

Summer 2019

Dear Friends of Tufts Physics & Astronomy,

As we say our goodbyes to the more than 20 physics and astrophysics majors from the class of 2019, it is a natural time to look back as well as ahead. This past year has been one of continued growth for the Department in our core areas of teaching and scholarship. Undergraduate enrollments continue to climb, as has our research funding over the past year. This includes cutting-edge areas of research like quantum information and computing, as well as in more traditional subfields such as High Energy Physics (which celebrated its 60th year of continuous funding at Tufts this past year). We'll share a few highlights with you here, but if you want to hear about in person, do stop by to say hello. We'd love to tell you more about our research in particle physics, soft and condensed matter physics, galactic evolution, quantum computation, physics education, and cosmology!

News

Students Found First SEDs Chapter at Tufts

Three Tufts students have founded the University's chapter of Students for the Exploration and Development of Space (SEDs). Justin Hudson, a Physics undergraduate student and Vice President of the chapter, joins President Sarah Carty (Mechanical Engineering) and Chair of the Board Joshua Etkind (Mechanical Engineering) as founding members. The group started SEDs to create more opportunities for students to get involved in space-related activities at Tufts. Since its inception in Summer 2018, the chapter has grown to approximately 40 members, with an additional 20 showing interest. About 10-12 members are Physics and Astronomy majors. Hudson explains that there is a lot of enthusiasm surrounding the chapter, which he wishes existed when he was a freshman: "It has grown to be a much larger group than I imagined this year, and I love seeing everyone involved so passionate about their projects and space." SEDs members launched a high-altitude weather balloon on April 21 – the Physics and Astronomy Department looks forward to hearing about the results and witnessing SEDs create a new legacy at Tufts.



Tufts SEDs Chapter

Faculty, Grad Students Work on Listening to Students' Thinking

Four physics faculty members (Profs. Tim Atherton, Peggy Cebe, Hugh Gallagher, and Lecturer Vesal Dini) and four graduate student teaching assistants (Michael Dolce, Alec Drobac, Mathew Giso and Kenneth Robbins) participated in a year-long series of workshops focused on attending to and responding to students' thinking about the science they're learning. The workshops are part of the *Listening Project*, a 5-year program funded by the Howard Hughes Medical Institute and led by Profs. Roger Tobin and David Hammer. The project's goal is to foster greater participation of students from traditionally underrepresented groups in the sciences by helping instructors develop habits and abilities for attending closely to all students' thinking. Participants from both physics and biology met regularly to practice understanding and interpreting the beginnings of scientific reasoning as revealed in classroom video clips and students' written work. This work then led to conversations about how we might change aspects of instruction to provide more space for the expression of student ideas, and how we might engage more productively with those ideas.

Danilo Marchesini's Research Group Granted NOAO Observing Time

Associate Professor Danilo Marchesini and postdoctoral scholar Marianna Annunziatella participated in a research program that was granted observing time by the National Optical Astronomy Observatory (NOAO). The research program, titled "Connecting the dots: linking massive spheroids at $z \sim 2$ to today's most massive galaxies through stellar metallicity, age, and velocity dispersion measurements," received 20 hours on the Large Binocular Telescope. The program aimed to observe two ultra-massive galaxies at $z \sim 2$ (10 billion years ago, when the universe was only ~ 3 billion years old) with the LUCI near-infrared spectrograph, to obtain near-infrared spectra and measure the chemical composition and age of the stars in these galaxies, as well as their velocity (to practically "weigh" the galaxy). Unfortunately, the nights allocated were obstructed by weather, and no data were collected. Professor Marchesini has resubmitted the proposal to hopefully be approved once again.



Prof. Danilo Marchesini and Anna Sajina

Tufts Astronomy Faculty Join Prime Focus Spectrograph Project

Associate Professors Danilo Marchesini and Anna Sajina have joined the international team responsible for building the Prime Focus Spectrograph (PFS). The PFS will be annexed to the Subaru Telescope at the summit of Mauna Kea, Hawaii and allows simultaneous spectral observation of up to 2,400 astronomical targets using a state-of-the-art fiber system, fiber positioner, four spectrographs, and a Wide Field Corrector (WFC). As part of the PFS Northeastern Participation Group (NEPG), Professors Marchesini and Sajina are guaranteed 300-350 nights of instrument access over 5-6 years with immediate access to the data generated. Access to such

data will assist with future research and grant applications for Tufts faculty, post-docs, and students. Sajina and Marchesini will primarily study galaxy formation and actively accreting supermassive black holes, but the instrument also allows other groups to study different areas pertaining to dark matter, dark energy, and galaxy history. PFS testing will begin in 2020, and it is expected to go live in late 2021 or early 2022.

The Department would like to thank and acknowledge the special philanthropic support we have received and continue to receive for the PFS Project from one of our own, **Marina Otis Spiropoulos, J70**. Marina's loyalty and generous support of her home department at Tufts is greatly appreciated. Her lifelong passion for physics as well as her desire to see the Department of Physics and Astronomy at Tufts University thrive make her approach to giving back to Tufts even more meaningful to all of us in her home department. If you are interested in learning how to support the PFS project like Marina, please contact Rob Ayles in University Advancement at (617) 627-2675 or robert.ayles@tufts.edu. You can also contact any department member you keep in touch with about how to make a gift. Thank you in advance for your consideration!

Vesal Dini Publishes Study on Scientific Engagement in Blended Online Learning Environments

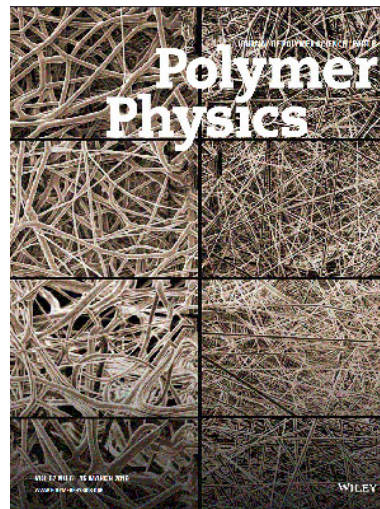
Lecturer Vesal Dini with co-authors Lama Jaber (School of Teacher Education, Florida State University) and Ethan Danahy (Department of Computer Science, Tufts University) have published a study investigating science teachers' scientific engagement in a blended-online professional development course. This study "invites attention to how scientific engagement emerges and persists online, highlighting the dynamic and consequential nature of learners' expectations." It examines a shift in participants' framing of course activities from an exercise in answer-giving to actually "doing science" and promoting scientific inquiry. The full study is available [here](#).

Cosmology Group Gains Visibility on YouTube

Professor Alex Vilenkin and Instructor Delia Perlov appear in successful videos on YouTube related to their cosmology research. Alex discusses "[A Multiverse from 'Nothing'](#)" in an hour-long interview included in the *Before the Big Bang* YouTube series. Delia discusses "[The Eternally Inflating Multiverse](#)" in her *TEDxTufts* talk.

Peggy Cebe and Nelaka Govinna Collaborate with the Department of Chemical and Biological Engineering to Develop Novel Water Filtration Membrane

Professor Peggy Cebe and graduate student Nelaka Govinna, in collaboration with Chemical and Biological Engineering Professor Ayse Asatekin and graduate student Ilin Sadeghi, recently concluded a research project that is featured on the Tufts Now Bulletin. The research work was focused on developing a novel filtration membrane for oil and water separation and yielded very promising results. Practical uses for the filtration membrane include low-cost, energy-efficient environmental remediation and wastewater treatment. The project bore fruit to two research papers. Paper #1 was published in *Journal of Polymer Science Part B: Polymer Physics*, and was selected to be featured on the cover of Issue #6, Volume #56. Paper #2 was published in *ACS Applied Polymer Materials* and was selected as the ACS Editors' Choice article for March 22nd, 2019—United Nations-designated World Water Day—recognizing the importance of the discovery. With this selection, the article is sponsored for immediate, free open access by the American Chemical Society due to its potential for broad public interest, an honor given to only one article from the entire ACS portfolio each day of the year.



Cover of *Polymer Physics* Issue 6, Vol. 56

Former Physics and Astronomy Professor Rainer Weiss Wins 2017 Nobel Prize in Physics

In February 2016, the LIGO and VIRGO collaborations created a shockwave when they announced the first observation of gravitational waves, predicted 100 years earlier by Albert Einstein. Since then, this discovery has received a lot of media attention (for example this *New York Time* article), captivating the public imagination. The LIGO and VIRGO experiments are based on laser interference techniques developed by Rainer Weiss in the 1960s. Prof. Weiss later co-founded the LIGO project and obtained NSF funding for initiating the project. In reward for his decisive contributions to the LIGO detector and the observation of gravitational waves he was awarded half of the 2017 Nobel Prize in Physics, the other half being shared between Kip Thorne and Barry Barish. Rainer Weiss spent most of his career as a faculty member at MIT, but his first faculty appointment was as an Assistant Professor at Tufts from 1962 to 1964. He is the second Nobel laureate that worked at Tufts, joining particle physicist Allan Cormack in this very distinguished category.

Student Awards

Both undergraduate and graduate students in physics and astronomy continue to be recognized for their outstanding achievements in multiple areas, including academics, athletics, teaching, and service. We are proud to share that the following students in our department have received awards this year.

James E. Miller and *John Pitten* received the N. Hobbs Knight Prize Scholarship in Physics, recognizing outstanding ability in theoretical and experimental physics.

Benjamin Zager received the Amos Emerson Dolbear Scholarship, awarded to a senior who has shown promise in the field of either physics or electrical engineering.

Cameron Holley received the Frederick Melvin Ellis Prize, awarded to students who have demonstrated marked athletic versatility, a modest manner, successful academic achievement, and the potential for effective leadership of youth.

Makayla Trask received the Audrey Butvay Gruss Science Award, recognizing outstanding academic work in any of the sciences by a student who is a scholarship recipient.

Rayleigh Parker received the Class of 1947 Victor Prather Prize, awarded to engineering or science majors who have demonstrated excellence in scientific research, enthusiasm for the pursuit of knowledge, and a dedication to scholarly achievement.

Edward Natkin received the Navy V-12/NROTC Memorial Prize, awarded to junior or senior Tufts students who are direct descendants of participants in the Tufts or other college V-12/NROTC programs during World War II, July 1943-June 1946, or are enrolled in an NROTC program. The award is based on scholastic achievement, demonstrated leadership, and significant contributions made by the candidates to the university and greater community.

Jonathan Minoff received the Benjamin G. Brown Scholarship, awarded to seniors who have shown promise in scientific research in fields other than chemistry.

Miriam Salcedo was named a Society of Physics Students poster competition winner at the American Physical Society March Meeting.



Howard Sample Prize Scholarship Winners 2019

This year's recipients of the Howard Sample Prize Scholarship in Physics for outstanding performance in Physics 11 and Physics 12 are: *Benjamin Bodine*, *Adam Lipton*, *Olivia Martin*, *Samee Mushtak*, *Kevin Naranjo*, *Casey Owen*, *Melissa Rowland*, *Joshua Tso*, and *Gian Marco Visani*.

Kalina Nedkova was a Fall 2018 winner and *Andrew Clark* was a Spring 2019 winner of the Graduate Student Research Competition. *Nelaka Govinna* won the Graduate Student Photo Contest: Graduate Research in Spring 2019.

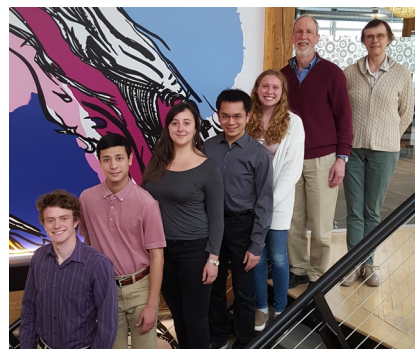
William Kirby won the prestigious National Science Foundation Graduate Research Fellowship for 2018 to pursue research in theoretical physics, focusing on quantum information and quantum computation. He is joined by three Physics and Astronomy alumni who won the Fellowship for 2019: *Tyler Chen* (B.S. '17, now at U. Washington), *Zachary Pagel* (B.S. '17, now at U.C. Berkeley), and *Adina Feinstein* (B.S. '18, now at U. Chicago).

Vladyslav Syrotenko won the prestigious Fermilab Neutrino Physics Center Fellowship. He will spend most of 2019 in the laboratory working on his thesis about neutrino physics.

Noah Kurinsky (B.S.E.P. '14) was awarded the Lederman Fellowship at Fermilab, which is intended to attract exceptional postdoctoral candidates who have demonstrated outstanding ability in research and have a strong interest in education and outreach.

Sigma Pi Sigma

Membership in Sigma Pi Sigma, the Physics Honor Society, acknowledges outstanding scholarship in undergraduate physics for junior and senior physics and astronomy majors. Congratulations to all our 2019 nominees: *Natalie Bohm*, *Aidan Fike*, *Jared Hwang*, *Elias Marcopoulos*, *Courtland Priest*, *Michael Rosenbaum*, *Kristen Schretter*, *David Stern*, *Andrew Sterner*, *David Tu*, *Joao Marcos Vensi Basso*, and *Susan Zec*. They join *James E. Miller*, *Jonathan Minoff*, *Ben Nissan*, *Rayleigh Parker*, and *Benjamin Zager*, who were inducted last year.



Sigma Pi Sigma Induction Ceremony 2019

Senior Theses

Five seniors completed and defended senior theses this year. We are pleased to recognize these students for taking on independent research projects.

- *Eduardo Barrera*, Advisor: Peggy Cebe

Thesis: "Coaxial Electrospinning of PEG-PCL Core-Sheath Morphology Nanofibers: Applications in Drug Delivery and Tissue Engineering"

- *Mario Delgado*, Advisors: Luisa Chiesa and Hugh Gallagher
Thesis: "Characterization of Mechanical and Electromechanical Properties of Single Tape High Temperature Superconductors for Applications in High Field Fusion Magnets"
- *Justin Hudson*, Advisor: Andrew Kemp
Thesis: "Is Winter Weather Worse? A Frequency Analysis of Extreme Snowfall in the Northeastern United States"
- *James E. Miller*, Advisor: Cristian Staii
Thesis: "A Closed-loop Isolated Muscle Preparation for Studying the Interaction of Internal and External Mechanics in Fish Swimming"
- *Jonathan Minoff*, Advisor: Peggy Cebe
Thesis: "Dielectric Properties of Poly(Vinylidene Fluoride) Electrospun Fibers"

Eliopoulos Summer Scholars

We are proud to announce that two of our undergraduate students were selected to be part of the Eliopoulos Summer Scholars program, which supports undergraduate research.

In 2019, *Benjamin (Kai) Kharpertian* is working with *Assistant Professor Taritree Wongjirad*. Benjamin is also a Resumed Education for Adult Learning (REAL) student and was one of the four Tufts nominees for the Barry M. Goldwater Scholarship.

In 2018, *Danielle Golub* worked with Associate Professor Danilo Marchesini on her project titled, "Spectral Classification of Galaxies Over 12 Billion Years of Cosmic History."

If you'd like to support the Summer Scholars program, [click here](#).

Faculty and Staff Awards

In September 2018, Professor Peter Love received awards from NSF, DOE and FQXi to support work on quantum information. One of the DOE awards was co-PI'd by Professor Gary Goldstein and is focused on the simulation of high energy physics problems using future quantum computers. The NSF award is a collaborative effort between Tufts, MIT, Duke, Maryland and Berkeley university to build and use ion trap quantum computers. The FQXi award is a collaboration with MIT and UMass Boston to study agent-based models in both quantum and classical settings. These awards were announced along with the signing of the National Quantum Initiative Act, which promises \$1.2B of new funding for quantum information over the next decade.

Alumni Profiles

Kevin Lewis, A'03

Current occupation:

I am currently an Assistant Professor in the Department of Earth & Planetary Sciences at Johns Hopkins University.

How do you use your physics background and training in your line of work? Did the Tufts Physics Department prepare you for your current career path?

My research in planetary geophysics on Mars and other planets lies at the intersection of physics, math and geology. Much of my work involves the analysis of planetary gravity and magnetic fields from a physics-based perspective. The methods I use every day stem directly from the



Kevin Lewis

understanding gained in my undergraduate physics curriculum - in particular, Mechanics and E+M. The knowledge gained in Optics and Quantum Mechanics at Tufts have been especially valuable for my work in planetary remote sensing. Although my graduate work had a more geological focus, an undergraduate physics major provides a fantastic foundation for a wide range of possible careers, particularly in the natural sciences. Exposure to best-practice research methods and software tools in Prof. Cebe's lab were a huge benefit and provided a smooth transition to graduate school!

What is your favorite memory of your time in the Tufts Physics Department?

Prof. Cebe's Optics class was my favorite! I am also very grateful to Krzysztof Sliwa for donating his time one summer to giving myself and David Attanasio (A'03) lessons in Intermediate Mechanics when we couldn't fit it into our course schedules - as a professor myself now, I understand how generous this was!

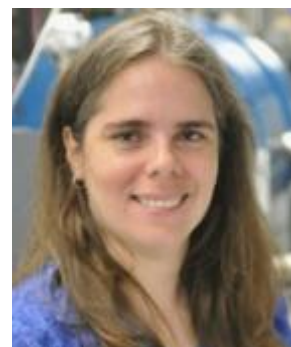
Mayly Sánchez, G'03

Current occupation:

Professor of Physics at Iowa State University

How do you use your physics background and training in your line of work?

I use my physics background and training every day. First of all because I teach, and so I literally have to go back to the books I used as part of my training to craft my lectures and train new students in physics. I also do research, and I have continued the line of work that I started at Tufts as a Ph.D. student. Little did I know when I started my Ph.D. that I would be working in experimental particle physics several decades later.



Mayly Sanchez

Did the Tufts Physics Department prepare you for your current career path?

Yes. I first learnt about experimental neutrino physics at Tufts. It was the first time that I got to consider particles as something that you could measure and observe in real life detectors. Being at Tufts allowed me to consider experimental particle physics as a career path and trained me for the research work that I am currently doing.

What is your favorite memory of your time in the Tufts Physics Department?

There are many, so it is hard to pick one. Perhaps one of my favorites is the day my advisor Prof. Jack Schneps convinced me to work in his group. He said, "Every good theorist should do experimental physics once." Here I thought I wanted to be a theorist, but his comment made me try out something new and change my path to the work I love doing. There are also the many times that Prof. Tony Mann walked into my office with the latest cool idea to try out. Some worked, some didn't, but it was always fun and exciting. And finally, there are the many chats with my office-mate Alex Sousa, who is my dear friend and colleague to this day.

Congratulations!

The department would like to congratulate all our 2019 graduates. We are proud of your work at Tufts and look forward to the great things in your future.

Bachelor of Science Degrees

Zachary Going, B.S., Physics
Danielle Golub, B.S., Astrophysics
Cameron Holley, B.S., Physics
Justin Hudson, B.S., Astrophysics
Samuel Lenney, B.S., Physics
Elias Marcopoulos, B.S.C.S., Computer Science/Applied Physics

Ely Novakoski, B.S.E.E., Electrical Engineering/Physics
Erick Orozco, B.S., Physics
Rayleigh Parker, B.S., Physics
Terence Parsons, B.S. Physics
John Pitten, B.S., Physics
Finn Pounds, B.S., Physics

Heather Mei, B.S., Physics
Christopher Meierfrankenfeld, B.S., Computer
Science/Physics
James E. Miller, B.S., Physics
Jonathan Minoff, B.S., Physics
Edward Natkin, B.S., Physics

Pere Puig, B.S., Physics
Andrew Sterner, B.S., Computer
Science/Astrophysics
Makayla Trask, B.S.E.P., Engineering Physics
Benjamin Zager, B.S.E.P., Engineering Physics

Master of Science Degrees

Kenneth Robbins, M.S., Physics

Doctoral Degrees

- *Joshua Cohen*, Advisor: Roger Tobin
Thesis: "Surface Physics of Nickel Nanoparticles on Gold"
- *Anna Phillips*, Advisor: David Hammer
Thesis: "Problematizing as 'Doing Physics': The Importance of Articulating, Refining, and Motivating Problems in Classrooms"
- *Eric Roebuck*, Advisor: Anna Sajina
Thesis: "Understanding Galaxy Evolution Through (Ultra) Luminous Infrared Galaxies and Hydrodynamical Simulations"
- *Hyungsuk Son*, Advisor: Hugo Beauchemin
Thesis: "Measurements of $Z \rightarrow \nu\nu + \text{jets}$ to $Z \rightarrow \ell\ell + \text{jets}$ differential cross section ratios in pp collisions at $\sqrt{s} = 13$ TeV using the ATLAS Detector"

Upcoming Events

The sixth **Kathryn A. McCarthy Lectureship** will be hosted by the Physics and Astronomy Department in Fall 2019 (please stay tuned for the date announcement). The Lectureship was established to highlight contributions made by women scientists in Physics and Astronomy who are recognized as outstanding in their fields. One of these noted scientists is honored through The Kathryn A. McCarthy Lectureship every three years. This award is named for former Provost and Professor Kathryn A. McCarthy, J45, mentor and advisor to hundreds of individuals at Tufts.

Professor Gary Goldstein's 50th Anniversary at Tufts Celebration will be held on Sept. 6, 2019, from 2:30-6:00 pm on the 4th Floor of 574 Boston Ave. We look forward to welcoming local and international guests to celebrate Professor Goldstein's accomplishments in physics, public policy, and science education outreach. If you would like to attend, please email Cassandra.Matthews@tufts.edu.

In Memoriam

It is with great sadness that we share news of the death of Prof. Emeritus Jack Schneps, who passed away on July 12, 2019. Jack joined Tufts in 1956, when he was hired by Julian Knipp to start a research group in particle physics. Jack served as the leader of the group for many years, and also served a nine-year stint as Department Chair. What came to be known as the high energy physics (HEP) group grew dramatically under Jack's leadership, and he played a pivotal role in the establishment of the Tufts Institute of Cosmology. His scientific legacy is vast - from studies of strange particles, to the discovery of the tau neutrino, to studies of neutrino oscillations through atmospheric and accelerator neutrinos. Jack was one of the first advocates for long-baseline neutrino oscillation experiments, which today form the cornerstone of experimental neutrino physics worldwide. Particularly important were Jack's diplomatic skills, sense of humor, kindness, and extraordinary talent as a mentor to students, post-docs, and faculty alike. We will gather with



Prof. Jacob (Jack) Schneps

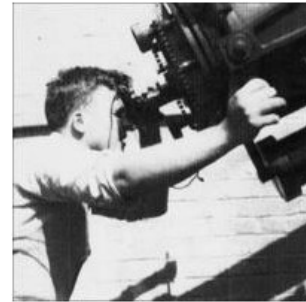
Jack's friends and family to celebrate his life on Wednesday, August 28 from 5:00-8:00pm in Distler Hall (Granoff Music Building), and we would welcome your presence at this gathering.



Jean Intoppa

It is with heavy hearts that we say goodbye to Jean Intoppa, who passed away in May 2019. Jean joined the Physics and Astronomy Department staff in 2001 after many years of previous service at Tufts. Her impact on the department has been immeasurable, including assisting with travel arrangements and reimbursements, student payroll, events, colloquia, GRASP, overseeing special programs, and myriad other aspects of department administration. It is hard to imagine the department without her infectious laugh and sharp wit, and she certainly leaves a legacy that we are honored to uphold.

We sadly say goodbye to Professor George Mumford, who passed away in February 2019. Professor Mumford was the founding member of the Tufts Physics and Astronomy Department in 1968. A year later, he was made Dean of Arts and Sciences. In the following years, he took on other Dean positions, including Dean of Research and Planning, Dean of the Graduate School of Arts and Sciences, Dean of Research and Interinstitutional Planning, and Dean of the College of Special Studies. He was made Professor Emeritus in 1997. During his tenure at Tufts, he continued to do research on super novae, utilizing observatories in Harvard, MA, Kitt Peak, Tucson, AZ, and Cerro Tololo, Chile.



George Mumford

Our Ever-Evolving Department

Additions

We are very pleased to welcome *Cassandra Matthews* as our new Department Manager. Cassandra previously worked at Harvard Business School and Brown University. She looks forward to using her logistical planning, finance, faculty affairs, and academic operations skills to support our department.

We also welcomed six new postdoctoral associates to Physics & Astronomy. *Marianna Annunziatella* joined the astronomy group, *Lara Appleby* joined the physics education research group, *Ralitsa Sharankova* joined the high energy physics group, *Andrew Tranter* joined the condensed matter group, and *Shaojiang Wang* and *Masaki Yamada* joined the cosmology group.

A brand new member joined the Physics & Astronomy extended family. *Taritree Wongjirad* and his family welcomed Edward Vasankumar Wongjirad on April 25, 2018.

Goodbyes

We also will miss Ozgur Altinok, Ryan Cybulski, Lucas Kocia, Ali Massoumi, McCullen Sandora, Federico Sforza, Heath Shipley, and Caroline Merighi who have moved on to other positions. We wish them all the best in their new roles!

Future Submissions

We welcome your news, stories, and ideas for our future newsletters. To contact us or to be added to our mailing list, please email newsletter editor: Cassandra.Matthews@tufts.edu. We would especially like to hear from recent graduates of the program (undergraduate or graduate) about what you're doing. You could be our next profile!

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