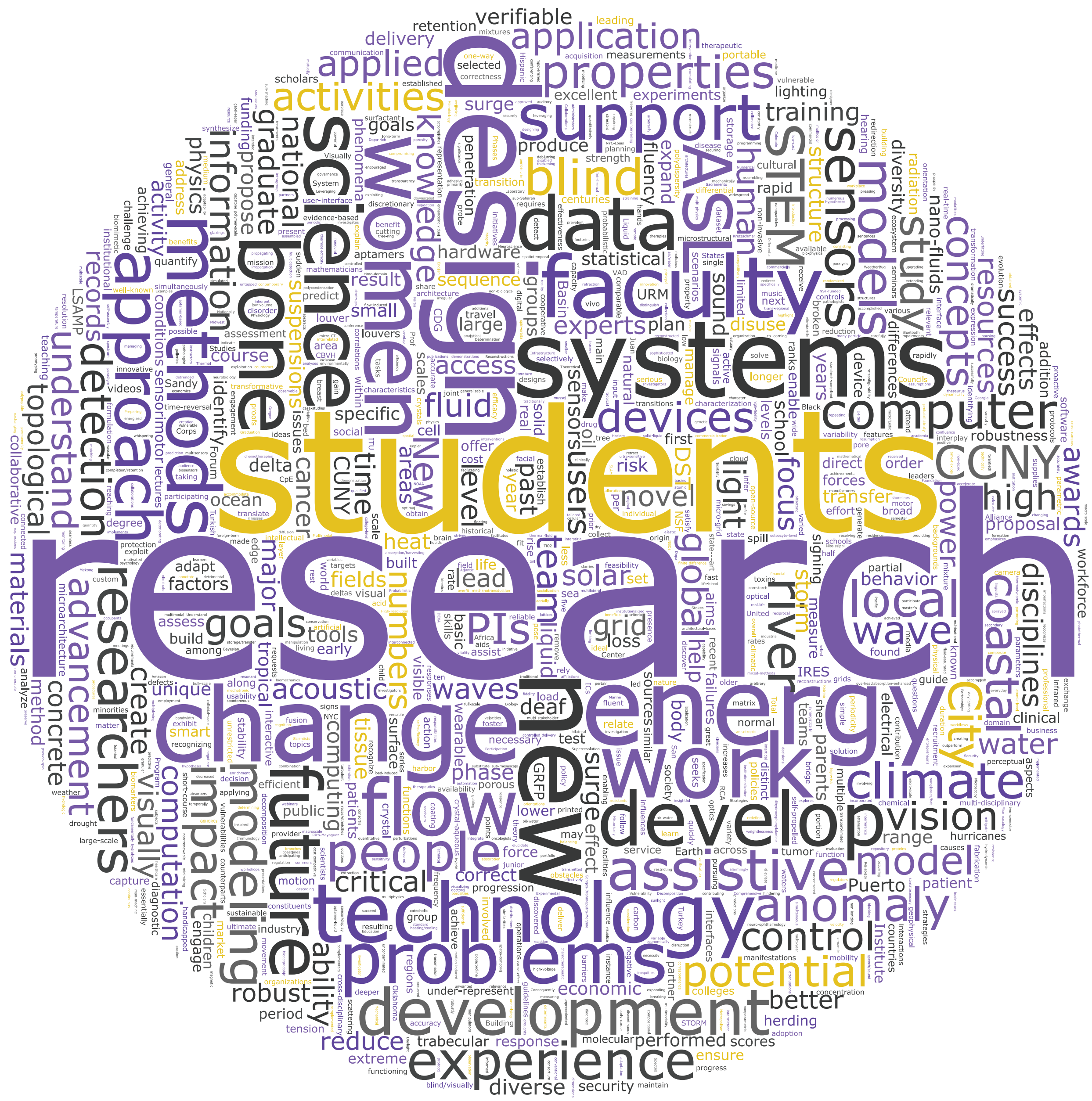
The City College of New York

The Grove School of Engineering



Research Report

FISCAL YEAR 2016

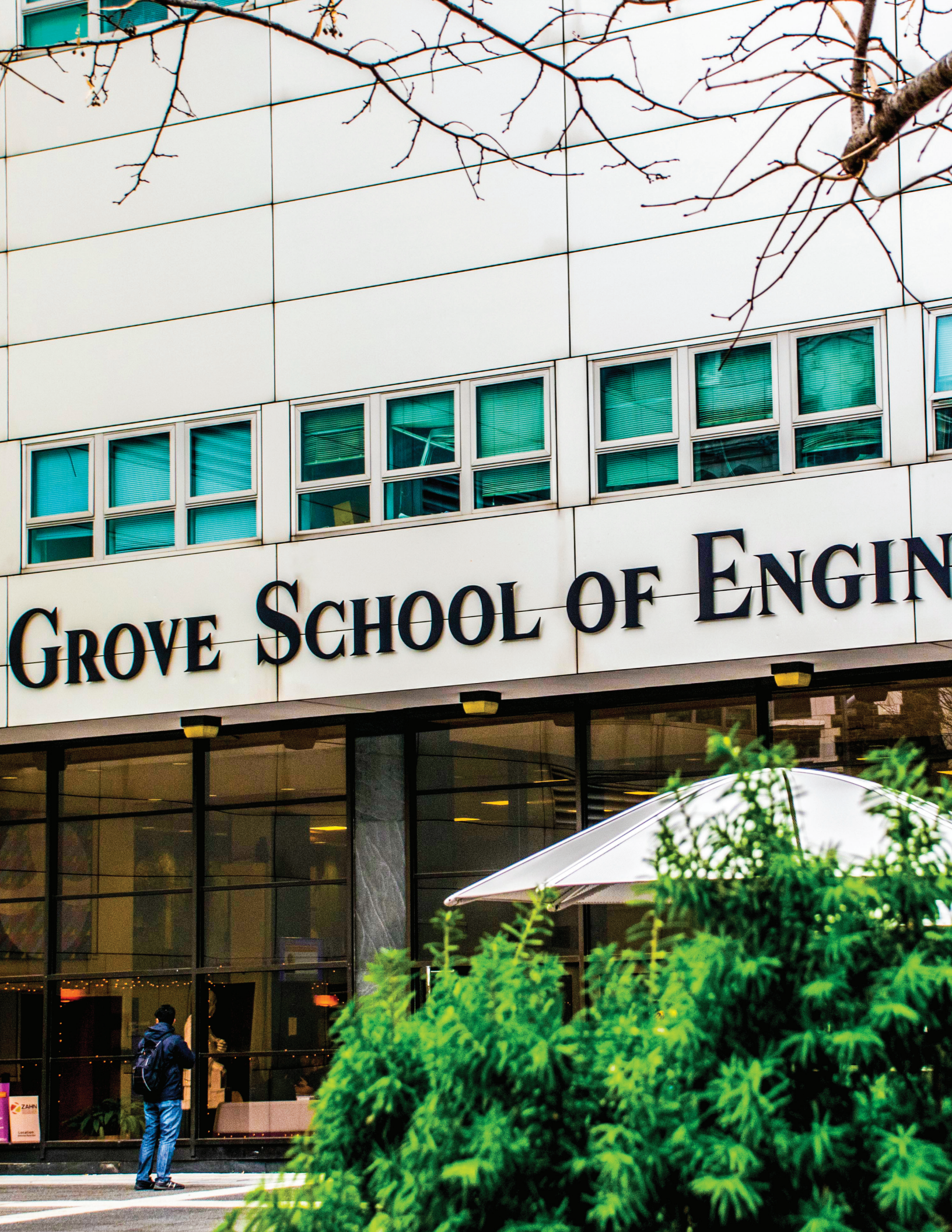

GROVE SCHOOL OF ENGIN
ZAHN

TABLE OF CONTENTS

Message From the Dean

Dear Friends,

With The Grove School of Engineering as the driving force, The City College of New York has long been the greatest generator of external research funding among the CUNY colleges. To build on that success and to harness the intellectual capacity at Grove for the purpose of enhancing our research capabilities, investment in our research enterprise is key. Leading that effort is Dr. Rosemarie D. Wesson, PhD, PE.

Dr. Wesson joined The Grove School of Engineering as the Associate Dean for Research—a newly developed position vital to the growth and visibility of research at Grove—in the summer of 2015. She brought with her extensive experience in academia, industry, and government, most recently, serving as the Director of the Directorate for Engineering at the National Science Foundation (NSF). She is versatile in the grant awards process, having served on both ends of the process. As the Associate Dean for Research, Dr. Wesson has been charged with the school's research administration, providing strategic leadership and support for short and long term research goals and initiatives.

This year, the Grove School continued to expand. We admitted the largest incoming class to date and, building on our curriculum, launched an interdisciplinary master's program in translational medicine. Faculty research remains strong and, as you'll find in this report, we continue to lead the College in research awards and funding.

While this report highlights only a glimpse of the research activity across our Centers and Departments, it is a testament to the high caliber of our faculty and students and the reach of a Grove School education.

Gilda Barabino
Dean and Berg Professor

Intro From the Associate Dean for Research

It gives me great pleasure to present the inaugural 2016 Grove School of Engineering Research Annual Report. Since my arrival to serve as the Associate Dean for Research, I have marveled at the breadth and depth of inquiry and investigation that is conducted within our School. With eleven departments and programs and 117 faculty members, our research portfolio is quite expansive, with work ranging from micro circuitry to the construction of bridges and tunnels to the development of neural devices.

As the only public school of engineering in New York City, students attend the Grove School of Engineering to engage in an outstanding education and research experience. In Fall 2015, we welcomed 3,529 undergraduate and graduate students to the School, an increase of 20% since Fall 2013. Within our student body, more than 500 of our students are currently pursuing graduate degrees and are conducting cutting edge research, much of which has a direct impact on our City. Our students participate in collaborations, internships and research experiences at some of the top companies in the world, including Bloomberg, Bank of America, and Con Edison.

The Grove School of Engineering is a major contributor to the research enterprise at the City College of New York. As you will see in this report, the Grove School of Engineering accounts for 42% of the total research expenditures at the College. In FY 2016, we were awarded $20 million in research awards, with more than half of those funds coming from federal sources.

We take great pride in the contribution of our faculty, centers, and alumni, who have made tremendous contributions in technology and engineering fields. This report highlights many of their accomplishments, and welcomes five new tenure-track faculty members across various departments within the School.

We are excited to share the achievements and advancements that have been made and welcome your interest and support of the research at the Grove School of Engineering.

Rosemarie D. Wesson
Associate Dean for Research

Research at the Grove School of Engineering

FY16 AT A GLANCE

$20 Million
RESEARCH AWARDS

$23 Million
RESEARCH EXPENDITURES

68%
FEDERAL FUNDING

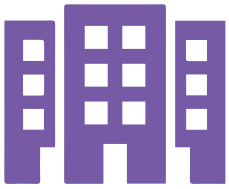
FACULTY MEMBERS

PH.D. STUDENTS

MASTER'S STUDENTS

6
DEPARTMENTS

5
PROGRAMS



213,696
TOTAL SQ FT IN BUILDING

82
RESEARCH LABS

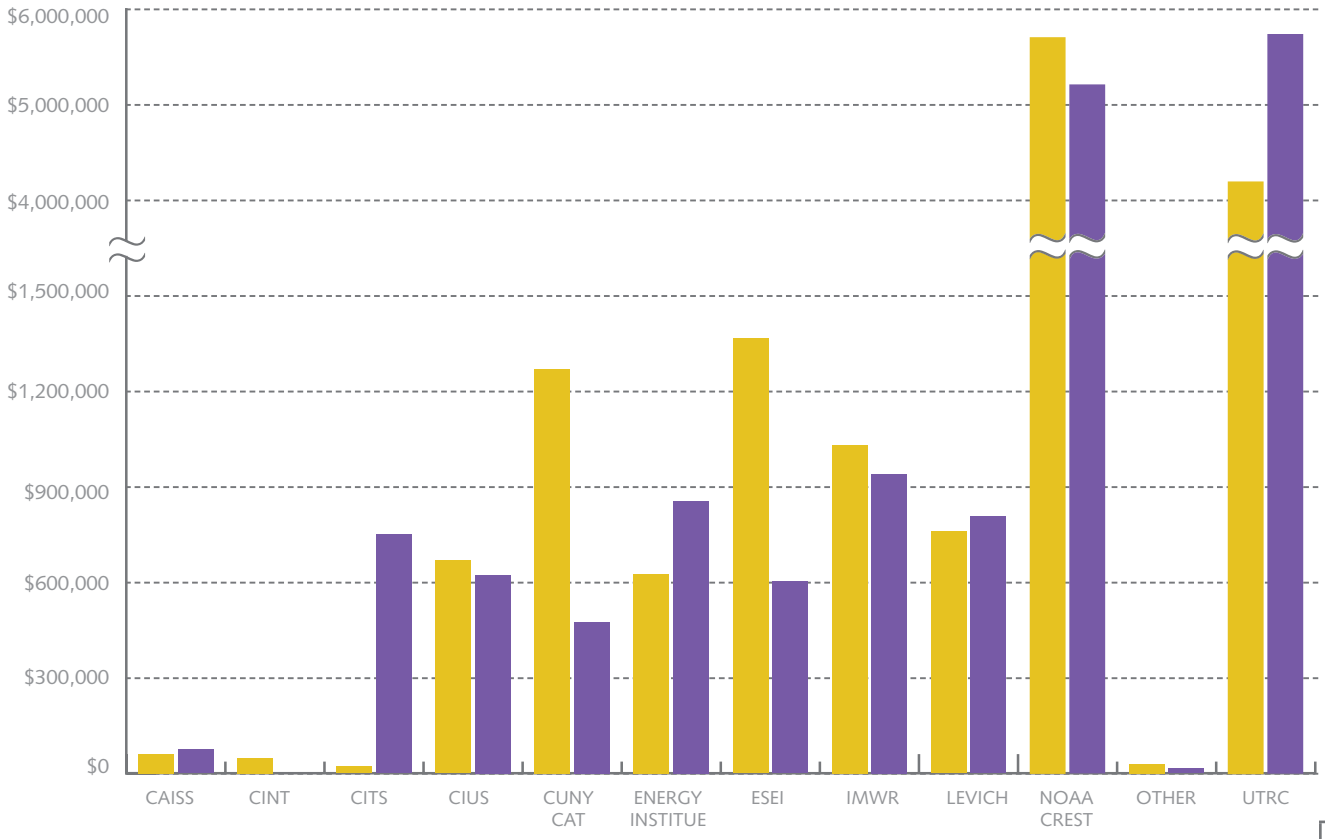
13
COMPUTER LABS

Center, Institute, and Department Listing

CENTERS & INSTITUTES	
NAME	ABBREVIATION
Center for Algorithms & Interactive Scientific Software	**CAISS**
Center for Information, Networking & Telecommunications	**CINT**
CUNY Center for Advancement of Technology	**CUNY CAT**
CUNY Institute for Transportation Systems	**CITS**
CUNY Institute for Urban Systems	**CIUS**
Energy Institute	**ENERGY INSTITUTE**
Environmental Science & Engineering Institute	**ESEI**
Institute For Municipal Waste & Management	**IMWR**
Levich Institute	**LEVICH**
NOAA-CREST	**NOAA-CREST**
Special Projects (FY16 includes Gateway)	**OTHER**
University Transportation Research Center	**UTRC**

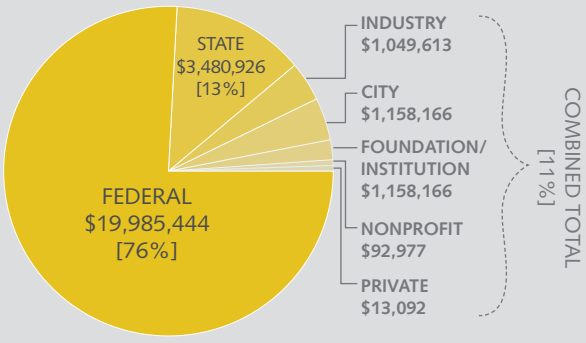
DEPARTMENTS	
NAME	ABBREVIATION
Biomedical Engineering	**BME**
Chemical Engineering	**CHE**
Civil Engineering	**CE**
Computer Science	**CSC**
Electrical Engineering	**EE**
Mechanical Engineering	**ME**
Programs: Computer Engineering, Earth & Environmental Engineering, Information Systems, Translational Medicine, Urban Sustainability	

RESEARCH AWARDS by Center and Institute in FY 2015 & FY 2016

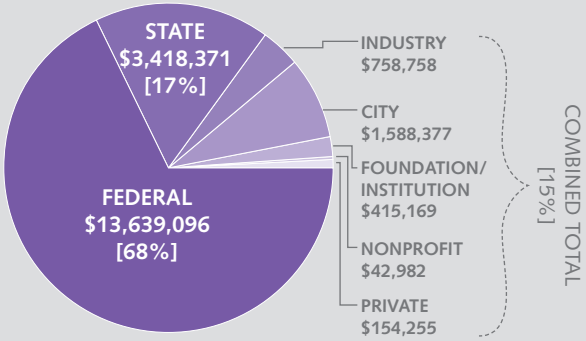


													TOTAL
FY2015	$55,331	$46,782	$20,051	$650,155	$1,236,784	$608,893	$1,329,381	$1,001,592	$739,431	$5,707,018	$26,842	$4,271,039	$15,694,299
FY2016	$74,000	—	$730,300	$607,075	$463,181	$833,946	$586,811	$915,000	$788,293	$5,120,690	$9,555	$5,771,467	$15,900,718

Research Awards Funding Sources

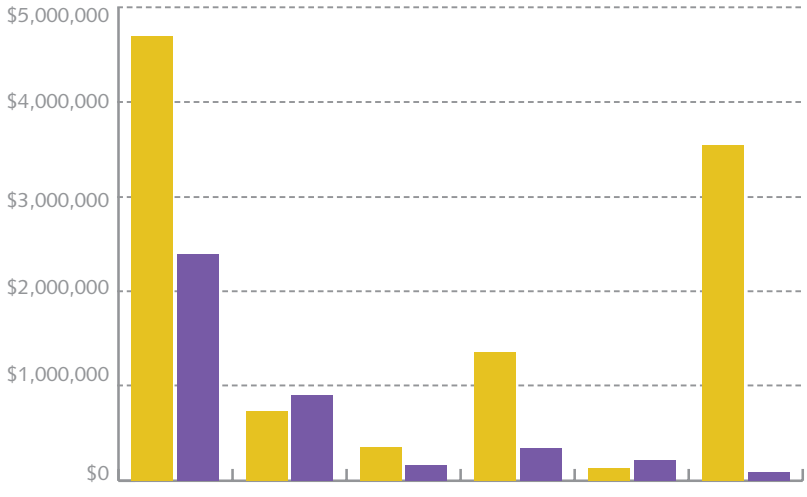


FY 2015: $26,517,012



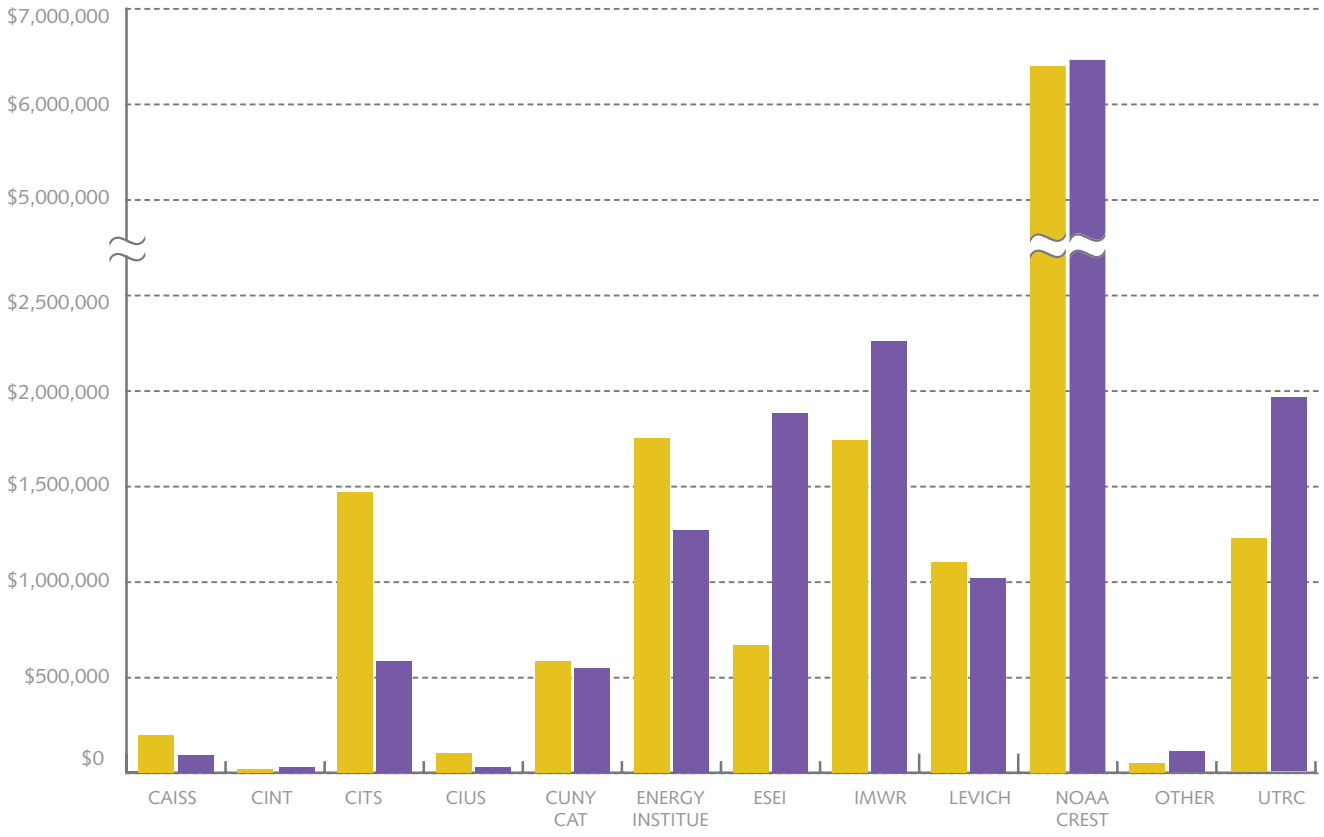
FY 2016: $20,017,007

RESEARCH AWARDS by Departments in FY 2015 & FY 2016



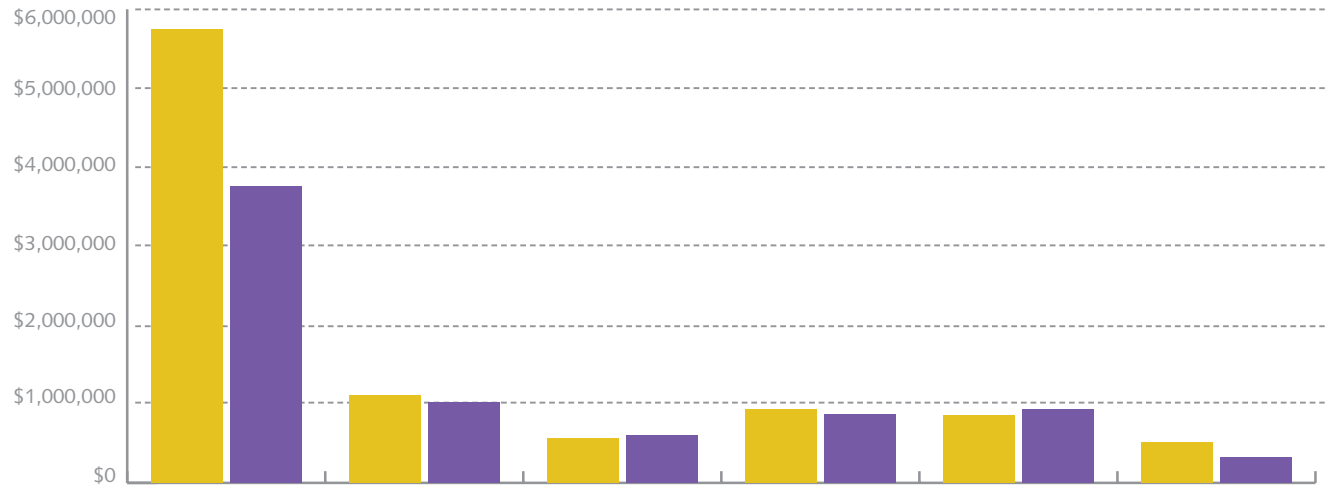
							TOTAL
FY2015	$4,696,432	$739,302	$351,129	$1,363,109	$128,166	$3,544,576	$10,822,713
FY2016	$2,395,054	$899,622	$167,459	$347,058	$221,020	$86,077	$4,116,289

RESEARCH EXPENDITURES by Center and Institute in FY 2015 & FY 2016



													TOTAL
FY2015	$204,548	$1,947	$1,473,308	$106,501	$686,944	$1,755,479	$672,634	$1,745,253	$1,107,471	$6,402,265	$22,584	$1,292,194	$15,471,128
FY2016	$97,674	$32,938	$588,596	$35,173	$556,232	$1,274,170	$1,880,138	$2,260,822	$1,020,325	$6,467,072	$264,361	$1,994,541	$16,472,043

RESEARCH EXPENDITURES by Departments in FY 2015 & FY 2016



							TOTAL
FY2015	$5,739,239	$1,106,713	$560,441	$929,981	$857,587	$518,824	$9,712,785
FY2016	$3,761,292	$1,023,183	$1598,372	$870,148	$935,927	$326,150	$7,515,072

FY 2015 FY 2016

“I love my job!”

Milovan Blair
CCNY, B.E. 1990
Senior Vice President for Central Operations
Con Edison Company of New York

Alumni Highlight

VIEW FROM THE HEIGHTS

With more than 10 million people in New York City and Westchester County counting on it for electric, gas and steam, Con Edison is one of the world’s largest energy delivery systems – and since his graduation from CCNY’s Grove School of Engineering, Milovan Blair sits near the top of the pyramid. The Grove School of Engineering caught up with him for an interview in his office high atop Con Ed headquarters.

Let's start at the beginning. Tell us about yourself, and how you got to CCNY.

MILOVAN BLAIR: I was the quintessential City College student, and I still see myself in today's engineering students. I was born and raised in Jamaica, where I benefited from the rigorous British education system. That, and loving and supportive parents gave me a great advantage, but it didn't mean things were easy for us. My parents came to New York looking for a better life. They worked hard, but like so many immigrants, they struggled when they got here. I joined them in New York in the mid 1980's. I knew I wanted to go to college – and of course my parents expected me to go – and I always wanted to be an engineer, but we didn't have much money. City College was not just an option – it was my only option. It was City College or nothing.

How did the Grove School of Engineering prepare you for your successful career at Con Edison?

MB: My engineering education at CCNY was excellent; it made me, I believe, technically competitive with the best graduates from the most prestigious public and private universities in New York, including Columbia, Cornell and Syracuse. More importantly, Con Edison believed it. In 1991, I was one of 26 recent grads chosen from more than 1,000 interviewees for the company's prestigious, career-building internship program. I got a once-in-a-lifetime opportunity to rotate through different departments, and to gain both the operational experience that helped me determine what direction I wanted to take and the leadership training that I needed to rise in the company. The rest, as they say, is history.

In addition to preparing you through education, did City College have anything specifically to do with the internship?

MB: Yes. City College was instrumental in scheduling on campus interviews with companies. I had the opportunity to interview with several and chose to come to Con Edison after a successful on campus interview. I was hired into their Internship Program, at the time, I had no idea that I would be here in this office all these years later.

So what are you actually responsible for?

MB: There are really two sides of energy operations: transmission (the generation of all the power our users will need), and distribution (sending that power from substations all around the city and Westchester to end-users). As Senior VP for Central Operations, I'm in charge of a team of 3,575 on the transmission side – responsible for planning, designing, operating and maintaining the company's electric transmission system, substations, primary control center, steam generating plants, steam distribution system, and engineering and construction activities.

What are the most important challenges that you face today?

MB: I would say that they lie in the intersection of sustainability and new technology. Energy sustainability in a warming world is a global challenge, and Con Edison is a major player in this arena. We will do our part to continue to develop and maintain sustainable sources, and of course as a business we face new competitors in this field. We must also develop and integrate new technologies for energy generation and distribution – many of them "greener" and all of them more efficient – into an infrastructure that traces its beginnings to 1823. We are always juggling cost and consequence.

In recent years, Grove engineering students have participated in several research projects with Con Edison engineers. Can you describe one or two?

MB: City College engineering students have worked with our engineers on several technologies to improve efficiency and cost-effectiveness. Students have prototyped an inexpensive thermoelectric generator to convert a small amount of heat from a customer's meter station piping into electricity in order to power a meter with built-in totalizer; success here saves a lot of money. Another group worked on a way to cut the repair time for underground steam piping facilities that have been flooded; they successfully tested both the software and a physical model of injecting hot air to pre-heat sections of a flooded steam main. These are just a few of the real-world problems that CCNY students are getting a chance to solve here at Con Ed.

In addition to your work, you spend personal time mentoring young people and serving on several non-profit boards. As a member of the External Advisory Board of the Grove School of Engineering, your connection to the school is particularly strong. What would you say to Grove School students today?

MB: I would tell them, 'Work as hard as you can, and then some – then wear your CCNY credentials with confidence. You are even more fortunate than I was. Now you have more world-class professors, like Sanjoy Banerjee, Director of the CUNY Energy Institute. You have opportunities as undergrads that I did not for internships and real world, applied research. Grab them, and you will be able to compete with the best for the career that you want.' In fact, as a board member, I hope to see the college create even more undergraduate internships and course work more applicable to corporate America.

You sound like a man who likes his job.

MB: I *love* my job. Every day is different, and everyday is a challenge. City College set me on this path; there's a direct line from the Grove School to this office. I will always be grateful for that.

Dr. Camille Kamga, Director
Assistant Professor, Civil Engineering

"Our primary focus is the stewardship, management, and future evolution of already mature transportation systems, in the context of rapidly changing demand and disruption. In addition to the rich research capabilities of CCNY and our partner institutions, the Center has over this past year organized many seminars, conferences and training sessions for transportation researchers, practitioners, civic organizations, non-profits, and government policy makers on the local, state and national level, and continues to educate the engineers and economists who will be the transportation leaders of the future."

Research that Builds our Cities:

The University Transportation Research Center – Region 2

BACKGROUND

The world's great cities serve as the engines of our economies and the generators and keepers of our cultural and intellectual capital, and they depend upon the efficient transportation of people, goods and services that comprise their lifeblood. Today, natural disasters, increased physical and cyber security vulnerabilities, aging and failing infrastructure, environmental degradation and disruptive technologies challenge the management and growth of these centers of civilization.

The Region 2 University Transportation Research Center at City College is one of ten original Centers established by Congress in 1987 with the recognition that transportation plays a key role in the nation's economy and the quality of life of its citizens. UTRC is the designated University Transportation Center representing the U.S. Department of Transportation (USDOT) Region 2, including New York, New Jersey, Puerto Rico, and the U.S. Virgin Islands; City College functions as the lead institution of this consortium of eighteen universities.

Over the past 10 years, UTRC has attracted $67 million in funded research, not only from its major funder, the USDOT, but also from regional and local transportation agencies. Its current research is focused on issues concerning the operation, expansion and maintenance of the region's vast networks of the increasingly complex intermodal and multimodal systems that must meet the needs of a growing and demanding customer base.

FOCUS ON SMART TECHNOLOGY: CONNECTED VEHICLE PILOT DEVELOPMENT

For the past decade, the USDOT has been interested in testing whether the technology that enables cars, busses and trucks to communicate with each other, and with elements of the transportation infrastructure, could significantly prevent or reduce the impact of millions of accidents every year and also improve mobility. In 2015, in a competitive process, USDOT selected New York City as one of three sites for its Connected Vehicle (CV) Pilot Development program. UTRC is a significant member of the New York City team, which will install Vehicle-to-Vehicle (V2V) technology into 8,000 city-owned vehicles, including city-owned cars, taxis, busses and trucks that frequently travel in Midtown Manhattan, as well as Vehicle to Infrastructure (V2I) technology throughout Midtown and Flatbush in Brooklyn.

Dr. Camille Kamga is a key member of the project team performing the pilot, in partnership with the New York City Department of Transportation. The largest Connected Vehicle technology deployment to date, the $20 million award is designed to evaluate the use of CV technology to improve the safety of travelers within this dense urban transportation network, bring New York City closer to its Vision Zero goal of eliminating traffic deaths. It is intended to measure the potential impact of the technology, and uncover the technical and non-technical barriers to its deployment.

UTRC MEMBER UNIVERSITIES

The City University of New York
Clarkson University
Columbia University
Cornell University
Hofstra University
Manhattan College
New Jersey Institute of Technology
New York Institute of Technology
New York University
Rensselaer Polytechnic Institute
Rochester Institute of Technology
Rowan University
Rutgers University
State University of New York
Stevens Institute of Technology
Syracuse University
The College of New Jersey
University of Puerto Rico Mayaguez

Connected Vehicle technology enables communications between travelers and infrastructure within a transportation network through a wireless technology called Dedicated Short Range Communications. It can be deployed in vehicles, mobile devices, and at infrastructure locations such as intersections, roadway curves, and work zones. The technology enables Vehicle-to-Vehicle (V2V) communications, which include warning drivers that a vehicle in the next lane is in their blind spot or that they are about to rear-end a vehicle in front of them. Devices in vehicles can also communicate with devices installed in transportation infrastructure – Vehicle-to-Infrastructure (V2I) communications – warning drivers that they are driving over the speed limit and approaching a dangerous curve.

PHASE I

Phase I of the project began in September 2015, consisting of the development of a comprehensive deployment plan for the rapid and efficient rollout of the CV technology. This phase was completed in September 2016.

PHASE II

Phase II, scheduled for FY 16-17, consists of the installation of V2V technology in 8,000 fleet vehicles, including taxicabs, MTA buses, and city-owned vehicles. The diverse and widespread locations covered by these large fleets ensure that the technology has a chance to perform over a wide area and under many different roadway conditions, including surface streets, tunnels and bridges, and higher speed, limited access highways. V2I units will be installed in sites in Manhattan and Brooklyn, including along a segment of the FDR Drive on the east side of Manhattan, along five heavily trafficked avenues in Midtown Manhattan and Brooklyn, as well as at fleet terminal facilities, airports, and bridges and tunnels. These diverse locations present a range of different challenges for CV technology to deal with, including heavy vehicular and pedestrian traffic, short-radius curves, and over size restrictions.

PHASE III

Phase III is scheduled for an 18-month operational period beginning in the summer of 2018, when the technology is active and data is collected for the evaluation of the system's benefits and overall operations.

Asked about the impact of this pilot project, Dr. Kamga points out that the rise of both self-driving and driverless cars suggests that the automobile industry may become the primary driver for which Connected Vehicle technologies will be widely adopted and what they will provide – although current smart car technologies have a more limited range, rely on line-of-sight, and are more expensive than the technology used in this project. The analysis of the data that UTRC's Connected Vehicle Pilot Program collects, however, will provide foundational information about how traffic moves around NYC. And it may well raise new possibilities for public-private partnerships, with the public sector installing the technology in the city's transportation infrastructure, and industry or individual vehicle owners using that connection to ensure safer, faster and more efficient travel.

Finding A Way To Manage Urban Freight Transport Sustainably

Dr. Alison Conway
Assistant Professor, Civil Engineering

At CCNY, Dr. Conway teaches courses in transportation engineering and planning and conducts research primarily in the areas of commercial freight policy and logistics, sustainable freight transportation, and multi-modal interactions in the urban environment. In addition, she is an associated faculty member of METROFREIGHT, a Volvo Research and Education Foundation Center of Excellence in Urban Freight. She currently chairs the ASCE Transportation and Development Institute's Freight and Logistics Committee, is the Vice Chair of TRB's Freight Data Committee, and is a member of TRB's Urban Freight Committee. Dr. Conway holds Ph.D. and Master's degrees in Civil Engineering from The University of Texas at Austin.

The amount of commercial freight being delivered in every large metropolis, the vast majority of which moves by truck, is increasing by leaps and bounds, along with congestion, noise, and pollution on our city streets. This is exacerbated by the fact that legacy infrastructure that accommodates those trucks is shrinking; more and more of it is dedicated to bicycles, pedestrians and mass transit. We want our stuff, we want it now, we don't want to pay more for it, and we want cleaner air, less noise and less traffic congestion in the bargain. Perhaps above all we want safer streets. These differing demands are not easily reconciled. It's a perfect storm, and it is buffeting New York City and its sister cities around the world.

This is the kind of challenge that Alison Conway, Assistant Professor of Civil Engineering at The City College of New York and the Associate Director for Education at the Region 2 University Transportation Research Center, attempts to address. Her paper, "Cargo cycles for local delivery in New York City: Performance and Impacts," co-authored with graduate students Jialei Cheng and Dan Wan and colleague Camille Kamga, won the prestigious Best Paper Award for the Freight Transport and Logistics track at the 14th World Conference on Transport Research (WCTR) in Shanghai in 2016. The WCTR is an international association of transport researchers whose triennial meeting attracts more than 1,000 researchers from around the world. Dr. Conway's paper was chosen from among 113 papers submitted.

Dr. Conway, whose research was funded by the New York State Energy Research Development Authority and the New York State Department of Transportation through UTRC at the Grove School, developed and implemented a method to compare the traffic performance (delivery speed), space consumption, and emissions impacts for freight delivery by human powered cargo cycle and motorized vehicle in Manhattan. She and her team collected data from six equipped vehicles: four cargo cycles operated by two local operators, and two trucks also

Focus on Research: Civil Engineer Alison Conway

operated by one of the cargo cycle companies. Their analysis of the data compared three traffic performance measures for each operator and vehicle type: speed, stopped-time delay: travel time ratio, and delivery or pick-up time. Finally, a hypothetical vehicle replacement scenario for one operator was evaluated using the estimated traffic performance measures as inputs for footprint estimation and vehicle emissions modeling.

Overall, results from this analysis suggested that cargo cycles can provide a competitive last-mile delivery option for local operators in New York City under some conditions. Although speeds were variable between the two cargo cycle operators because of differences in the loads carried, driver conditions, and the nature of the business, cargo cycles demonstrated that they *can* compete with the speed of trucks in several scenarios, most notably in very congested areas and where cargo cycles are able to operate on off-street paths or opposite to the direction of motor vehicle traffic. Cargo cycles also produced considerable space and emission savings. As the city's bike network continues to expand, trucking is likely to be increasingly negatively impacted, making cargo cycles even more speed competitive, although they cannot necessarily compete with the economies of scale that the more capacious trucks rely on.

Asked what next steps her findings compelled, Dr. Conway laughed, "Of course, I'm an academic – we always want more data! We did show that there are ways that "green" delivery – human-powered cycles – can be safe, cost effective and environmentally friendly. But clearly we need to more broadly evaluate the market potential for cargo cycle operations in NYC; operators of larger supply chains will have to weigh the potential for reduced costs from congestion and parking against other logistics costs, such as a driver wages and the space required for transloading. For operators moving larger *volumes* of goods, cargo cycle operations may be prohibitively expensive. I don't think we will ever completely replace trucks in the city. There are so many more scenarios with different variables than we were able to test this time; to scale up the advantages that our study reveals, we simply need more information about when, where and how we can expand the use of human powered cycles to compliment the use of trucks to improve the quality of life in the city as its delivery infrastructure changes. The challenges are not going to get any easier."

Dr. Conway goes on to make another important point. City planning boards and state and municipal departments of transportation govern public transit, bike lanes, parking rules and pedestrian access; New York State could, for example, lift the current ban on electric assist motors for delivery cycles – which would in turn expand the weight they can carry and the distance they can travel. But freight has always been viewed as a purely private-sector enterprise. "We need", she adds, "to bring solid data about the needs of truckers to the table when policy is being made. We cannot outrun this 'perfect storm.' We have to weather it."

PICTURED FROM LEFT TO RIGHT: Dr. S. Jim Gates, Dr. Pramod Khargonekar, Dean Gilda Barabino and Mr. Anthony Joseph DiNardo ('64 EE)

Grove School of Engineering Research Day

The following is adapted from an article written by Ramona Maben.

In May, the Grove School of Engineering presented Research Day 2016 which included CCNY engineering students and a renowned group of speakers. The purpose of the symposium was to begin a dialogue centered on cutting edge research and discuss the research projects of our faculty and students. The event gave students the opportunity to engage with industry representatives and to showcase the outstanding engineering research conducted at CCNY.

CCNY President Dr. Lisa S. Coico welcomed the guest speakers and advised the students to take the opportunity to reach out and connect with the distinguished guests. Dr. Gilda Barabino, Dean and Berg Professor at the Grove School and Dr. Rosemarie D. Wesson, Associate Dean for Research, also provided welcoming remarks.

The keynote speaker was Dr. S. Jim Gates, Jr., a Distinguished University Professor at the University System of Maryland. Dr. Gates is a Regents Professor and John S. Toll Professor of Physics at the University of Maryland, member of the US President's Council of Advisors on Science & Technology and recipient of the National Medal of Science. He is the co-author of "Superspace" and is a leading authority on superstring theory. Dr. Gates told his heartwarming story of how science fiction comic books inspired him as a young man. Sparked by a fascination of unknown worlds, Dr. Gates furthered his knowledge by identifying, studying and pursuing what became a professional passion in the areas of biology and technology. Dr. Gates' motivational words encouraged participants to be limitless in their pursuit to understand and advance their research interests.

In addition to Dr. Gates remarks, Mr. Anthony J. Dinardo, the Chief Scientist for Space Based Infrared System Payload at Northrop Grumman Corporation and GSOE alumnus ('64 EE), spoke on the topic of the future of research. Mr. Dinardo noted research at the university level is one of the most powerful avenues that we have for the development of new innovations. Additionally, Dr. Pramod Khargonekar, Assistant Director for the Directorate of Engineering at the National Science Foundation gave a presentation that emphasized the importance of design and creativity in research. He discussed innovations at the nexus of natural resources and nanotechnology.

Research Day 2016 also included a graduate student poster session, which included topics on bioengineering, devices & instrumentation, energy, and environmental and materials-related research. More than 50 students participated in the poster session and infused great excitement throughout the School. In presenting their work, the students were passionate toward making positive, direct and meaningful changes that impacted society. The sustainable, eco-friendly systems, programs and machinery displayed illustrated the care the students have about the environment, sustainability and energy conservation.

The students and the alumni of The Grove School of Engineering are developing a myriad of innovative technologies, all of which serve to benefit society. Through continued partnerships with the private and public sectors, the future of our students and faculty is bright.

For the full article, visit the Harlem Times
http://theharlemtimes.com/education/the-grove-school-of-engineering-research-day

New Faculty

The Grove School of Engineering welcomes five new tenure track faculty members. Their research spans various sectors of engineering, computing, and technology.

JACEK DMOCHOWSKI

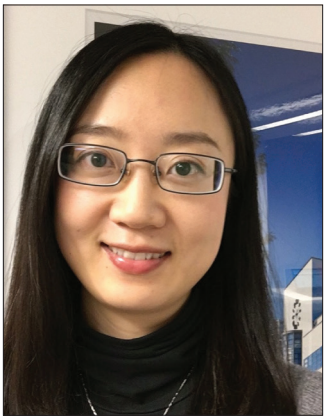
Biomedical Engineering

EDUCATION:

Ph.D., Institut National de la Recherche Scientifique
B.S. and M.S., Carleton University

RESEARCH:

Dr. Dmochowski studies the decoding of human brain activity. He records neural activity using EEG and functional MRI while human participants perform behavioral tasks or are exposed to natural stimuli. This research has the potential to increase our understanding of how the brain represents its environment and directs action. He also studies non-invasive brain stimulation. Dr. Dmochowski investigating techniques that perturb neural activity in a specific and reversible manner. The goal of his work is to advance neuromodulation for clinical interventions and to increase our ability to interrogate brain circuits.



JING FAN

Mechanical Engineering

EDUCATION:

Ph.D., The University of Hong Kong
B.S. and M.S., Shandong University

RESEARCH:

Dr. Fan's research interests lie in the areas of microfluidics, complex fluids, and soft materials. She uses microfluidic technology to design functional materials at the micron-scale. The materials are useful for targeted delivery, optics, tissue engineering, biomedicine, petroleum engineering, and environmental engineering. Dr. Fan also uses microscale functional materials to build experimental model systems to study a variety of problems on the dynamics of complex fluids, such as the coupling of transport processes in biological tissues, enhanced oil recovery and flood conformance control, physics and applications of microfluidics, and foam/emulsion physics.

ROBERT MESSINGER
Chemical Engineering

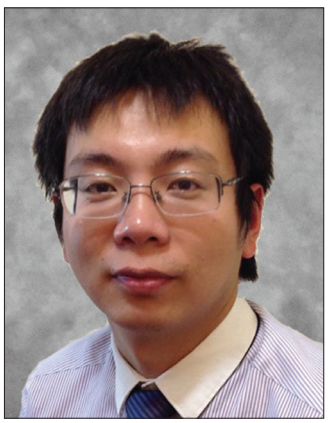
EDUCATION:
Ph.D., University of California, Santa Barbara
B.S., The Ohio State University

RESEARCH:
Dr. Messinger designs and synthesizes novel materials and devices for energy and engineering applications, with a strategic emphasis on measuring, understanding, and controlling the molecular-scale phenomena that govern their macroscopic functions. Advanced spectroscopic, diffraction, and electrochemical methods, including multi-dimensional solid-state nuclear magnetic resonance (NMR) spectroscopy, are used to study material properties from the atomic length scale. Novel rechargeable batteries composed of low-cost, earth-abundant elements are of current interest, such as rechargeable aluminum metal batteries.

HUY VO
Computer Science

EDUCATION:
B.S. and Ph.D.,University of Utah

RESEARCH:
Dr. Vo focuses on large-scale visualization, big data systems, and scalable displays. He is one of the co-creators of VisTrails, an open-source scientific workflow and provenance management system, where he led the design of the VisTrails Provenance SDK.



BO YUAN
Mechanical Engineering

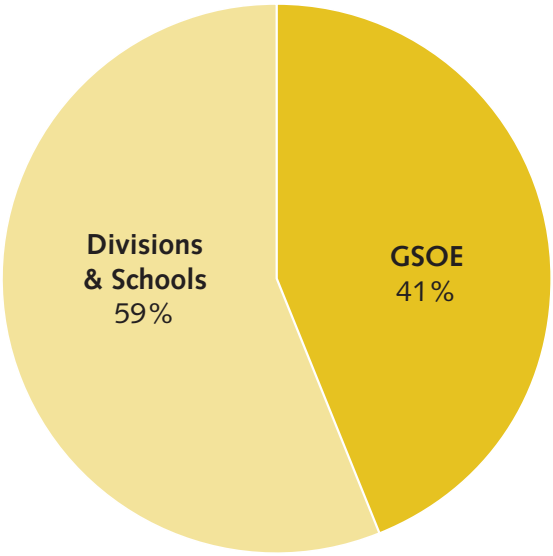
EDUCATION:
Ph.D., The University of Hong Kong
B.S. and M.S., Nanjing University

RESEARCH:
Seeking to address the emerging challenges for designing efficient computing systems in the exciting artificial intelligence (AI) and Internet-of-Things (IoT) eras, Dr. Bo Yuan's lab focuses on the algorithm and hardware co-design for various information processing systems, including large-scale machine learning, signal processing, next-generation high-speed wired/wireless communication and ultra-high density storage systems. By performing optimization at various design levels (algorithm, architecture, circuit) as well as highly integrating domain knowledge during the design flow, we aim to develop energy-efficient, ultra-reliable, low-latency and high-throughput general and specific computing system to satisfy the energy, security and speed requirements over the next decades.

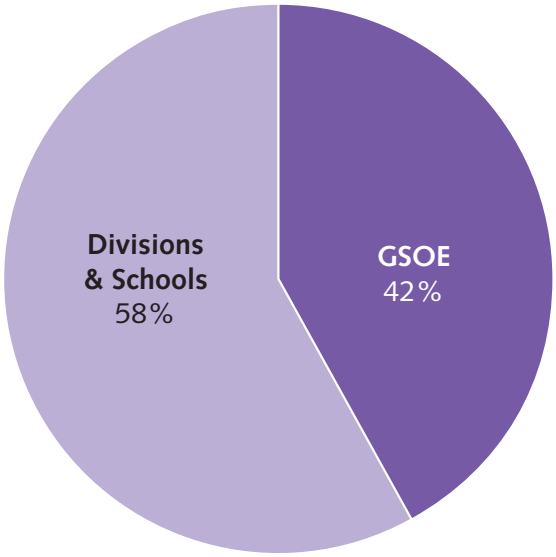
CCNY EXPENDITURES*

SCHOOLS & DIVISIONS:

- Administration
- Sophie Davis School of Biomedical Education
- Division of Science
- Division of Humanities and the Arts
- Division of Interdisciplinary Studies
- Powell School of Civic and Global Leadership
- The Bernard and Anne Spitzer School of Architecture
- School of Education



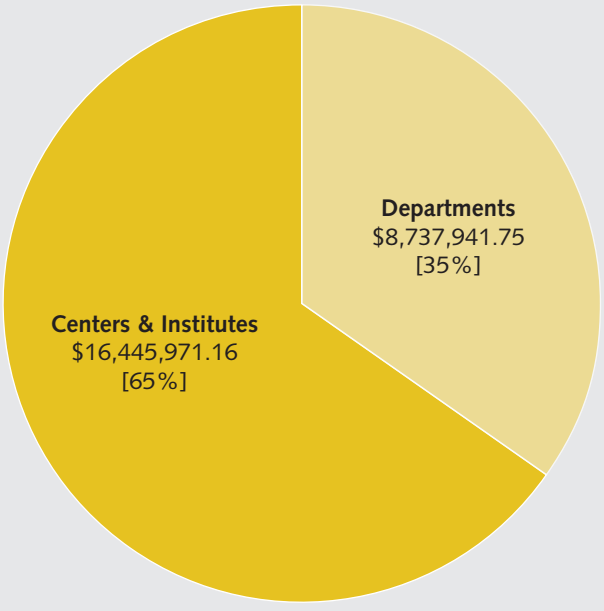
FY 2015



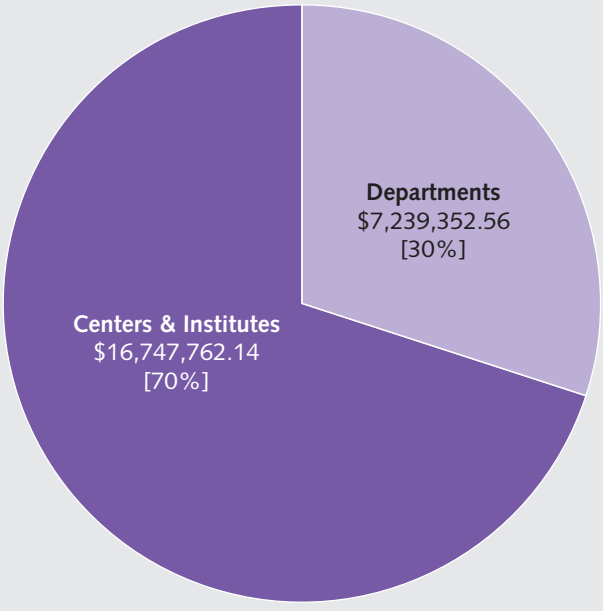
FY 2016

*Source: RF Research Report

GSOE RESEARCH EXPENDITURES BY DEPARTMENTS AND CENTERS/INSTITUTES



FY 2015



FY 2016

The City College of New York

The Grove School of Engineering

WRITERS: MARY LOU EDMONDSON & LOLA BROWN DESIGN: JOANN HUANG

160 CONVENT AVE, NEW YORK, NY 10031
WWW.CCNY.CUNY.EDU/ENGINEERING | 212-650-5435

CUNY