Happy 40th anniversary to the Monell Science Apprenticeship Program (MSAP)! This eight-week internship inspires young people to pursue science education and careers in the biomedical sciences by providing apprentices with high quality, hands-on learning experiences in a professional laboratory setting.

Our mission is to provide Philadelphia area students — especially those from groups underrepresented in the sciences — opportunities to engage in scientific discovery through laboratory-based biomedical research. This mission is deeply rooted in a commitment to the Philadelphia community and to training the next generation of scientists and STEM (Science, Technology, Engineering, and Medicine) professionals.

The 2021 application pool was impressive and made the committee’s job of selecting candidates a challenge. We received 237 applicants and accepted a total of 11 apprentices (also known as SAPlings). These high school and undergraduate students joined the Monell scientific community for six weeks (June 14 - August 6, 2021), working directly with PhD- and MD-level scientists and highly skilled lab staff and technicians. Because of the unique circumstances of 2021, apprenticeships were a mixture of in-person and hybrid work. Our heartfelt congratulations to this year’s SAPlings who persevered and achieved success given the evolving challenges of learning and experiencing science in a pandemic.

The MSAP Executive Committee is committed to providing each student with a unique summer internship experience. Unlike other internships this is a full-time paid internship with a mentor-apprentice model that is designed to provide SAPlings with high quality technical training, science education, and accessible role models who can help guide apprentices in their academic and professional pursuits.
The Committee carefully matches each SAPling with a full-time scientist mentor, and apprentices work closely with the primary investigator and lab staff on an independent research project.

Apprentice success hinges on proper education and training, and mentors, in conjunction with Monell’s Human Resource Department, are responsible for ensuring that apprentices receive appropriate training and follow safety procedures.

Apprentices become part of the lab staff and attend and contribute to lab meetings and other routine virtual and in-laboratory activities. Many mentors make an effort to meet with their apprentice at least once a day to answer questions and provide guidance, with a minimum of two one-on-one meetings per week with the principal investigator.

As supervisors, mentors answer daily activity questions, assist with day-to-day problems, and regularly check in with their apprentices to guide them through lab procedures and data analysis. Other lab members, such as postdoctoral fellows and lab technicians, contribute to SAPlings’ overall mentorship throughout the eight weeks.

Providing apprentices with proper supervision and resources ensures that they have a complete understanding of the hypotheses and research objectives of their individual projects and of the mentor’s larger research program. The Capstone Symposium — where the apprentices present their research — reflects this comprehensive understanding, which is critical to learning and understanding.

"Science and everyday life cannot and should not be separated."

**Rosalind Franklin,** Chemist and X-Ray Crystallographer

“We’ve tried ignorance for a thousand years. It’s time we try education."

**Dr. Joycelyn Elders,** Former Surgeon General of the U.S
It is our great pleasure to thank those who made the 2021 Monell Science Apprenticeship Program possible. Organizations, agencies, and individuals who donated to MSAP 2021 are listed below.

## Monell Circle ($1,000+)

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<th>Donor</th>
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<td>Shawn Marcell</td>
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<td>Kathleen Dorries*</td>
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## Other Donors

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<td>Anonymous (4)</td>
<td>Steven Labows</td>
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<td>Donna Antonucci</td>
<td>Joel Mainland</td>
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<td>Raymond Beauchamp*</td>
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<td>Jenifer Trachtman</td>
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<td>John Labows*</td>
<td>John K. Tran*</td>
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*Donor to the Joseph A. Brand Fund. Many thanks to the Brand family for establishing a fund in Joseph Brand’s name that will support a student apprenticeship for many years to come. Your generosity inspired others to give in Joe’s memory, creating a lasting legacy.
The Apprentices

Name: Jala
School: LaSalle University
Lab: Rawson Lab
Mentors: Dr. Nancy Rawson and Maureen O'Leary
Project: Monell--Turning Research into Education
I learned networking skills, how to market myself, non-profit organizations, science.

Name: Amari
School: Carver High School of Engineering and Science
Lab: Alhadeff Lab
Mentors: Dr. Amber Alhadeff, Nathaniel Nyema, Sarah Appleby, and Aaron McKnight
Project: The Connection Between Sugar Preference and Hunger
I gained knowledge on how to better my work ethic and how to manage science experiments at the professional level.
Supported by the Joseph Brand Memorial Fund

Name: Norah
School: Germantown Friends School
Lab: Dalton Lab
Mentors: Drs. Pamela Dalton and Stephanie Hunter
Project: Can SCENTinel Screen for COVID-19?
Having this opportunity to be completely immersed in a research setting is not something a high schooler can usually get. I'm really thankful for Monell for giving me this opportunity to meet amazing people and see incredible research being done.
Name: Rennie
School: Julia R. Masterman School
Lab: Breslin Lab
Mentor: Dr. Paul Breslin, Dr. Linda Flammer, Anilet Tharp, and Natasha Rivers
Project: ENaC Genotypes, Blood Pressure, and Taste Perception

My interest in and attitude about science have changed; I am now MORE interested in science

Supported by The Christopher Ludwick Foundation

Name: Sarah
School: University of Colorado Boulder
Lab: Reed Lab
Mentors: Dr. Danielle Reed and Katie Bell
Project: Can We Smell with Our Tongues?

The Reed Lab has provided me with a great opportunity to grow as a scientist and an anosmic.

Name: Theresa
School: Friends’ Central School
Lab: Mainland Lab
Mentors: Drs. Joel Mainland and Emily Mayhew
Project: Do Structurally Similar Odorants Smell More Alike?

MSAP met my expectations and then some because I didn’t know I’d be learning other things like coding during my time there, which was a plus.

Name: Joshua
School: Pennsauken High School
Lab: Mainland Lab
Mentors: Drs. Joel Mainland and Bob Pellegrino
Project: Predicting Mixture Intensities Using Models

I am more accustomed and have a greater appeal for sensory research. And research in general, I was motivated to pursue a degree in research/bioengineering even more after Monell.

Supported by Richard L. Berkman
Name: Miliani  
School: Charlotte Country Day School  
Lab: Alhadeff Lab  
Mentor: Dr. Amber Alhadeff, Nathaniel Nyema, Sarah Appleby, and Aaron McKnight  
Project: Glucose and Fructose’s Post-Ingestive Effects on Eating Behavior

What I like most about the MSAP program is the atmosphere, the other students, and the last lecture (in person) we had about restorative justice (it really help bond everyone).

Name: Katelyn  
School: Haverford College  
Lab: Wang Lab  
Mentors: Drs. Hong Wang and Akihito Kuboki  
Project: How Does Respiratory Virus Affect Our Smell?

Monell has shown me many perspectives and what to expect in a research career which aligns with my personality and what I like in a job.

Name: Sarah  
School: Amherst College  
Lab: Zhang Lab  
Mentors: Dr. Yali Zhang and Wyatt Koolmees  
Project: The Genetic Basis of High Sour Taste in Fruit Flies

Before Monell I only wanted to be a physician but after Monell I am definitely going to do research, probably medical research.

*Some presentations are unavailable due to the confidential or unpublished nature of the research*
Each year the MSAP Executive Committee carefully plans additional enrichment activities designed to supplement the apprentices’ research projects. The foundation of this year’s MSAP experience was engaging in intricate data analysis alongside professional scientists.

A popular seminar series has been a key part of the program for several years. This series exposes SAPlings to a wide range of STEM-related fields — including government, industry, and the media. Our virtual seminar series this year was open to the public, including all program applicants and students of the area.

Monell postdoctoral fellows organize enrichment activities including discussions of how to read and prepare scientific articles and journal club gatherings featuring in-depth discussions of select scientific articles. The article presentations were given by this year’s apprentices with feedback from mentors. A team of postdoctoral fellows and research technicians also led a series of virtual laboratory rotations to expose the SAPlings to a variety of research skills. These rotations included one hour of an introductory lesson to various research disciplines at Monell, an independent data analysis task, and one hour of activity review.

Also included in this year’s programming were the following enrichment lectures: “Science Communication” and “How to Present Your Science”. Taken in tandem, these seminars were designed to better prepare SAPlings to create and present their research and results at the Capstone Symposium, and beyond.
<table>
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<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
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| Mon. June 14 | 9am – 10:30am | Program Kickoff and Welcome  
Introduction by Paul Breslin, Director of MSAP  
Welcome from the Director of the Center, Robert Margolskee @ 9:30am  
HR overview by Christine Paoletti  
Group Photo |
| Tue. June 15 | 11am – 12pm   | Safety Training Session                                                 |
|              | 1pm – 2pm     | Lecture 1: Federica Genovese & Emily Mayhew, Monell Postdoctoral Fellows in the Reisert and Mainland Labs |
| Weds. June 16| 2pm – 3pm     | Social Trivia Event – Apprentices vs. Monellians!                      |
| Thurs. June 17 | 11am – 12pm  | Enrichment Seminar: Dolly Al-Koborssy, Monell Postdoctoral Fellow in the Reisert Lab |
| Mon. June 21 | 10am – 11am   | Rotation 1 – Introduction to Psychophysics  
Led by: May Cheung and Emily Mayhew, Postdoctoral Fellows in the Wise and Mainland Labs |
| Tues. June 22| 1pm – 2pm     | Lecture 2: Joel Mainland, Associate Member, Monell  
Title: “Methods of Rationality” |
| Weds. June 23| 10am – 11am   | Rotation 1 – Psychophysics Review  
Led by: May Cheung and Emily Mayhew, Postdoctoral Fellows in the Wise and Mainland Labs |
| Mon. June 28 | 10am – 11am   | Rotation 2 – Introduction to Clinical Psychology  
Led by: Bob Pellegrino, Postdoctoral Fellow in the Mainland Lab |
| Tue. June 29 | 1pm – 2pm     | Lecture 3: Paul Breslin, Member, Monell  
Title: “A Primer on Nutrition” |
| Weds. June 30| 10am – 11am   | Rotation 2 – Clinical Psychology Review  
Led by: Bob Pellegrino, Postdoctoral Fellow in the Mainland Lab |
<p>| Thurs. July 1 | 11am – 12pm  | Journal Club with Mackenzie Hannum, Postdoctoral Fellow in the Reed Lab |
|              | 4pm – 5pm     | Popsicle Social! With pops from Lil Pop Shop |
| Mon. July 5  | Monell closed – Independence Day observed                      |</p>
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<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
<th>Presenter/Details</th>
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<tr>
<td>Tues. July 6</td>
<td>1pm–2pm</td>
<td><strong>Lecture 4:</strong> Paul Breslin, Member, Monell</td>
<td><strong>Title:</strong> “Hypothesis Testing”</td>
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<tr>
<td>Thurs. July 8</td>
<td>11am–12pm</td>
<td><strong>Enrichment Seminar:</strong> Postdoc Panel</td>
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<tr>
<td>Mon. July 12</td>
<td>10am–11am</td>
<td><strong>Rotation 3 – Introduction to Immunohistochemistry</strong></td>
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<td>Tues. July 13</td>
<td>1pm–2pm</td>
<td><strong>Lecture 5:</strong> Sharne Jackson, Senior Director of Events, Education &amp; Giveback, Fragrance Foundation</td>
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<tr>
<td>Weds. July 14</td>
<td>10am–11am</td>
<td><strong>Rotation 3 – Immunohistochemistry Review</strong></td>
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<tr>
<td>Thurs. July 15</td>
<td>11am–12pm</td>
<td><strong>Enrichment Seminar:</strong> Science Communications</td>
<td>Led by: Jayatri Das, Chief Bioscientist, Franklin Institute</td>
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<tr>
<td>Mon. July 19</td>
<td>10am–11am</td>
<td><strong>Rotation 4 – Introduction to Molecular Biology</strong></td>
<td>Led by: Katie Bell, Research Technician, Reed Lab</td>
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<tr>
<td>Weds. July 21</td>
<td>10am–11am</td>
<td><strong>Rotation 4 – Molecular Biology Review</strong></td>
<td>Led by: Katie Bell, Research Technician, Reed Lab</td>
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<td>Thurs. July 22</td>
<td>11am–12pm</td>
<td><strong>Enrichment Seminar:</strong> How to Present Your Science</td>
<td>Led by: Joel Mainland, Associate Member</td>
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<td>Tues. July 27</td>
<td>1pm–2pm</td>
<td><strong>Lecture 6:</strong> Sama Ahmed, Presidential Postdoctoral Researcher, Princeton Neuroscience Institute</td>
<td><strong>Title:</strong> &quot;The neurobiology of multitasking (in fruit flies)&quot;</td>
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<tr>
<td>Thurs. July 29</td>
<td>11am–12pm</td>
<td><strong>Journal Club</strong> with Stephanie Hunter, Postdoctoral Fellow in the Dalton Lab</td>
<td>Led by: MSAP Apprentices</td>
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<td>Tues. Aug 3</td>
<td>1pm–2pm</td>
<td><strong>Lecture 8:</strong> Skyller Walkes, Assistant Dean of Diversity and Inclusion, University of Texas at Austin</td>
<td><em>In person lecture!</em></td>
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<tr>
<td>Thurs. Aug 5</td>
<td>2pm–5pm</td>
<td><strong>Final Symposium:</strong> Student presentations</td>
<td>Family members and friends are cordially invited.</td>
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<tr>
<td>Fri. Aug 6</td>
<td>To be scheduled</td>
<td>Exit Interviews and Return Keys with HR</td>
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Capstone Presentations

The Capstone Presentations mark the end of the program. SAPlings present the results of their research and learning to family, friends, and fellow scientists at a virtual conference-style presentation session. This year’s virtual event was attended by the apprentices’ families, Monell scientists and staff, seminar speakers, donors, and several MSAP alumni.

The Capstone celebrates the apprentices’ accomplishments during a summer full of hard work and discovery. It is a very proud moment for the apprentices, their mentors, and especially their families. Each apprentice created a scientific presentation using the data they collected, analyzed, and graphed. The presentations described their hypotheses and results, and SAPlings gave oral presentations in a conference-style environment to the Capstone guests.

This year’s Capstone Symposium also featured a keynote address from Nina Cao. Nina was the 2016 MSAP Sensational Science Award Winner who went on to study Particle Physics at Harvard University. Nina gave heartfelt encouragement to this years SAPlings, urging them to pursue their dreams.

This event is an excellent opportunity for apprentices to exercise their science writing and presentation skills and learn how to deliver their results to a diverse audience. Apprentices also learn how to engage in academic exchange by demonstrating that they understand: i) their hypothesis, ii) why their research question was asked, iii) whether their data support their hypotheses, and iv) what this work means in a broader context.

The eleventh annual “Monell Sense-ational Science Award” for best project was chosen by a panel of Monell staff, Drs. May Cheung, Johannes Reisert, Federica Genovese, Hakan Ozdener, and Paul Wise, Monell advisory board members Larry Clark and Charles Peterson, as well as Monell Alum Marcia Pelchat. This year’s recipient was Miliani, who worked in the Alhadeff Laboratory. Her project was titled, “Glucose and Fructose’s Post-Ingestive Effects on Eating Behavior”. Congratulations, Miliani!
Addressing a Community Need

According to the Pew Research Center, Black and Hispanic workers are significantly underrepresented in the STEM workforce. In the US, only 9% of STEM workers are Black and only 7% are Hispanic. Last summer, Shut Down Stem was an effort to bring awareness to the racial inequality in stem education.

The Monell Science Apprenticeship Program addresses this pressing need by providing Philadelphia students, most of whom are underrepresented in the sciences, with a summer bench science apprenticeship with a seasoned mentor.

The target population for the Monell Science Apprenticeship Program is high school and college students who are racial and ethnic minorities, females, and the economically disadvantaged. In order to recruit, we have forged relationships with the teachers in the School Districts of Philadelphia, guidance counselors, and teachers who are a part of the Philadelphia Education Fund's Math + Science Coalition, and the Ellis Trust for Girls which serves at-risk girls in Philadelphia. The Ellis Trust sends out a postcard announcing the apprenticeship to their cohort and provides funding for those accepted into the program.

This year we added two new recruitment partners: the Philadelphia Education Fund’s College Access Program and Squash Smarts, both of which have a cohort of students that is largely underrepresented in the sciences. We did hands-on workshops for their leadership and with their students to build enthusiasm for the program and to prepare them for the application process. The results are extraordinary! This year’s applicant pool is 53% from underrepresented groups. Compare this to 39% last year. And, because we seek to offer this opportunity as early as possible to students, we worked to grow the percentage of Philadelphia-based high school student applicants this year. Again, we found success, with 85% of applicants in high school compared to 76% last year.

This new recruitment strategies aligns with other Center-wide efforts at Monell focused on diversity and equity. These include our new Respectful Workplace Committee which is focused on all aspects of a productive workplace. Another effort of note is our new Diversity Journal Club which meets monthly and is open to all staff, board, and committee members as a safe space to learn about and discuss strategies to decrease systemic racism within our organization and our field. And, finally, we have redoubled our efforts to build a more diverse STEM workforce through changes to our recruitment strategy for new faculty.

Our Innovation

The Monell Science Apprenticeship has always been highly innovative because we are the only independent research center devoted to the study of taste and smell.

Where else can students imagine stimulating human taste receptors—not just on the tongue, but in the gut, pancreas, and brain—to make healthier foods more palatable and nutritious? What other Center offers the opportunity to consider harnessing human stem cells to replace damaged or aging smell receptors to restore our sense of smell. Our students get to envision a time when a simple taste test can guide your doctor in making personalized nutritional or medical recommendations. These aren't far-fetched science fiction plots, but real-life glimpses of what tomorrow might look like -- and our student apprentices learn quickly that tomorrow is coming sooner than they think!
This year in particular will provide students with an unprecedented learning experience because they will be working among the scientists on the frontline of the COVID crisis who are tirelessly trying to understand the relationship between smell and taste loss and COVID. Students will become acquainted with a global group of scientists working on this issue. And, if students are not interested in smell and taste loss, we offer many other scientific questions that they can ask and answer. This is truly a once in a lifetime opportunity for most students. For society, it offers the great opportunity for a more diverse STEM workforce.

The Apprenticeship Program is made possible only through contributed income and the number of students we accept into the program each year is dependent on the amount of grant funds we raise. One of the reasons this program is successful at bringing in underrepresented apprentices is that we pay them a full-time salary over the summer. This is a cornerstone of the program and is only possible due to the generous donations we have received.

Celebrating 40 Years MSAP

This year MSAP Celebrated it’s 40 year anniversary. To celebrate the 4 decades of training the scientists of tomorrow, the 2021 Cohort of Saplings shared cake and reminisced with mentors about past cohorts. A local news cameraperson, Christina, from Philly NBC10/Telemundo was onsite to record the event. Monell is so proud of the 11 students from the 2021 Cohort and the over 290 SAPlings!

Meet the new Administrative Coordinator, Kianna Price

Kianna joined the MSAP team in the Fall of 2021 and is hard at work preparing for our 2022 Summer Program. We are so lucky to have her and can’t wait to implement some of her innovations to the program. Kianna also provides support for the Center’s postdoc training program and the Center’s seminar series.

Welcome Kianna!