

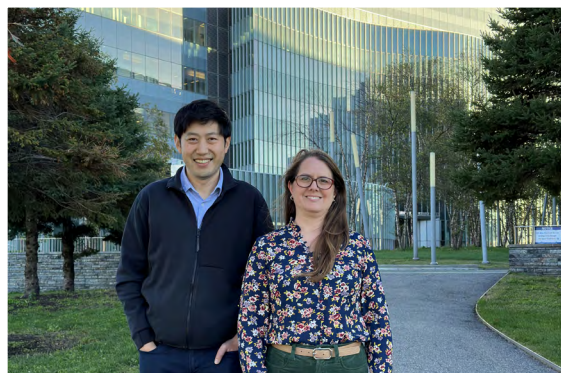
Shepard Hall and Quadrangle - The City College of New York (CCNY) 1904

Chemical Engineering Newsletter

Two ChE Associate Professors Win \$1.7 M in Federal Grants

Professors **Xi Chen** and **Elizabeth J. Biddinger** secured a combined total of \$1.7 M in federal funding this past summer 2023. Prof. Chen was awarded a National Science Foundation (NSF) CAREER Award. Prof. Biddinger received a U.S. Department of Energy (DOE) grant. Both of them also received NSF collaborative grants.

Prof. Chen received the prestigious NSF CAREER Award (\$538,547), which will support him and his research team to advance the field of “hygroscience”—an emerging area of research that seeks to harness the power of water evaporation for water harvesting, locomotion, green chemistry, and renewable energy generation. He is recognized as a leader in the fields of hygroscopic materials and evaporation energy harvesting. This year, his research resulted in publications in *Nature*, *Nature Communications*, and *Small*. In addition to the CAREER award, Prof. Chen was also awarded a collaborative research grant from NSF (\$173,091) this summer. He and his collaborators, Prof. Raymond Tu at CCNY and Prof. Jin Kim Montclare at NYU, will attempt to engineer proteins into high-performance water-responsive materials.



Prof. Xi Chen & Elizabeth J. Biddinger

Prof. Biddinger is expanding her research into the area of liquid organic hydrogen carriers (LOHCs) for long duration energy storage and transport with two grants awarded in August 2023. The energy associated with hydrogen in chemical bonds can be stored in LOHCs avoiding handling compressed or cryogenic H₂. This strategy leverages the carbon backbone of organic molecules to exchange hydrogen, reversibly, without emitting CO₂. Prof. Biddinger received \$562,500 from the DOE Funding Accelerated, Inclusive Research (FAIR) program to work with Dr. Juan Lopez-Ruiz at Pacific Northwest National Laboratory (PNNL) on electrochemical cycling of LOHCs using flow electrochemistry. Her team will work closely with PNNL that includes an opportunity for her PhD students to intern there. As part of NSF’s Environmental Convergence Opportunities in Chemical, Bioengineering, Environmental, and Transport Systems (ECO-CBET), she received \$425,000 in the program to work with a collaborative team from Lehigh University, University of Oklahoma, and NYU to research thermal and electrochemical cycling of LOHCs and evaluate how they could be deployed.

MESSAGE FROM THE CHAIR



Prof. Marco Castaldi, Chair

Dear CCNY ChE Community,

This is my first newsletter as Chairman of the department and it is a great honor for me to be in this position. I want to thank Prof. Kretzschmar for her outstanding leadership, dedication and enthusiasm to ChE for the past seven-and-a-half years. She has set ChE on a solid foundation and made significant progress in setting the stage for ChE to excel well into the future. I know it will not be easy to match her performance, but I promise that I will dedicate myself to the advancement of the department over the next three years. I have a great model to follow and she has promised to help guide me. Prof. Kretzschmar is now on a well-deserved sabbatical at University of Melbourne and periodically participates with us. We are managing without her, yet eagerly await her return. We welcome back Profs. Morris and Biddinger from their sabbaticals and look forward to the new energy and ideas they will bring to the department and the students.

In the last newsletter, Prof. Kretzschmar provided my professional background and I would like to add my personal background and why City College is personally very special to me. I am a first-generation college student, born in The Bronx, and am a second generation Italian-American who greatly values the United States and the liberty and opportunity it provides. While I did not attend CCNY, I have always known it to be a premier engineering school that produced solid technical and professional leaders. Upon graduation from UCLA with my PhD in ChE, I am finally here at CCNY after three tries, and truly charmed. I have a 1965 Ford Mustang and love the muscle cars of the '50s, '60s and '70s and greatly appreciate the vintage models. I enjoy working on the Mustang but have an everyday car that is a beauty – the Alfa-Romeo Giulia. You may be thinking that kind of enthusiasm is normally found in mechanical engineering, yet the cars would be expensive garden ornaments if it weren't for the fuels that power the engines. That is one of the areas of my research and the group I lead, The Combustion and Catalysis Lab (CCL) that focuses on renewable and environmentally benign energy technologies and processes.

Going forward I will be focused on gaining more visibility for CCNY ChE domestically and internationally. I am hoping we can count on you to help with this effort. An analysis that I have done and presented to the faculty during our August retreat reveals that, based on all the typical metrics, our department is on-par with any top department in any institution. We routinely receive large grant awards, participate and engage in technical societies, have high publication rates and receive numerous lecture invitations. Yet we do not share the prominence that is commensurate with that productivity. In fact, our faculty are hitting on all cylinders in important areas that make great departments. For example, Prof. Xi Chen has received the NSF CAREER Award making it three for three in career awards (2 NSF & 1 DOE) among our recent assistant professors. Prof. Elizabeth Biddinger has secured two major funding grants. Prof. Morris is currently the President-elect of The Society of Rheology, which is the original soft matter professional society and has a very large international membership. This is a well-deserved recognition and a great follow-up to his Bingham Medal award. I have been elected as Chair of the Material & Recovery Division of ASME, for which I am a Technical Fellow. Our students, both graduate and undergraduate, continue to excel. Several of our students, highlighted in later pages, have obtained top jobs from companies such as Intel, GE Aerospace, Macronix/IBM, and attend international and domestic conferences where they present their research findings. One of our undergraduates, Isabella Huang, class of 2024, was featured in the CCNY newsletter, "CityBeat" for her activity in research labs. This is just a sample that demonstrates our department's productivity.

We announced in the last newsletter that Dr. Dominick Mazzone (ChE ME '82, PhD '86) led a fundraising effort to name our Unit Operations Lab in honor of Professor Emeritus Harvey L. List. The opening ceremony was attended by nearly 80 alumni and guests and included opening remarks from CCNY President Vince Boudreau. We have welcomed our 2nd Tardos Lecture Series recipients, Drs. Mario Huber and Jinjiang Li from Bristol-Myers-Squibb, who will co-teach the Powder Science and Technology course. We are ecstatic that we received a very generous donation from one of our alumni that will provide \$1 Million over ten years to support student research exchanges for graduate and undergraduates to spend up to six months at an institution to conduct research and solidify collaborations. I anticipate this will help raise the external profile of CCNY ChE.

In closing, I am honored to be in such an important position with the support of an outstanding, collegial and dedicated faculty and student body. I am excited about the future and will work hard to further improve by building on past successes while maintaining the strength and traditions that make this a great place to live, work, dream and explore. You already know that and now it is time for the world to recognize it.

— Marco J. Castaldi

More Pictures from the Harvey L. List Event



(L-R) Amos Avidan (ChE PhD '80), Connie and Dominick Mazzone (ChE ME '81, ChE PhD '86)



Elaa Hilou (ChE BE '13)--middle--with her sister & Prof. Marco Castaldi



(L-R) Dean Couzis, Connie Mazzone, Morton Denn, David Rumschitzki & Dominick Mazzone



(L-R) Michel Orsi & Dennis Burgner



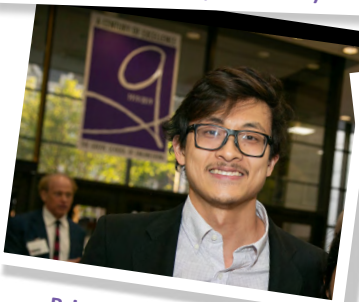
Arnold Stancell (ChE BE '58)



(L-R) Dean Couzis, President Boudreau, Lisa Taylor & Chair Kretzschmar



Prof. Raymond Tu presenting students' experiments



Brian Chen (ChE BE '18)



(L-R) Nicole Donovan, Baseemah Rucker & Gershon Starr



(L-R) Philippe Jean-Baptiste (ChE BE '21), Prof. Carol Steiner & Arlind Kacirani (ChE BE '21)



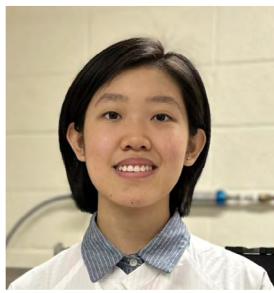
(L-R) Dean Couzis, President Boudreau & Chair Kretzschmar



(L-R) Moses Chilunda, Michel Orsi, Surabh KT, Sarvar Talipov & Umar Farooq

ChE-BE Student Highlights & OXE Club Updates

Undergraduates Get Hands-on Experience at Summer REUs



Isabella Huang
(Class of 2024)

Senior **Isabella Huang** was one of 10 students selected to participate in the NSF-funded ChemE-NYC: Climate and Health Solutions REU (Research Experiences for Undergraduates) at Columbia University over the summer of 2023. This was her second summer there; the year before she was a Columbia University—Amazon SURE Fellow and had worked on a project studying Polymer-Grafted Nanoparticle (GNP) membranes with Dr. Sanat K. Kumar's group. She returned to Kumar's lab this summer and worked on a different project that focused on upcycling polymer blends. Upcycling is the process of improving upon a used material, such as semicrystalline plastic waste which contains different types of polymers, and turning it into a better product than before. The goal of this project is to enhance the mechanical properties of semicrystalline polymer blends. Isabella learned how to use analytical instruments such as a Differential Scanning Calorimeter (DSC), and a Scanning Electron Microscope (SEM) to characterize her samples and she interpreted Small Angle X-Ray Scattering (SAXS) data for polymer blend of different configurations. Through this analysis, she found that their method of treating the polymer blends does enhance the mechanical properties, indicating success. The summer

concluded with presentations of all REU projects to students and faculty. Outside of the lab, the REU provided opportunities for the students to attend weekly research presentations by faculty, tour the Regeneron facilities, and learn about entrepreneurship at the Columbia Start-Up Lab.

Junior **Maty Gueye** participated in an REU program at Columbia University during the summer of 2023. Her research was mainly focused on Computational Fluid Dynamics. The project was the study of the drafting, kissing and tumbling of two circular metal intruders in granular materials. Fluidization is the process in which solid particles are suspended and behave like a fluid when subjected to an upward flow of a fluid (air). The group she worked with introduced two metal intruders in a fluidized bed filled with glass beads to see their interaction and behavior within the bed. Initially, two intruders are placed one on top of the other. In the drafting stage of motion, the upper intruder approaches the lower intruder due to the low pressure in the wake of the lower intruder. In the kissing stage, the intruders come into contact or briefly touch each other while moving through the granular material. In the tumbling stage, the upper intruder pushes the lower intruder aside and takes the lead. This study is applicable to robotics, natural phenomena and geotechnical engineering.



Maty Gueye
(Class of 2025)



Omega Chi Epsilon (OXE) Chemical Engineering Honor Society

Building upon the efforts of the previous e-board, OXE has been re-energized this semester! The objectives of OXE are to build a community and engage with and meet the needs of all chemical engineering students through trips, hands-on activities, sharing resources (like their 'Guide to ChemE'), and continuing the department's student-alumni mentorship program, ChAMP.

So far, OXE has held a resume workshop and organized a trip to a wastewater treatment plant facility. The trip was a great opportunity to observe an engineering workplace and apply coursework to real life. Recently, the e-board and alum Long Ng (ChE BE '18) kicked off the fourth year of ChAMP as well. Coming up are study sessions and a graduate student roundtable. They are working hard to plan more events and fundraisers, so stay tuned!



ChE-BE students visit the Newtown Creek Wastewater Treatment Plant in Brooklyn

CCNY Omega Chi Epsilon Leadership 2023-2024

President: Jie Yi (Debbie) Cheong

Vice-President: Terena Tsao

Treasurer: Mohammad Arif

Secretary: Fariha Islam

Alumni & Outreach Event Chair: Jamie Rowland

PhD Students Engage in International Research

Doctoral Students Go Abroad to Form Global Connections



Dennis Burgner

Dennis Burgner has been working on the National Science Foundation's (NSF's) Partnerships for International Research and Education (PIRE) Project since joining Prof. Jeff Morris' Lab, including an internship at INRAE in Anthony, France from January to July 2022. The PIRE Project consists of four thrusts seeking to understand multiphase fluid phenomena and working with multiple international collaborators, with Dennis working on the thrust dedicated to gas hydrates. Gas hydrates are particles that form when water is brought to near freezing temperatures and exposed to a guest compound at elevated pressures. Dennis has been studying these particles and the aggregates they form by examining the bulk fluid properties with a traditional rheometer. The internship at INRAE, under the tutelage of Dr. Laurence Fournaison and Dr. Anthony Delahaye, enabled him to study gas hydrate slurry within a flow loop as well as measure in situ particle size by using a Focused Beam Reflectance Measurement (FBRM) probe. The objective is to build a model that predicts the formation and behavior of gas hydrates. An accurate model would help prevent hydrate plugs from stopping flow within offshore oil drilling platforms and could enable hydrates to be used as a means of refrigeration or CO₂ storage.

Jungeun "Jay" Park from Prof. Rob Messinger's group performed two 3-month internships (fall of 2022 & 2023) - with international PIRE collaborator Dr. Ulrich Scheler (IPF, Dresden). While there, Jay was able to use ¹H rheo-NMR and MRI velocimetry methods to investigate phase-change nano-emulsions for thermal energy storage. Another delightful experience was enjoying hot wine (Glühwein) at beautiful Christmas markets with colleagues.



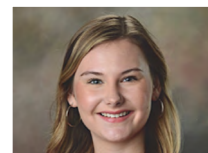
Jay Park next to an NMR spectrometer in Germany



Lauren Creadore

Lauren Creadore from Prof. Marco J. Castaldi's Combustion & Catalysis Laboratory (CCL) was hosted by the CRECK Modeling Group of Politecnico di Milano in Italy in June 2023. As a visiting student, Lauren continued her work in the area of large-scale, high-speed combustion at the Politecnico di Milano (PoliMi). The CRECK Modeling Group is led by Dr. Tiziano Faravelli, an expert in modeling the kinetics of thermal carbon conversion processes. While there, she was introduced to the group's numerical simulation software, OpenSMOKE++, which she used to model polymer decomposition.

Kaitlyn Lawrence was hosted by CCL collaborator Dr. Ange Nzihou of the Centre de Recherche d'Albi en génie des Procédés, des Solides Divisés, de l'Énergies et de l'Environnement (RAPSODEE) in France. As a visiting student, Kaitlyn continued her work on the catalytic use of waste to energy ashes in NO_x reduction. The French group, whose name translates to the "Albi Research Center for Process Engineering, Divided Solids, Energy, and the Environment," is led by Dr. Ange Nzihou, a pioneer in the area of waste valorization. He advised Kaitlyn during her brief, 3-week visit to Albi, in which she did characterization experiments of ashes using inductively coupled plasma atomic emission spectroscopy (ICP-AES) and X-ray fluorescence (XRF) spectrometry.



Kaitlyn Lawrence



(L-R) Lauren Creadore, Prof. Marco J. Castaldi, Kaitlyn Lawrence, and Janhvi Trivedi at the conference venue, Politecnico di Milano's Piacenza Campus's Caserma Neve building.

Janhvi Trivedi, (ChE PhD student) said that, "attending the MatER conference was an enriching experience, as I had the opportunity to engage with leading experts in the field and gain valuable insights into the latest research trends. The presentations and discussions expanded my knowledge and fostered meaningful connections with fellow scientists."

ChE Researchers Continue to Publish in High-impact Journals

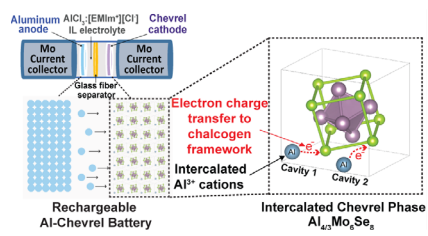


Image adapted from JACS

Rechargeable Multivalent-Ion Batteries published in *Journal of the American Chemical Society (JACS)*

Dr. Ankur L. Jadhav (ChE PhD '21) and **Dr. Brendan E. Hawkins** (ChE PhD '23), formerly working with Prof. Rob Messenger, and co-authors have revealed critical insights of the electronic charge storage mechanism in rechargeable multivalent-ion batteries. Dr. Jadhav and Dr. Hawkins have since transitioned into roles at Intel and Urban Electric Power, where they serve as a Process Engineer and a Senior Battery Engineer, respectively.

In this paper, the team elucidated the electronic charge storage mechanism that occurs in chevrel phase electrodes upon the electrochemical intercalation of multivalent cations. Upon cation intercalation, electrons are transferred selectively to the anionic chalcogen

framework, while the transition metal octahedra are redox inactive. This reversible electrochemical anionic redox, which occurs without breaking or forming chemical bonds, is a fundamentally different charge storage mechanism than that occurring in most transition metal-containing intercalation electrodes using anionic redox to enhance energy density. The results suggest material design principles aimed at realizing new battery electrodes that enable the facile electrochemical intercalation of multivalent cations. *Journal Reference:* Ankur L. Jadhav, Taylor R. Juran, Matthew A. Kim, Andrea M. Bruck, Brendan E. Hawkins, Joshua W. Gallaway, Manuel Smeu, and Robert J. Messenger in *Journal of the American Chemical Society* 145, 15816-15826 (2023). <https://doi.org/10.1021/jacs.3c02542> Featured in "JACS Spotlights": <https://doi.org/10.1021/jacs.3c07672>.

Snail Mucus published in *Nature Communications*

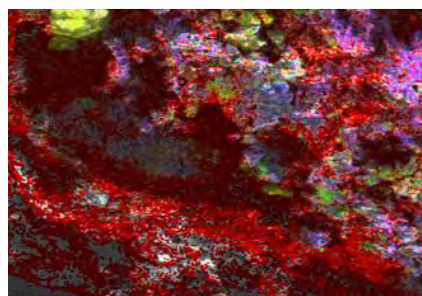
Dr. Zhi-Lun Liu (ChE PhD '22), formerly of Prof. Xi Chen's lab, co-authored a paper that analyzes three types of mucus produced by the common garden snail *Cornu (C.) aspersum*. Dr. Liu has gone on to become a Material Research Engineer at Macronix/IBM.

Every animal secretes mucus, placing them among the most diverse biological materials. There is substantial interest in commercializing mucus from the garden snail, *C. aspersum*, for skincare, drug delivery, and tissue engineering. *C. aspersum* secretes three mucins—one shielding the animal from environmental threats, one adhesive mucus from the pedal surface of the foot, and another pedal mucus that is lubricating. In this study, the authors characterize mucus proteins, glycosylation, ion content, and mechanical properties that could be used to provide insight into structure-function relationships through an integrative "mucomics" approach. Revealing differences between *C. aspersum* mucus shows how considering structure at all levels can inform the design of mucus-inspired materials.

Journal Reference: Antonio R. Cerullo, Maxwell B. McDermott, Lauren E. Pepi, Zhi-Lun Liu, Diariou Barry, Sheng Zhang, Xu Yang, Xi Chen, Parastoo Azadi, Mande Holford, and Adam B. Braunschweig in *Nature Communications* 14, 5361 (2023). <https://doi.org/10.1038/s41467-023-41094-z>



Credit: Antonio Cerullo



Credit: Tasnuva Moutushi

Reactions in Waste Combustion Ash published in *Waste Management & Research*

Dr. Tasnuva Moutushi (ChE PhD '22), formerly of the Combustion & Catalysis Lab directed by Prof. Marco J. Castaldi, investigated reactions occurring in waste combustion ash using thermal analysis coupled with gas analysis and characterization. Dr. Moutushi is now working at Intel, as a Module and Integration Yield Engineer.

In this study, waste-to-energy (WtE) ash was investigated for thermal reactions that generate gas components such as hydrogen and carbon dioxide. The results reveal that the processes releasing H_2 and CO_2 are independent of each other, and the CO_2 generation depends on the constant input of energy. These results enable the identification of the possible processes occurring in WtE ash decomposition of Friedel's salt at $280^\circ C$ and dehydration of $Ca(OH)_2$ at $410^\circ C$, both of which release H_2O that reacts with the aluminium present to release H_2 . At temperatures higher than $480^\circ C$, an alumina layer is formed preventing further production of H_2 . The outcome of this study enables identifying the possible reactions in WtE ash that can be causing the energy changes seen during disposal, storage and transportation of ash. These results can give direction for detailed understanding and development of the kinetics and the mechanisms of the reactions occurring in WtE ash which is important for optimization of reuse and disposal of ash.

Journal Reference: Tasnuva Moutushi and Marco J. Castaldi in *Waste Management & Research* 41, 871-880 (2023). <https://doi.org/10.1177/0734242X221134966>

In Memoriam



Dear Alumni, Friends and Supporters,

It is with a heavy heart that I inform you of the passing of **Professor David Rumschitzki**. David unexpectedly passed away on November 2nd from natural causes. We are still adjusting to this incredible shock and in the near future we will send more information about a memorial event. David's family held a ceremony at Shomrei Hadas Chapel in Brooklyn and transferred to Mount Moriah Cemetery, Fairview N.J. for the burial on Sunday, November 5th. Several faculty, family, former students and friends attended both. I was at the airport awaiting my flight to the Annual AIChE meeting but was at least able to watch the ceremony via a live streaming link. We were able to assemble a simple memorial at the AIChE CCNY reception that we had on Sunday evening.

Please share the sad news with anyone you know who knew David and have them reach out to the department if they have any questions. We are including this as an addendum because the timing of his passing was unexpected and occurred after the completion of the newsletter. We will provide updated information on a memorial event once everything is determined. Below you can read the release from CCNY President Vince Boudreau.

Sincerely,
Marco J. Castaldi, Chair



Dear Members of the City College Community,

I am deeply saddened to report that Dr. David Rumschitzki, of the Chemical Engineering Department, has passed away. He spent his last minutes as he spent much of the past 40 years—in his office, among friends, working to advance the educational careers of students and to develop his own profoundly innovative engineered contributions to human progress.

David came to CCNY in 1983 and so leaves our community as one of its longest serving and most engaged members. His research and teaching career led him to work on questions regarding the chemical processing of cholesterol in the blood, with a particular interest in how different cells engage the process of maintaining cholesterol homeostasis.

David's interest in arterial health was both professional and personal. He was one of the most assiduous stewards of his own health that I've ever met. As late as yesterday, he was preparing to run in the NY Marathon. He ran, exercised, rode his bike for transportation and recreation and restricted his diet to vegetarian foods. He literally threw himself into his work, and his personal commitment to discovering pathways to better health was evident in his every professional contribution.

On campus, he was legendary for his stewardship of student research, his engagement with student clubs and his participation in faculty committees, including this year and in years past, in the executive committee of the faculty senate.

Those who knew David best understood that he drew no distinction between his personal and professional life: many people say this, but for David, CCNY was his home and we were all his family. CCNY and the Grove School will not be the same without David among us. We will certainly put together a memorial event in the coming weeks and will communicate particulars about that, and funeral arrangements, as they become available.

Sincerely,

Vince Boudreau
President

Connect, Engage, & Contribute

CONNECT

There are many ways to connect with your alma mater. Please check the boxes that interest you.

- I would like to visit the campus.
- I would like to speak about my experience to students.
- I would like to attend departmental seminars on technical & research topics (Mondays 2-3 PM).
- I would like to connect via LinkedIn group "CCNY ChemEng Alumni."
- I would like to mentor students.

ENGAGE



A sneak peak of more to come. **Dr. Stu Soled**, CCNY Chem BS '69, Distinguished Research Associate at Exxon Mobil and CCNY ChE External Advisory Board member, has been creating videos of faculty and their research groups to help promote the great research going on in the department. Stu kindly volunteered

his time to help promote the department. The videos are intended to help prospective PhD students, potential collaborators, and the general public learn more about each of the faculty and their research groups. It's also a great way for alumni to get to know who the faculty are and what they are engaged in today. Stu spent several days in the Fall of 2023 with the faculty and research groups doing interviews and taking footage of the labs. The videos will be available online once the editing is complete. Stu also took some time out from behind the camera to engage with the students. Shown are members of the Biddinger Research Group discussing the future of the clean energy transition with Stu.

If you are interested in contacting Stu, he can be reached via LinkedIn: <https://www.linkedin.com/in/stu-soled-4b081934>.

CONTRIBUTE

Please fill out this form to provide an information update and/or to make a donation to the Department of Chemical Engineering at CCNY.

Name _____
Graduation Year & Degree from CCNY (if applicable) _____
Company _____
Address _____
City _____ State _____ Zip Code _____
Phone _____
Email _____
Signature _____ Date _____
\$ _____ towards Fund for Excellence
\$ _____ towards Undergraduate Student Activities
\$ _____ towards Graduate Student Development
_____ A Gift in Kind

My employer makes matching gifts.

Employer name: _____

To leave a gift in your will, simply share this sentence with your attorney or financial planner:

"I bequeath \$ _____ or _____ % of my estate to the Department of Chemical Engineering, CCNY, Steinman Hall, T322, 140th Street & Convent Avenue, New York, NY 10031."

I have included the Department of Chemical Engineering (CCNY) in my will.

Checks may be made out to: **The Foundation for City College (Chemical Engineering)**

Gifts to the Department of Chemical Engineering (CCNY) are tax-deductible as permitted by law.

Please return information/pledge card and checks to: Department of Chemical Engineering Office, City College of New York, Steinman Hall Room 322, 140th Street & Convent Avenue, New York, NY 10031

Information-only updates may be sent to: che@ccny.cuny.edu