include a full comparison to prior year revenues and expenses. Brown's statement of cash flows (page 48) analyzes the changes in balance sheet lines that affect the University's cash position.

The financial statements include prior year totals and are consolidated to include wholly owned subsidiaries. Brown's independent auditors, KPMG, have issued an unqualified opinion on the fiscal year 2010 statements and related footnotes included in this report.


STEREOGRAPHICS
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Selected Statistics

	2010	2009	2008	2007	2006
Enrollment *					
Undergraduates	5,989	5,846	5,789	5,778	5,903
Graduate School	1,817	1,719	1,700	1,705	1,689
Medical School	416	408	373	354	344
Total Enrollment	**8,222**	**7,973**	**7,862**	**7,837**	**7,936**
Undergratuate Admissions					
Number of applicants	30,135	24,988	20,633	19,097	18,316
Admit rate	9%	11%	14%	14%	14%
Yield (% accepted who matriculate)	53%	54%	55%	56%	58%
First-year students receiving Univ. scholarship	46%	41%	43%	40%	39%
Graduate Admissions					
Number of applicants	9045	7202	7237	6,934	6,282
Admit rate	15%	17%	17%	17%	17%
Yield (% accepted who matriculate)	44%	47%	41%	44%	43%
Tuition and Fees					
Undergraduate & Graduate tuition	38,048	36,928	35,584	33,888	32,264
Total tuition, fees, room, board	49,128	47,740	45,948	43,754	41,770
Medical School tuition	41,016	39,824	38,000	36,192	34,472
Number of Faculty **	687	689	680	662	631
Square Footage of Campus Facilities	6,905,481	6,882,112	6,843,871	6,928,696	6,417,998
Financial Data and Ratios (in thousands)					
Total assets	$3,729,250	$3,398,653	$4,367,935	$4,044,004	$3,360,670
Total liabilities	(856,917)	(673,837)	(877,262)	(668,971)	(530,112)
Net assets	$2,872,333	$2,724,816	$3,490,673	$3,375,033	$2,830,558
Endowment market value	$2,178,837	$2,039,140	$2,778,022	$2,669,325	$2,198,936
Pledges receivable, net	$194,664	$208,007	$225,582	$250,358	$226,103
External debt	$609,160	$492,400	$496,292	$450,049	$365,553
Facilities, net of depreciation	$820,133	$777,539	$733,643	$673,084	$582,813
Total resources to debt	4.2X	4.8X	6.3X	6.7X	6.9X
Expendable resources to debt	2.5X	2.8X	3.5X	3.8X	3.5X
Debt service to operations	4.3%	3.5%	3.9%	3.3%	2.4%

* Degree candidates only.

** Includes all tenured/tenure track faculty. It does not include 202 research faculty, 646 doctors at affiliated hospitals, and 1,023 doctors in private practice.

Independent Auditors' Report

The President and Corporation
Brown University:

We have audited the accompanying statements of financial position of Brown University (the University) as of June 30, 2010 and 2009, and the related statements of activities and cash flows for the years then ended. These financial statements are the responsibility of the University's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the University's internal control over financial reporting. Accordingly, we express no such opinion. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Brown University as of June 30, 2010 and 2009, and the changes in its net assets and its cash flows for the years then ended in conformity with U.S. generally accepted accounting principles.

As discussed in note 1(c) to the financial statements, the University changed its method of accounting for donor restricted endowment funds in 2009 due to the adoption of Accounting Standards Codification 958-205, *Endowments of Not-for-Profit Organizations: Net Asset Classification of Funds Subject to an Enacted Version of the Uniform Prudent Management of Institutional Funds Act, and Enhanced Disclosures for all Endowment Funds*.

KPMG LLP

Providence, Rhode Island
October 8, 2010

Statements of Financial Position

YEARS ENDED JUNE 30, 2010 AND 2009 (DOLLARS IN THOUSANDS)

	2010	2009
Assets		
Cash and cash equivalents	**$71,368**	$129,452
Accounts receivable and other assets	**59,289**	47,575
Contributions receivable, net	**194,664**	208,007
Notes receivable, net	**33,355**	32,894
Funds held in trust by others	**27,961**	13,193
Investments	**2,522,480**	2,189,993
Land, buildings and equipment, net	**820,133**	777,539
Total assets	**$3,729,250**	3,398,653
Liabilities		
Accounts payable and accrued liabilities	**$112,104**	78,027
Deferred revenues and student deposits	**33,184**	25,666
Liabilities associated with investments	**37,084**	10,081
Refundable advances	**37,013**	39,258
Split-interest obligations	**15,816**	15,987
Asset retirement obligations	**12,556**	12,418
Bonds, loans and notes payable	**609,160**	492,400
Total liabilities	**856,917**	673,837
Net assets		
Unrestricted	**653,377**	694,198
Temporarily restricted	**1,178,781**	1,046,982
Permanently restricted	**1,040,175**	983,636
Total net assets	**2,872,333**	2,724,816
Total liabilities and net assets	**$3,729,250**	3,398,653

SEE ACCOMPANYING NOTES TO FINANCIAL STATEMENTS.

Statement of Activities

Year ended June 30, 2010 (dollars in thousands)

2010	Unrestricted	Temporarily Restricted	Permanently Restricted	Total
Operating revenues:				
Tuition and fees	$320,538			**$320,538**
Less university scholarships	(106,456)			**(106,456)**
Net tuition and fees	214,082			**214,082**
Grant and contracts – direct	113,034			**113,034**
Grant and contracts – indirect	36,459			**36,459**
Contributions	51,652	4,056		**55,708**
Endowment income appropriated	124,181	10,339		**134,520**
Sales and services of auxiliary enterprises	81,927			**81,927**
Other income	24,946	709		**25,655**
Net assets released from restrictions	6,195	(6,195)		**—**
Total operating revenues	652,476	8,909		**661,385**
Operating expenses:				
Salaries and wages	315,164			**315,164**
Employee benefits	83,785			**83,785**
Purchased services	49,189			**49,189**
Supplies and general	78,780			**78,780**
Utilities	19,412			**19,412**
Other	36,693			**36,693**
Total operating expenses before interest and depreciation	583,023			**583,023**
Interest	23,955			**23,955**
Depreciation and amortization	51,814			**51,814**
Total operating expenses	658,792			**658,792**
Change in net assets from operating activities	(6,316)	8,909		**2,593**
Nonoperating activities:				
Contributions to long-term assets	18,561	10,186	53,912	**82,659**
Net investment return	45,922	173,506	(1,041)	**218,387**
Endowment income appropriated	(30,202)	(104,318)		**(134,520)**
Other changes, net	(68,786)	43,516	3,668	**(21,602)**
Change in net assets from nonoperating activities	(34,505)	122,890	56,539	**144,924**
Change in net assets	(40,821)	131,799	56,539	**147,517**
Net assets, beginning of year	694,198	1,046,982	983,636	**2,724,816**
Net assets, end of year	$653,377	1,178,781	1,040,175	**2,872,333**

See accompanying notes to financial statements.

Statement of Activities

Year ended June 30, 2009 (dollars in thousands)

2009	Unrestricted	Temporarily Restricted	Permanently Restricted	Total
Operating revenues:				
Tuition and fees	$302,018			**$302,018**
Less university scholarships	(100,181)			**(100,181)**
Net tuition and fees	201,837			**201,837**
Grant and contracts – direct	103,149			**103,149**
Grant and contracts – indirect	30,698			**30,698**
Contributions	48,038	1,867		**49,905**
Endowment income appropriated	122,992	10,038		**133,030**
Sales and services of auxiliary enterprises	80,682			**80,682**
Other income	23,620	966		**24,586**
Net assets released from restrictions	11,746	(11,746)		**—**
Total operating revenues	**622,762**	**1,125**		**623,887**
Operating revenues:				
Salaries and wages	301,192			**301,192**
Employee benefits	83,639			**83,639**
Purchased services	48,447			**48,447**
Supplies and general	77,787			**77,787**
Utilities	21,495			**21,495**
Other	34,110			**34,110**
Total operating expenses before interest and depreciation	**566,670**			**566,670**
Interest	18,635			**18,635**
Depreciation and amortization	51,242			**51,242**
Total operating expenses	**636,547**			**636,547**
Change in net assets from operating activities	**(13,785)**	**1,125**		**(12,660)**
Nonoperating activities:				
Contributions to long-term assets	41,633	10,030	54,793	**106,456**
Net investment return	(688,093)	(11,123)	(12,436)	**(711,652)**
Endowment income appropriated	(122,992)	(10,038)		**(133,030)**
Other changes, net	(12,733)	(14,542)	12,304	**(14,971)**
Change in net assets from nonoperating activities	**(782,185)**	**(25,673)**	**54,661**	**(753,197)**
Adjustments required under Rhode Island's enacted version of UPMIFA and ASC 958-205	(362,917)	799,180	(436,263)	—
Change in net assets	(1,158,887)	774,632	(381,602)	**(765,857)**
Net assets, beginning of year	1,853,085	272,350	1,365,238	**3,490,673**
Net assets, end of year	**$694,198**	**1,046,982**	**983,636**	**2,724,816**

See accompanying notes to financial statements.

Statement of Cash Flows

Years ended June 30, 2010 and 2009 (dollars in thousands)

	2010	2009
Cash flows from operating activities:		
Change in net assets	147,517	(765,857)
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Net realized and unrealized (gains) losses on investments	(228,650)	710,255
Depreciation and amortization	51,814	51,242
Change in estimate of split-interest obligations	1,700	(4,920)
Other changes	(4,205)	—
Contributions restricted for plant and endowment	(77,149)	(101,543)
Decrease in operating assets, net	1,629	17,853
Increase in operating liabilities, net	34,331	17,762
Net cash used in operating activities	**(73,013)**	**(75,208)**
Cash flows from investing activities:		
Purchase of land, buildings and equipment	(89,251)	(102,164)
Purchases of investments from sales and other sources	(2,981,813)	(3,294,102)
Sales of investments	2,904,979	3,393,202
Notes issued	(36,056)	(31,021)
Notes repaid	35,595	31,048
Change in funds held in trust by others	(14,768)	52,590
Net cash (used in) provided by investing activities	**(181,314)**	**49,553**
Cash flows from financing activities:		
Contributions restricted for plant and endowment	77,149	101,543
Payments under split-interest obligations	(1,871)	(2,029)
Payments under commercial paper program	(50,000)	—
Payments on long-term debt	(4,035)	(3,892)
Net proceeds from issuance of debt, including premium	175,000	—
Cash collateral posted under swap agreements	—	(13,600)
Cash collateral returned under swap agreements	—	13,600
Net cash provided by financing activities	**196,243**	**95,622**
Change in cash and cash equivalents	(58,084)	69,967
Cash and cash equivalents, beginning of year	129,452	59,485
Cash and cash equivalents, end of year	**$71,368**	**129,452**
Supplemental disclosure:		
Cash paid for interest	$23,525	18,294
Change in accounts payable from land, buildings and equipment	5,157	(7,026)

See accompanying notes to financial statements.

Notes to Financial Statements

1. Summary of Significant Accounting Policies

A. ORGANIZATION

Brown University is a private, nonprofit, nonsectarian, coeducational institution of higher education with approximately 6,000 undergraduate students and 2,200 graduate and medical students. Established in 1764, Brown University offers educational programs for undergraduates in liberal arts and engineering, professional training for students pursuing a career in medicine, and graduate education and training in the arts and sciences, engineering and medicine.

Brown University is a not-for-profit organization as described in Section 501(c)(3) of the Internal Revenue Code, as amended, and is generally exempt from income taxes pursuant to the Code. The University assesses uncertain tax positions and determined that there were no such positions that have a material effect on the financial statements.

B. BASIS OF PRESENTATION

The financial statements are presented on the accrual basis of accounting in accordance with U.S. generally accepted accounting principles (GAAP) and have been prepared to focus on the University as a whole and to present balances and transactions according to the existence or absence of donor-imposed restrictions.

The accompanying financial statements include the accounts of the John Nicholas Brown Center for the Study of American Civilization and Fairview Incorporated, a real estate holding company, both of which are separate entities that are consolidated in the financial statements. Brown University and these consolidated entities are collectively referred to herein as the University. All significant inter-entity transactions and balances have been eliminated in consolidation.

C. CLASSIFICATION OF NET ASSETS

In 2009, the University adopted the provisions of ASC 958-205, which provides guidance on the net asset classification of donor-restricted endowment funds for a not-for-profit organization that is subject to an enacted version of the Uniform Prudent Management of Institutional Funds Act (UPMIFA) and also requires disclosures about endowment funds, including donor-restricted endowment funds and board-designated endowment funds.

The University is incorporated in and subject to the laws of Rhode Island, which effective as of June 30, 2009 adopted legislation that incorporates the provisions outlined in UPMIFA. Under UPMIFA, the assets of a donor-restricted endowment fund may be appropriated for expenditure by the Corporation of the University in accordance with the standard of prudence prescribed by UPMIFA. As a result of this new law and the adoption of ASC 958-205, the University has classified its net assets as follows:

- *Permanently restricted net assets* contain donor-imposed stipulations that neither expire with the passage of time nor can be fulfilled or otherwise removed by actions of the University and primarily consist of the historic dollar value of contributions to establish or add to donor-restricted endowment funds.
- *Temporarily restricted net assets* contain donor-imposed stipulations as to the timing of their availability or use for a particular purpose. These net assets are released from restrictions when the specified time elapses or actions have been taken to meet the restrictions. Net assets of donor-restricted endowment funds in excess of their historic dollar value are classified as temporarily restricted net assets until appropriated by the Corporation and spent in accordance with the standard of prudence imposed by UPMIFA.
- *Unrestricted net assets* contain no donor-imposed restrictions and are available for the general operations of the University. Such net assets may be designated by the Corporation for specific purposes, including to function as endowment funds.

Prior to 2009, the University was subject to the Rhode Island Uniform Management of Institutional Funds Act (UMIFA), as amended. Rhode Island's enacted version of UMIFA required the University to maintain the purchasing power of the historic dollar value of its donor-restricted endowment funds and, as a result, the University annually added a portion of the funds' return to permanently restricted net assets to account for inflation. This requirement was eliminated by the enactment of UPMIFA and, accordingly, in 2009 the University reclassified the $463,263 cumulative amount of such additions from permanently restricted net assets to temporarily restricted net assets. In addition, the adoption of ASC 958-205 in 2009 resulted in the reclassification within donor-restricted endowment funds of $362,917 from unrestricted net assets to temporarily restricted net assets to reflect the unappropriated and unspent balance above historic dollar value. In 2010, upon further analysis, $56,272 of additional endowment fund balances were reclassified from unrestricted net assets to temporarily restricted net assets and are included in other changes, net, on the 2010 statement of activities.

D. FAIR VALUE MEASUREMENTS

Investments, funds held in trust by others, and interest rate swaps are reported at fair value in the University's financial statements. Fair value represents the price that would be received upon the sale of an asset or paid upon the transfer of a liability in an orderly transaction between market participants as of the measurement date. GAAP establishes a fair value hierarchy that prioritizes inputs used to measure fair value into three levels:

- Level 1 – quoted prices (unadjusted) in active markets that are accessible at the measurement date for assets or liabilities;
- Level 2 – observable prices that are based on inputs not quoted in active markets, but corroborated by market data; and
- Level 3 – unobservable inputs are used when little or no market data is available.

The fair value hierarchy gives the highest priority to Level 1 inputs and the lowest priority to Level 3 inputs. In determining fair value, the University utilizes valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible. Because the University uses net asset values reported by fund managers as a practical expedient to estimate the fair values of its investments held through limited partnerships and other funds, classification of these investments within the fair value hierarchy is based on the University's ability to timely redeem its interest rather than on inputs used. See note 3 for further discussion.

E. STATEMENTS OF ACTIVITIES

The statements of activities separately report changes in net assets from operating and nonoperating activities. Operating activities consist principally of revenues and expenses related to ongoing educational and research programs, including endowment income appropriated by the Corporation to support those programs. Nonoperating activities consist of net investment return, an offset for endowment income appropriated for operating activities, noncapitalized plant expenditures, changes in fair values of interest rate swaps, change in pension plan obligations, contributions to long-term assets and net assets released from restrictions for plant expenditures, and other activities not in direct support of annual operations.

Revenues are derived from various sources, as follows:

- Tuition and fees are recorded at established rates, net of financial aid and scholarships provided directly to students, in the period in which the sessions are primarily provided. Sales and services of auxiliary enterprises are recognized at the time the services are provided.
- Contributions, including unconditional promises to give reported as contributions receivable, are recognized at fair value in the period received and are classified based upon the existence or absence of donor-imposed restrictions. Expirations of donor-imposed restrictions are reported as net assets released from restrictions. Contributions and investment return subject to donor-imposed stipulations that are met in the same reporting period are reported as unrestricted revenue. Bequest intentions and conditional promises are not recorded in the University's financial statements.
- Government grants and contracts normally provide for the recovery of direct and indirect costs, subject to audit. The University recognizes revenue associated with direct and indirect costs as direct costs are incurred. The recovery of indirect costs is pursuant to an agreement which provides for a predetermined fixed indirect cost rate.
- Dividends, interest and realized and unrealized gains (losses) on investments are reported as increases (decreases) in (1) permanently restricted net assets if the terms of the contributions (or, prior to fiscal 2010, relevant state law) require them to be added to principal; (2) temporarily restricted net assets if the terms of the related contributions impose restrictions on their availability or use; or (3) unrestricted net assets in all other cases. As UPMIFA became effective on June 30, 2009, investment return attributable to donor-restricted endowment funds in fiscal 2010 is reported as temporarily restricted to the extent not appropriated and spent.

Expenses are reported as decreases in unrestricted net assets.

F. CASH EQUIVALENTS

For purposes of the statements of cash flows, cash equivalents, except for those held by investment managers, consist of money market funds and investments with original maturities of three months or less and are carried at cost, which approximates fair value.

G. ACCOUNTS AND NOTES RECEIVABLE AND OTHER ASSETS

Accounts receivable and other assets include amounts due from students, reimbursements due from sponsors of externally funded research, accrued income on investments, inventory and prepaid expenses and are carried at net realizable value, which approximates fair value. Notes receivable

consist primarily of loans to students that may have significant restrictions and long maturities, and it is not practicable to estimate their fair value.

H. LAND, BUILDINGS AND EQUIPMENT

Land, buildings and equipment are stated at cost of acquisition or construction (including capitalized interest) or, if received as a gift, at estimated fair value at the time of receipt, and are presented net of accumulated depreciation. All other expenditures for maintenance, repairs, and library books are charged to operating net assets as incurred.

Depreciation is calculated using the straightline method with estimated useful lives of 30 years for buildings, 20 years for building improvements, and 10 years for building equipment. Moveable equipment is depreciated over a range of 3 to 15 years, depending upon asset class.

I. REFUNDABLE ADVANCES

The University holds certain amounts advanced by the U.S. government under the Federal Perkins Loan Program and the Health Professions Student Loan Program (the Programs). Such amounts may be reloaned by the University after collection; however, in the event that the University no longer participates in the Programs, the amounts are generally refunded to the U.S. government. Refundable advances also include amounts received from funding agencies in advance of project activities related to sponsored programs.

J. COLLECTIONS

The University's collections include works of art, historical treasures, and artifacts that are maintained in the University's libraries and museums. These collections are protected and preserved for education and research purposes. The collections are not recognized as assets in the financial statements of the University.

K. USE OF ESTIMATES

The preparation of financial statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, and disclosures of contingent assets and liabilities, at the dates of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates.

L. RECLASSIFICATIONS

Certain 2009 financial information has been reclassified to conform to the 2010 presentation.

2. Contributions Receivable

The University's contributions receivable are recognized net of discounts at rates commensurate with the risks involved and after allowance for uncollectibles are reported at net realizable value, which approximates fair value.

Contributions receivable were as follows at June 30:

	2010	2009
Contributions expected to be received in:		
One year or less	$57,217	48,928
Between one and five years	153,581	182,465
More than five years	11,248	10,133
Gross contributions receivable	**222,046**	**241,526**
Unamortized discount (at rates ranging from 1.52% to 6.3%) and allowance for uncollectibles	(27,382)	(33,519)
Contributions receivable, net	**$194,664**	**208,007**

3. Investments

INVESTMENT STRATEGY

In addition to traditional stocks and fixed-income securities, the University may also hold shares or units in institutional funds as well as in alternative investment funds involving hedged strategies, private equity and real asset strategies. Hedged strategies involve funds whose managers have the authority to invest in various asset classes at their discretion, including the ability to invest long and short. Funds with hedged strategies generally hold securities or other financial instruments for which a ready market exists and may include stocks, bonds, put or call options, swaps, currency hedges and other instruments, and are valued accordingly. Private equity funds employ buyout and venture capital strategies and may focus on investments in turnaround situations. Real asset funds generally hold interests in public real estate investment trusts (REITS) or commercial real estate, generally through commingled funds. Private equity and real asset strategies therefore often require the estimation of fair values by the fund managers in the absence of readily determinable market values.

Investments also include assets related to donor annuities, pooled income funds, and charitable remainder trusts. Certain of these funds are held in trust by the University for one or more beneficiaries who are generally paid lifetime income, after which the principal is made available to the University in accordance with donor restrictions, if any. The assets are recorded at fair value and liabilities, which are reported as split-interest obligations, are recorded to recognize the present value of estimated future payments to beneficiaries.

BASIS OF REPORTING

Investments are reported at estimated fair value. If an investment is held directly by the University and an active market with quoted prices exists, the market price of an identical security is used as reported fair value. Reported fair values for shares in registered mutual funds are based on share prices reported by the funds as of the last business day of the fiscal year. The University's interests in alternative investment funds are generally reported at the net asset value (NAV) reported by the fund managers and assessed as reasonable by the University, which is used as a practical expedient to estimate the fair value of the University's interest therein, unless it is probable that all or a portion of the investment will be sold for an amount different from NAV. As of June 30, 2010 and 2009, the University had no plans or intentions to sell investments at amounts different from NAV.

Because of the inherent uncertainties of valuation, these estimated fair values may differ significantly from values that would have been used had a ready market existed, and the differences could be material. Such valuations are determined by fund managers and generally consider variables such as operating results, comparable earnings multiples, projected cash flows, recent sales prices, and other pertinent information, and may reflect discounts for the illiquid nature of certain investments held.

The following tables summarize the University's investments and other assets within the fair value hierarchy as of June 30, 2010 and 2009, as well as related strategy, liquidity and funding commitments:

	June 30, 2010				Redemption	Days'
	Level 1	Level 2	Level 3	Total	or liquidation	notice
Investments:						
Equities:						
U.S. equities	$15,520	79,738	—	95,258	Daily to quarterly	1 – 60
Non-U.S. equity index funds	87,938	—	—	87,938	Daily	1
Non-U.S. equity funds	2,140	101,573	98,874	202,587	Daily to illiquid	15 – 120
Fixed income:						
U.S. bonds	11,666	333,899	49,894	395,459	Daily to annual	1 – 60
U.S. Treasury inflation-protected	—	97,574	—	97,574	Daily	1
Hedged strategies:						
General arbitrage funds	—	82,063	108,950	191,013	Daily to illiquid	15 – 90
Distressed funds	—	—	68,300	68,300	Biennial to illiquid	90
Global/non-U.S. funds	—	143,351	436,145	579,496	Monthly to illiquid	30 – 180
Private equity:						
Buy-out funds	—	—	330,315	330,315	Illiquid	N/A
Venture funds	—	—	111,456	111,456	Illiquid	N/A
Real assets:						
Real estate and timber	1,203	1,572	166,703	169,478	Daily to illiquid	N/A
Commodities, oil and gas	—	—	43,919	43,919	Illiquid	N/A
Cash and cash equivalents	149,687	—	—	149,687	Daily	1
Total	**$268,154**	**839,770**	**1,414,556**	**2,522,480**		
Funds held in trust by others	**$16,914**	**—**	**11,047**	**27,961**	**Daily to illiquid**	**1 - N/A**

	June 30, 2009				Redemption	Days'
	Level 1	Level 2	Level 3	Total	or liquidation	notice
Investments:						
Equities:						
U.S. equities	$16,975	63,308	11,046	91,329	Daily to annual	1 – 60
Non U.S. Equity funds	—	75,465	97,381	172,846	Daily to illiquid	15 – 120
Fixed income:						
U.S. bonds	65,334	157,040	42,463	264,837	Daily to annual	1 – 60
U.S. Treasury inflation-protected	—	85,438	—	85,438	Daily	1
Hedged strategies:						
General arbitrage funds	5,530	15,468	115,529	136,527	Daily to illiquid	15 – 90
Distressed funds	—	—	48,952	48,952	Biennual to illiquid	90
Global/non-U.S. funds	—	107,730	474,458	582,188	Monthly to illiquid	30 – 180
Private equity:						
Buy-out funds	—	—	266,300	266,300	Illiquid	N/A
Venture funds	—	—	104,720	104,720	Illiquid	N/A
Real assets:						
Real estate and timber	885	1,392	168,211	170,488	Daily to illiquid	N/A
Commodities, oil and gas	—	—	38,066	38,066	Illiquid	N/A
Cash and cash equivalents	228,302	—	—	228,302	Daily	1
Total	**$317,026**	**505,841**	**1,367,126**	**2,189,993**		
Funds held in trust by others	**$2,650**	**—**	**10,543**	**13,193**	**Daily to illiquid**	**1 - N/A**

Registered mutual funds are classified in Level 1 of the fair value hierarchy as defined in note 1(d) because their fair values are based on quoted prices for identical securities. The University's fixed income strategy includes directly held U.S. corporate bonds, which although readily marketable are valued using matrix pricing and are classified in Level 2. Most investments classified in Levels 2 and 3 consist of shares or units in nonregistered investment funds as opposed to direct interests in the funds' underlying securities, which may be readily marketable or not difficult to value. Because the NAV reported by each fund is used as a practical expedient to estimate the fair value of the University's interest therein, its classification in Level 2 or 3 is based on the University's ability to redeem its interest at or near the date of the statement of financial position. If the interest can be redeemed in the near term, the investment is classified in Level 2. Accordingly, the inputs or methodology used for valuing or classifying investments for financial reporting purposes are not necessarily an indication of the risks associated with those investments or a reflection of the liquidity of or degree of difficulty in estimating the fair value of each fund's underlying assets and liabilities.

Certain hedge funds of funds contain "rolling" lockup provisions. Under such provisions, tranches of the investment are available for redemption at calendar year end once every two or three years, if the University makes a redemption request prior to the next available withdrawal date in accordance with the notification terms of the agreement. Private equity and real assets are held in funds that have initial terms of eight to ten years with extensions of one to three years, and have an average remaining life of approximately six to seven years.

The following tables present the activities for the years ended June 30, 2010 and 2009 for the University's assets classified in Level 3:

2010

Level 3 roll forward	Equities	Fixed income	Hedged strategies	Private equity	Real assets	Total	Funds held in trust by others
Beginning value as of July 1, 2009	$108,427	42,463	638,939	371,020	206,277	1,367,126	10,543
Acquisitions	21,000	—	20,000	62,61	37,755	141,370	—
Dispositions	(26,980)	—	(131,209)	(35,640)	(17,729)	(211,558)	—
Transfers	(7,268)	—	(32,945)	—	—	(40,213)	—
Net realized and unrealized gains (losses)	3,695	7,431	118,610	43,776	(15,681)	157,831	504
Fair value at June 30, 2010	**$98,874**	**49,894**	**613,395**	**441,771**	**210,622**	**1,414,556**	**11,047**

2009

Level 3 roll forward	Equities	Fixed income	Hedged strategies	Private equity	Real assets	Total	Funds held in trust by others
Beginning value as of July 1, 2008	$153,294	53,735	940,787	412,485	344,139	1,904,440	13,249
Acquisitions	10,000	10,071	62,400	70,882	52,382	205,735	—
Dispositions	—	(30,122)	(182,693)	(11,214)	(69,514)	(293,543)	—
Transfers	—	—	(26,371)	—	—	(26,371)	—
Net realized and unrealized gains (losses)	(54,867)	8,779	(155,184)	(101,133)	(120,730)	(423,135)	(2,706)
Fair value at June 30, 2009	**$108,427**	**42,463**	**638,939**	**371,020**	**206,277**	**1,367,126**	**10,543**

The following summarizes investment return components for the years ended June 30, 2010 and 2009:

	2010	2009
Interest and dividends	$9,615	26,162
Net realized and unrealized gains (losses), net of investment management and advisory fees	222,500	(726,752)
Investment return	**$232,115**	**(700,590)**

Investment returns is included in the statements of activities as follows for the years ended June 30:

	2010	2009
Operating:		
Endowment income appropriated	$134,520	133,030
Included in other incomes	13,728	11,062
Nonoperating activities:		
Net investment return above (below) endowment income appropriated	83,867	(844,682)
Investment return	**$232,115**	**(700,590)**

Total investment management and advisory fees were $18,953 and $16,497 for the years ended June 30, 2010 and 2009, respectively.

A. LIQUIDITY

Investment liquidity as of June 30, 2010 is aggregated below based on redemption or sale period:

	Investment fair values
Investment redemption or sale period:	
Pending	$47,196
Daily	749,465
Monthly	109,288
Quarterly	299,554
Semi-annually	32,519
Subject to rolling lock-ups	485,218
Illiquid	799,240
Total as of June 30, 2010	**$2,522,480**

B. COMMITMENTS

Private equity and real asset investments are generally made through limited partnerships. Under the terms of these agreements, the University is obligated to remit additional funding periodically as capital or liquidity calls are exercised by the manager. These partnerships have a limited existence, generally ten years, and such agreements may provide for annual extensions for the purpose of disposing portfolio positions and returning capital to investors. However, depending on market conditions, the inability to execute the fund's strategy, and other factors, a manager may extend the terms of a fund beyond its originally anticipated existence or may wind the fund down prematurely. As a result, the timing and amount of future capital or liquidity calls expected to be exercised in any particular future year is uncertain. The aggregate amount of unfunded commitments associated with private equity and real asset investments as of June 30, 2010 was $274,553 and $82,844, respectively.

C. INVESTMENT DERIVATIVES

The University's endowment investment portfolio includes derivative financial instruments that have been acquired to reduce overall portfolio risk by hedging exposure to certain assets held in the portfolio. The endowment also employs certain derivative financial instruments to replicate long or short asset positions more cost effectively than through purchases or sales of the underlying assets.

As a result of owning derivative financial instruments, the University is subject to market risks such as changes in interest rates that arise from normal business operations. The University regularly assesses these risks and has established business strategies to provide natural offsets, supplemented by the use of derivative financial instruments to protect against the adverse effect of these and other market risks. The University has established policies, procedures, and internal controls governing the use of derivatives. The effects of investment derivatives on the University's financial statements were not material for the years ended June 30, 2010 and 2009.

D. FUNDS HELD IN TRUST BY OTHERS

Funds held in trust by others represent funds that are held and administered by outside trustees, including perpetual trusts established by donors of $11,047 and $10,543 at June 30, 2010 and 2009, respectively. The University receives all or a specified portion of the return on the underlying assets of such trusts, which is primarily restricted for scholarships. The University will never receive the assets held in trust. Other trusteed funds of $16,914 and $2,650 at June 30, 2010 and 2009, respectively, represent bond proceeds to be utilized for construction projects or required to be held in reserve in accordance with bond agreements.

4. Endowment

The University's endowment consists of approximately 2,500 individual funds established for a variety of purposes, including both donor-restricted endowment funds and funds designated by the Corporation to function as endowments. Net assets associated with endowment funds, including funds designated by the Corporation to function as endowments, are classified and reported based on the existence or absence of donor-imposed restrictions.

Endowment net assets consist of the following at June 30, 2010:

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor-restricted endowment funds	$(42,835)	955,351	952,028	1,864,544
Corporation-designated endowment funds	292,213	54,446	—	346,659
Total endowment net assets	**$249,378**	**1,009,797**	**952,028**	**2,211,203**

Endowment net assets consist of the following at June 30, 2009:

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor-restricted endowment funds	$(49,306)	811,084	896,699	1,658,477
Corporation-designated endowment funds	356,956	52,447	—	409,403
Total endowment net assets	**$307,650**	**863,531**	**896,699**	**2,067,880**

Changes in endowment net assets for the year ended June 30, 2010 are as follows:

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Endowment net assets, June 30, 2009	$307,650	863,531	896,699	2,067,880
Interest and dividends	8,497	567	—	9,064
Net realized and unrealized gains (losses)	28,956	172,805	(2,483)	199,278
Endowment income appropriated	(30,202)	(104,318)	—	(134,520)
Contributions	701	1,924	53,277	55,902
Reclassifications and other changes	(66,224)	75,288	4,535	13,599
Endowment net assets June 30, 2010	**$249,378**	**1,009,797**	**952,028**	**2,211,203**

Changes in endowment net assets for the year ended June 30, 2009 are as follows:

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Endowment net assets, June 30, 2008	$1,393,647	92,729	1,291,647	2,778,023
Interest and dividends	22,960	—	—	22,960
Net realized and unrealized losses	(647,315)	(10,370)	(12,107)	(669,792)
Endowment income appropriated	(122,992)	(10,038)	—	(133,030)
Contributions	2,716	287	41,687	44,690
Transfers in	28,741	—	—	28,741
Reclassifications and other changes	(7,190)	(8,257)	11,735	(3,712)
Reclassification from adoption of UPMIFA	—	436,263	(436,263)	—
Reclassification under ASC 958-205	(362,917)	362,917	—	—
Endowment net assets, June 30, 2009	**$ 307,650**	**863,531**	**896,699**	**2,067,880**

A. INTERPRETATION OF RELEVANT LAW

The portion of donor-restricted endowment funds that is not classified as permanently restricted net assets is classified as temporarily restricted net assets until those amounts are appropriated for expenditure by the University in a manner consistent with the standard of prudence prescribed by UPMIFA. In accordance with UPMIFA, the University considers the following factors in making a determination to appropriate or accumulate donor-restricted endowment funds:

- The duration and preservation of the fund
- The purposes of the University and the donor-restricted endowment fund
- General economic conditions
- The possible effect of inflation and deflation
- The expected total return from income and the appreciation of investments
- Other resources of the University
- The investment policies of the University

B. FUNDS WITH DEFICIENCIES

From time to time, the fair value of assets associated with an individual donor-restricted endowment fund may fall below the fund's historic dollar value. Deficiencies of this nature, which are reported in unrestricted net assets, aggregated $42,835 and $49,306 as of June 30, 2010 and 2009, respectively. These deficiencies resulted principally from investment losses and continued appropriation for certain programs that was deemed prudent by the Corporation. Subsequent gains that restore the fair value of the assets of these endowment funds to their historic dollar value will be classified as increases in unrestricted net assets.

C. RETURN OBJECTIVES AND RISK PARAMETERS

The University has adopted investment and spending policies for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets, including both donor-restricted and designated funds. The long-term investment return objective is formulated to maintain purchasing power after accounting for both inflation and spending. The Corporation has set a long-term return goal at 5.5% above the higher education price index. Actual returns in any given year or period of years may vary from this amount.

D. STRATEGIES EMPLOYED FOR ACHIEVING OBJECTIVES

To satisfy its long-term rate-of-return objectives, the University relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (interest and dividends). The University targets a diversified asset allocation to achieve its long-term return objectives within prudent risk constraints.

E. SPENDING POLICY AND HOW THE INVESTMENT OBJECTIVES RELATE TO SPENDING POLICY

The University invests its endowment funds and allocates the related earnings for expenditure in accordance with the total return concept. The endowment usage is determined in accordance with the policy adopted by the Corporation. This policy fixes the spending range of endowment total return between 4.5% and 5.5% of the average fair value of the applicable endowment over the prior twelve quarters, with the objective being to hold the spending rate to no more than 5% average over time. Applicable endowments include Corporation-designated and donor-designated endowment funds.

5. Land, Buildings and Equipment

Land, buildings and equipment include the following at June 30:

	2010	2009
Land	$56,992	53,448
Buildings and improvements	1,124,871	1,081,829
Equipment	94,847	87,635
Construction in progress	109,843	71,440
	1,386,553	**1,294,352**
Accumulated depreciation	(566,420)	(516,813)
Land, buildings and equipment, net	**$820,133**	**777,539**

Outstanding commitments on uncompleted construction contracts total $103,727 at June 30, 2010.

6. Bonds, Loans and Notes Payable

The University has entered into various agreements for the purpose of financing the acquisition, renovation, and improvement of its facilities. The bonds, loans and notes payable outstanding for these purposes are as follows.

Name of issue	Interest rate(s)	Type of rate	Final maturity	Balance at June 30 2010	2009
Taxable Standard Commercial Paper Notes, Series A, revolving through 2036	0.25% – 0.38%	Fixed	Revolving	$46,800	46,800
Rhode Island Health and Educational Building Corporation (RIHEBC) Facilities Revenue Bonds:					
Series 1998	4.75%	Fixed	2014	7,740	9,075
Series 2001A	4.125% – 5.25%	Fixed	2023	27,595	28,165
Series 2001B	0.25% *	Variable	2032	55,340	55,340
Series 2003A	3.00% – 4.85%	Fixed	2037	43,775	44,600
Series 2003B	0.26% *	Variable	2043	44,160	44,530
Series 2004	3.10% – 4.75%	Fixed	2025	19,280	20,140
Series A 2005	0.21% *	Variable	2035	85,500	85,500
Series 2007	4.25% – 5.00%	Fixed	2037	90,010	90,010
Series 2009	5.00%	Fixed	2039	70,795	—
Tax-exempt commercial paper revolving through 2036	n/a	Fixed	Revolving	—	50,000
Brown University Taxable Bonds					
Series 2005	5.09%	Fixed	2015	17,000	17,000
Series 2009	4.57%	Fixed	2019	100,000	—
Loan payable – U.S. Department of Education	5.50%	Fixed	2021	1,165	1,240
Total bonds, loans and notes payable				**$609,160**	**492,400**

* As of June 30, 2010

A. TAX EXEMPT BONDS

The University's tax exempt debt, primarily Facilities Revenue Bonds, is issued through RIHEBC, a state agency serving as a conduit issuer of tax exempt debt. The University is required under certain of its financing agreements with RIHEBC to appropriate funds from operating and other net assets for payment of principal and interest and for maintenance of the properties. The Revenue Bonds currently outstanding were issued primarily to finance new and ongoing capital projects for research, student housing, academic and administrative buildings, and infrastructure throughout the University. In October 2009, the Series 2009 Facilities Revenue Bonds were issued to finance capital projects and to pay down tax exempt commercial paper.

B. TAXABLE BONDS AND OTHER DEBT

The University's outstanding debt includes two taxable bond issues. Series 2005 Taxable Bonds were issued to finance a portion of the acquisition cost of an office building. Series 2009 Taxable Bonds were issued to provide liquidity and to protect against a tightening in liquidity markets. In addition, the University implemented a Taxable Commercial Paper Program in November 2005. The program provides for the issuance, up to $50,000, of Taxable Standard Commercial Paper Notes, Series A, and Taxable Extendible Commercial Paper Notes, Series B.

In fiscal 2010 the University eliminated the balance outstanding under its tax exempt commercial paper program, which was renewed and is expected to be drawn upon again in the future.

Principal payments of bonds and loans payable as of June 30, 2010 for the succeeding five fiscal years ending June 30 are as follows:

2011	$ 4,185
2012	5,954
2013	7,814
2014	8,184
2015	8,574

The University's bonds, loans and notes payable are stated at face value. The University's bonds trade periodically in a limited market. Utilizing available market pricing information provided by a third party and other data, the University determined that the aggregate carrying value of its debt as of June 30, 2010 and 2009 approximated its fair value.

The University has a revolving line of credit available up to $40,000. As of June 30, 2010, the full amount of $40,000 was available at a rate of 1.10088%.

C. INTEREST RATE SWAPS

At June 30, 2010, the University had in place various interest rate swap agreements to effectively convert a portion of its variable rate bonds to fixed rates until maturity of the bonds. The swaps' notionals amortize at the same rate as the related debt principal.

As of June 30, the following interest rate swap agreements were outstanding:

Counterparty	Issue date	Effective date	Expiration date	Remaining notional amount	Swap fixed rate	Fair value at June 30 asset (liability) 2010	2009
JP Morgan (formally Bear Stearns)	11/06/2003	03/03/2008	09/01/2043	$44,160	3.732%	$(9,944)	(7,361)
Goldman Sachs	07/07/2005	10/04/2005	05/01/2035	85,500	3.979	(9,641)	(4,373)
Goldman Sachs	11/15/2006	11/21/2006	09/01/2032	55,340	3.891	(5,870)	(3,007)
						$(25,455)	**(14,741)**

The variable rate on the two Goldman Sachs swaps is based on the USD-BMA Municipal Swap Index. The variable rate on the JPMorgan swap is based on 67% of one-month LIBOR-BBA. The Goldman Sachs swaps require posting of collateral by either party at thresholds based on their respective credit ratings. Based on the University's current credit rating, cash collateral must be posted by the University if the aggregate mark-to-market liability payable by the University exceeds $25 million. The JPMorgan swap stipulates that the University maintain a minimum credit rating to avoid collateral posting requirements. The counterparties are required to maintain a minimum credit rating based on provisions contained in the individual swap agreements, which were at or above the minimum thresholds contained in the agreements as of June 30, 2010 and 2009.

Interest rate volatility, remaining outstanding principal and time to maturity will affect each swap's fair value at subsequent reporting dates. To the extent the University holds a swap through its expiration date, the swap's fair value will reach zero. Because the swap fair values are based predominantly on observable inputs corroborated by market data, they are classified in Level 2 in the GAAP fair value hierarchy.

7. Retirement Benefits

The University participates in two contributory retirement plans. The plans provide for the purchase of annuities on a compulsory basis by full-time faculty and administrative staff. The expense to the University, representing its contributions to the accounts of faculty and staff, was $20,988 and $19,437 for the years ended June 30, 2010 and 2009, respectively.

The Brown University Food Services and Plant Operations Employees' Pension Plan is a noncontributory defined benefit plan which provides pensions for certain fulltime weekly paid employees. The policy of the University is to fund pension costs in accordance with the Employee Retirement Income Security Act of 1974, as amended.

Information regarding the defined benefit pension plan for the years ended June 30 is as follows:

	2010	2009
Change in projected benefit obligation:		
Projected benefit obligation at beginning of year	$43,579	38,291
Service cost	2,079	1,806
Interest cost	2,684	2,541
Benefits paid	(1,456)	(1,326)
Actuarial loss	6,529	2,267
Projected benefit obligation at end of year	**$53,415**	**43,579**

The projected benefit obligation was determined using the following assumptions as of June 30:

	2010	2009
Discount rate	5.40%	6.24%
Rate of compensation increase	4.00	4.00

The following is a summary of activity under the plan for the years ended June 30:

	2010	2009
Change in plan assets:		
Fair value of plan assets at beginning of year	$29,654	32,398
Actual return on plan assets	3,075	(5,668)
Contributions	4,500	4,250
Benefits paid	(1,456)	(1,326)
Fair value of plan assets at end of year	**35,773**	**29,654**
Projected benefit obligation at end of year	(53,415)	(43,579)
Funded status recorded in accounts payable and accrued liabilities	**$(17,642)**	**(13,925)**

The plan assets at June 30, 2010 and 2009 consist of investments measured at NAV and are classified in Level 2 in the GAAP fair value hierarchy because of the plan's ability to redeem its interests at or near the statement of financial position date.

	2010	2009
Net periodic pension cost:		
Service cost	$2,079	1,806
Interest cost	2,684	2,541
Expected return on assets	(2,191)	(2,426)
Amortization of unrecognized loss and prior service cost	723	149
Net periodic pension cost	**$3,295**	**2,070**

Net periodic pension cost was determined using the following assumptions for the years ended June 30:

	2010	2009
Discount rate	6.24%	6.82%
Rate of compensation increase	4.00	4.00
Expected long-term rate of return	7.50	7.50

The expected rate of return on assets was derived based upon assumptions of inflation, real returns, anticipated value added by the investment manager and expected asset class allocations.

Net periodic pension cost is reflected in operating activities on the statements of activities. As of June 30, 2010 and 2009, the items not yet recognized as components of net periodic pension cost are an unrecognized prior service cost of $680 and $812, respectively, and a net unrecognized actuarial loss of $16,667 and $11,611, respectively. These changes affecting the funded status of the plan are included in other changes in nonoperating activities.

The investment strategy for the Plan takes into account several factors consistent with the characteristics of an employee pension plan. As such, the strategy recognizes a long-term time horizon where a substantial allocation to equities is appropriate and will help to maximize returns; broad diversification in order to increase return and reduce risk; and investment in institutional retirement annuities that serves to reduce administrative costs.

The actual asset allocation for the pension plan as of June 30, 2010 and 2009, and the weighted average asset targeted allocation are as follows:

		Actual	
	Target	2010	2009
Equity securities	65%	57%	59%
Fixed income securities	33	32	30
Cash and cash equivalents	2	11	11
Total	**100%**	**100%**	**100%**

The University's estimated contribution for 2011 is $3,000.

Estimated future benefit payments as of June 30, 2010 are as follows:

	Amount
Fiscal year:	
2011	$1,931
2012	1,974
2013	2,066
2014	2,179
2015	2,321
2016 - 2020	14,780

8. Net Assets

The University's net assets as of June 30 are as follows:

2010	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating:				
Undesignated, departmental funds	$31,624	—	—	31,624
University designated	64,443	—	—	64,443
Donor restricted	—	11,365	—	11,365
Net investment in plant	298,111	41,740	—	339,851
Student loans	9,821	—	9,362	19,183
Endowment	249,378	1,009,797	952,028	2,211,203
Pledges receivable	—	115,879	78,785	194,664
Total net assets	**$653,377**	**1,178,781**	**1,040,175**	**2,872,333**

2009	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating:				
Undesignated, departmental funds	$38,008	—	—	38,008
University designated	47,011	—	—	47,011
Donor restricted	—	31,916	—	31,916
Net investment in plant	291,971	21,690	—	313,661
Student loans	9,558	—	8,775	18,333
Endowment	307,650	863,531	896,699	2,067,880
Pledges receivable	—	129,845	78,162	208,007
Total net assets	**$694,198**	**1,046,982**	**983,636**	**2,724,816**

9. Functional Classification of Expenses

Functional categories are reported after allocating, on a square footage basis, expenses for operation and maintenance of plant, interest on indebtedness and depreciation. Operating expenses incurred in the fiscal years ended June 30 were as follows:

	2010	2009
Instruction and departmental research	$240,996	236,373
Sponsored programs	113,503	103,988
Academic and student support	124,360	116,727
Auxiliary services	87,072	92,957
Institutional support	92,861	86,502
	$658,792	**636,547**

10. Commitments and Contingencies

All funds expended in conjunction with government grants and contracts are subject to audit by governmental agencies. In the opinion of management, any potential liability resulting from these audits will not have a material effect on the University's financial position.

The University is a defendant in various legal actions arising out of the normal course of its operations. Although the final outcome of such actions cannot currently be determined, the University believes that eventual liability, if any, will not have a material effect on the University's financial position.

11. Related-Party Transactions

Members of the Corporation and senior management may, from time to time, be associated, either directly or indirectly with companies doing business with the University. The University has a written conflict of interest policy that requires annual reporting by each Corporation member as well as the University senior management. When such relationships exist, measures are taken to mitigate any actual or perceived conflict, including requiring that such transactions be conducted at arms' length, based on terms in the best interest of the University.

12. Subsequent Events

The University considers events or transactions that occur after the statement of financial position date, but before the financial statements are issued, to provide additional evidence relative to certain estimates or to identify matters that require additional disclosure. These financial statements were issued on October 8, 2010, and subsequent events have been evaluated through that date.

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