

Broadening Access to STEM Careers through Mentored Research Experiences



American Museum Of Natural History

The Pinkerton Foundation

The NYC Science Research Mentoring Consortium is supported through the generosity of The Pinkerton Foundation. NYC SRMC is led by the American Museum of Natural History.



THE FUTURE OF STEM PATHWAYS: A YOUTH DEVELOPMENT APPROACH

The New York City Science Research Mentoring Consortium is a **partnership** of academic, research, and cultural institutions committed to providing dynamic, mentored, **science research experiences** for NYC high school students.

The **mission** of the NYC SRMC is to provide students from historically underrepresented backgrounds in STEM access to **innovative research internships** that will support them in their college and career pathways.

Our **foundational belief** is that youth creativity, potential, commitment, and diversity—as well as the multiple perspectives youth bring and the important cultural and community-based knowledge they hold—will better enable us as a society to address the critical challenges our society and our planet faces.



THE NEED FOR HIGH SCHOOL MENTORED RESEARCH EXPERIENCES

Addressing Inequities in STEM

Power of belonging to a research community

Bringing essential voices to STEM & the workforce Black, Latine, and Indigenous students are severely underrepresented in STEM, experiencing lower levels of representation in STEM degrees and careers compared to the overall U.S. population.[1] Equitable access to fulfilling jobs in STEM is a **matter of justice**, as STEM careers can provide financially sustaining salaries and the opportunity to work on important issues. **Diversifying STEM is vital for equity**, as diversity drives the innovation and creativity needed to generate the array of solutions necessary to address the most present problems facing our society. [2]

Opportunities to engage in STEM, and particularly research, are an effective route to fostering a sense of belonging in STEM for youth while **developing skills and practices** that allow them to explore their interests.[3] **Doing research alongside a compassionate mentor** can have profound positive impacts on the career trajectories of BIPOC students.[4] Youth who participated in mentored research while in high school reported high **sense of belonging in STEM**, interest in pursuing STEM careers, and confidence in their ability to do so.[5]

Through in-depth research experiences in the Consortium, high school students **develop and refine their interests** and gain exposure to career paths in STEM, often leading them to pursue STEM-related careers. Consortium students build **technical skills** that help them land internships and jobs that can prepare them for STEM careers such as technical skills such as pipetting, programming, and experimental design, and **workplace skills** like accountability, collaboration, and communication. All students strengthen their critical thinking and problem solving skills. With these skills, Consortium alumni are **well prepared to bring their diverse perspectives to the STEM workforce.** This has the potential to expand and further diversify the STEM workforce, both locally in NYC and nationally.

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CONSORTIUM DEMOGRAPHICS

The NYCSRMC reaches Other Not Multiple Racial Listed <1% a broad array of Identities not incl Black 16% students who represent the diversity of NYC Multiple Racial White 23% vouth. Of 4455 total Identities incl Black 3% graduates, 3254 (73%) shared their racial Middle Eastern 1% and/or ethnic identities Black or African with us. American 26% Because ethnic Asian 29% identities intersect with many racial identities, ethnicity data was collected Native/Indigenous* 1% separately from racial *North or South American. Alaska identity. Native, Hawaiian, Pacific Islander Of the 3254 The rate of araduates for whom Latine/Latinx we have race or 25% students has been ethnicity data, 56% 56% roughly steady at include Black or 25% of graduates African American or every year. Latine/Latinx among their identities. Of the 1367 Of the 4185 graduates for whom graduates for whom we have family we have gender education data. data, 65% identify 47% 65% 47% of graduates as female, 35% as report that their male, and less than primary caregivers 1% are in additional do not have a 4 year gender categories. college education.

PATHWAYS IN STEM & STEM-RELATED OCCUPATIONS FOR NYC YOUTH



STEM job growth in NYC has increased dramatically in the last decade with a growth rate of 67%, outpacing the national growth rate for STEM employment nationally [1]. There has also been rapid growth in the rate of STEM degrees issued by NYC universities, with a 61% increase in the annual number of STEM degrees awarded between 2011-2021. This tremendous expansion of the STEM ecosystem in NYC is resulting in more local jobs that require STEM skills, competencies, content knowledge, and interest. The NYCSRMC aims to prepare youth with the skills and competencies necessary to successfully gain access to and build a path towards meaningful future STEM and STEMrelated degrees and careers.

COMPETENCIES FOR STEM & STEM-RELATED CAREERS

Whether or not one pursues a STEM career, there are a set of interpersonal skills gained by engaging in STEM work that are not only important for success in the workplace but can also lead to continued opportunities and growth. Therefore, a focus on STEM skills and expertise can expand the opportunities available to youth, even if they hope or aim to do work in other fields or domains.



STEM-RELATED

The National Science Foundation defines **STEM-related occupations** as occupations that require STEM skills & expertise, including: health care workers, mangers, teachers, technologists, & technicians in a variety of science and engineering fields.

Youth will need:

- Experience in & knowledge of science, technology, and engineering practices coupled with research skills such as ability to search and read primary sources; engage with big data; and use and develop models
- Interpersonal skills and competencies, including team collaboration and leadership, abilities to think scientifically and develop creative solutions for complex problems; and curiosity & reliability

[1] NYC/EDC, 2024;

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IMPACT OF THE CONSORTIUM ON STUDENT PATHWAYS INTO **COLLEGE & CAREERS**

OUT-OF-SCHOOL MENTORED RESEARCH SHOWS A POSITIVE RELATIONSHIP TO PURSUIT OF A STEM COLLEGE DEGREE AND/OR CAREER

Our 10-year NSF-funded longitudinal research study found that over 350 Consortium graduates who consented to participate in our study are pursuing a variety of academic and career pathways, including STEM-related and other-than-STEM degrees and careers. In year 8 of our research study, we have found that:



undergraduate degree in a STEM field



profession in STEM or a STEM-related field

YOUTH MAINTAIN A STRONG SENSE OF BELONGING TO STEM MAJORS & DISCIPLINES

Youth pursuing STEM majors report high levels of belonging to their academic majors, included feeling a sense of acceptance and membership to their STEM field. Feeling a higher level of acceptance to one's major and discipline is associated with fewer experiences with microaggressions about one's academic or intellectual abilities.

SOCIAL NETWORKS PLAY AN IMPORTANT ROLE IN SUPPORTING YOUTH'S STEM PATHWAYS

Youth report that a variety of people in their social networks provide vital academic, professional, and socio-emotional support and advice, including: peers, family members, faculty, employers and colleagues. However, youth also report struggling to identify and pursue individuals that may support their persistence in a STEM career. Consortium programs provide important resources to youth alumni to support them in building and expanding social networks that support their career goals.

GUIDING PRINCIPLES of the NYCSRMC

NYC Science Research Mentoring Consortium all create dynamic experiences for youth that follow a set a of shared guiding principles:



Commitment to Increasing Racial, Socio-economic, and Gender Diversity in STEM

• All programs are committed to recruiting and supporting groups who have been historically excluded from STEM fields.



Community

• Program activities and events foster a strong, supportive community among youth, mentors, alumni, and staff.



Scaffolded Supports

- Youth complete a minimum of 30 hours of STEM competency learning on foundational scientific concepts, lab skills, and exposure to professional scientists.
- Activities foster fluency in science communication, including reading, writing, and verbal skills.
- Program provides academic and career guidance.



Authentic Engagement Over Time

- Youth complete at least 100 hours of mentored research experiences alongside a scientist mentor.
- Youth develop STEM skills by working on a novel project and presenting their research.



Mentor Preparation

• Scientist mentors are provided ongoing support and preparation to work with NYC youth.



Compensation

• All youth are paid to participate. Labs are provided a stipend.



PROGRAM STRUCTURES

Individual programs bring the Consortium Guiding Principles to life through different structures and formats. For example:

AMERICAN MUSEUM OF NATURAL HISTORY: SCIENCE RESEARCH MENTORING PROGRAM

60 students begin with a 4-week Summer Institute focused on developing skills and understanding of data science, and designed through equity and justice lenses.

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August

with **Museum researchers** on projects connected with ongoing research in astrophysics, anthropology, and biology for **150+ hours.** Students meet monthly at advisories focused on science communication, equity in STEM,

and professional development.

All students join AMNH research

labs for the academic year and work

Students share their findings with AMNH scientists & educators, their peers, families, and friends through videos, blog posts, and posters in the **June Colloquium** held at AMNH.



September through May

June

MEMORIAL SLOAN KETTERING CANCER CENTER: SCIENCE ENRICHMENT PROGRAM



November-June



Each student conducts research in a laboratory or clinical research setting with an MSK faculty member for a total of 300 hours over eight weeks. They also participate in journal clubs and peer partnership workshops.

July and August

Students present their research to the MSK faculty and Leadership and to peers, scientists, and community at the AMNH August Symposium.

August

HUDSON RIVER PARK TRUST: SCIENCE LEADERSHIP PROGRAM



8-12 female students from a set of partner programs and schools participate in a six week program for a total of 100+ hours. Students develop independent projects under the main topic of the year (e.g., plastic pollution) with the guidance of staff scientists and college student who serve as **near peer mentors**. Students spend two days per week on coursework on the foundations of science research and equity and leadership workshops, and conduct direct fieldwork the rest of the week.

Students join their peers across the Consortium in presenting their work at the AMNH August Symposium.

July and August

August

TOTAL REACH OF THE CONSORTIUM



~380 Scientist Mentors Annually

Undergraduates, graduate students, postdoctoral scholars, professors, and research staff learn to mentor youth in science research.

~550+Youth Researchers

High school students conduct novel, authentic research in STEM while building confidence and developing technical and communication skills.

4455 Program Alumni Since 2013

Alumni stay connected through workshops, events, and a monthly newsletter. Many return to their programs as near peer mentors.

PROGRAM LOCATIONS

NYCSRMC Programs are distributed across New York City.



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NEIGHBORHOODS & SCHOOLS STUDENTS COME FROM

Between 2013 and 2023, students in the NYCSRMC came from a variety of NYC zip codes and 503 different schools across the city.



Home zip codes of Consortium students by year

Over the years, the Consortium has deliberately expanded its reach across the five boroughs of NYC.





Home zip codes of Consortium students by year





CENTERING YOUTH VOICES WITH ALUMNI ENGAGEMENT

We are dedicated to helping students succeed even after they graduate from our programs. Through research and observations, we know that students in the Consortium have great experiences and feel supported in their research programs. Yet, as they move into college and workplace settings, they report feelings of isolation and often struggle to identify and pursue the resources they need to succeed in their degree programs.

Through our alumni engagement efforts, we provide Consortium Alumni with resources, community, and opportunities that can help them thrive in college and beyond. Because we believe that alumni are best equipped to advise on what alumni need, want, and care about, we established the Alumni Council: alumni from across the Consortium who are now pursuing a range of career paths. The members of the Alumni Council share internships and opportunities on our Alumni Hub, send monthly newsletters, plan events, and serve as liaisons to programs to help students transition to college.



Leila Belgaid Rockaway Institute for Sustainability and Equity -Columbia University Environmental Biology



Nazia Jannat Project TRUE and WERM: Wave Hill

Queens College Environmental Science



Jasmine Kwong Brooklyn College STEM Research Academy

> Brooklyn College Psychology



Daisy Palaguachi RockEDU LAB Jumpstart

Hunter College Psychology



Jaida Thomas ARISE at NYU Tandon

Hunter College Pre-Nursing



Chris Dong Urban Barcode Research Program -New York University Biology and Film



Science Research Mentoring Program, AMNH

CUNY School of Professional Studies Business



Chinonye Nnajiofor BioRocket at Genspace -Columbia University Neuroscience

ALUMNI CO-RESEARCHERS OF NYCSRMC PATHWAYS

Six NYCSRMC Alumni also participate as co-researchers on our 10-year pathways study, working with senior researchers to investigate the career pathways of over 350 alumni.

2023 Snapshot

Programs came together for key events in Summer 2023:

June Colloquium

Students who completed projects during the school year presented research to friends, family, and peers.

250 14 Attendees Programs 84 56

84 56 Student Presenters Research Posters

Alumni Lunch

Alumni returned for a lunch event to discuss their college experiences, get resources on building community, and share advice with younger students.

50+ Attendees 13 Programs

August Symposium

Students in summer programs presented research at a 10 year Consortium Anniversary Celebration.

950 Attendees 480

Z / Programs

480 240 Student Presenters 240

Youth Workshop

Students in summer programs gathered for a tailored workshop on Mental Health: Conflict Resolution and Healthy Social Media.

150+ Attendees

12 Programs

At **Consortium meetings in 2023**, programs shared data, materials, and perspectives as they created new resources within four major strands of work to advance the work individually and collectively:

Program staff work in **collaborative partnership** to jointly address and support one another to create effective, equity-based programs. Partners learn and share effective practices, exchange resources, and use their **pooled expertise** to help all programs improve.

MENTOR PREPARATION

STUDENT RECRUITMENT

CONTENT AND CURRICULUM

COLLEGE AND CAREER SUPPORT

Reflecting on 10 years of the Consortium

Initially created to expand the reach of the Science Research Mentoring Program (SRMP) in NYC, in 2013 the Consortium launched with 6 programs and 90 students. In 2024 it now works with 28 programs across the city and serves more than 550 youth each year in academic, research, and cultural institutions.

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Evolve and Adapt

Unique Relationship with Funders

Over time, the Consortium has refined the Guiding Principles in response to learnings from new partners, the introduction of different internship models, and growing expertise within the field of Youth Development. Building from shared values and Guiding Principles has allowed for programs to experiment with new ideas and program components that continue to serve the overarching goals of the Consortium.

Programs

550 +

Students per year

Expanding the reach of the Consortium while staying true to the underlying Guiding Principles has been possible due to the unique relationship with the Pinkerton Foundation. Programs in the Consortium receive **sustained funding**, allowing them to invest in minoritized youth for the long term. As active participants in Consortium meetings, The Pinkerton Foundation engages as a **thought partner** as well as a funder, working in partnership with Consortium leaders at the American Museum of Natural History and forging connections with additional funders.

Evolution of the Consortium Structure

Since the Consortium's launch, having dedicated staff overseeing the network has been crucial to the Consortium's success. AMNH Consortium leaders are responsible for bringing members together, setting agendas and goals, and having the "birds eye view" of the multiple programs, assisting with sharing resources effectively.



Center for Scientific Collaboration and Community Engagement. (2020) The CSCCE Community Participation Model – A framework for member engagement and information flow in STEM communities. Woodley and Pratt doi:10.5281/zenodo.3997802

Over time, the structure of the Consortium has shifted to become a more complex and stronger ecosystem with layers of partner interactions. Early on, Consortium leadership disseminated information and guidelines to the partners akin to the **"convey and consume**" transmissive model in the Community Participation Model by the Center for Scientific Collaboration and Community Engagement, then morphed into a **"contribution**" model where partners shared back to the Consortium team, then to **"collaboration**" where partners shared amongst themselves yet still centered around the Consortium team. Now, the network is moving into a transformational **"co-creation**" model where partners create resources and assets together, with and without the oversight of the central Consortium team.

The Consortium structure has allowed for **key initiatives to be managed centrally and at scale**, allowing individual programs to focus on creating effective programming for students:

Alumni Engagement

Sustained support for alumni across all programs though Alumni Connects virtual hub and engagement events are managed through the Consortium leadership team, increasing the networking opportunities and resources available to all alumni.

Research on Impact

The Staying in Science 10-year longitudinal study on Consortium Alumni pools findings from all Consortium programs, amplifying the scale and the impact of the research far beyond what can be done with any one program alone.

Bringing the Guiding Principles to Life



Commitment to Increasing Racial, Socioeconomic and Gender Diversity in STEM

All programs are committed to recruiting and supporting groups who have been historically excluded from STEM fields.

Each program recruits students independently, using strategies such as:

- open applications with direct outreach to other youthserving programs and schools who work with minoritized populations
- exclusive partnership with one school
- limited eligibility including selected partner schools

Programs are exploring ways to specifically recruit more young Black men who are underrepresented across the Consortium.

Programs support minoritized students by:

- enacting a curriculum that centers diverse perspectives
- engaging in structured discussions about equity in STEM with students
- leading staff and mentors in professional development on equity and inclusion
- focusing on building a sense of belonging within the program and to STEM

IMPACT: RESEARCH FINDINGS

Our longitudinal research study has found that over 90% of youth report they are making valuable contributions to the scientific community and have a strong sense of belonging and connectedness to program mentors and peers.

Additionally, **90% of youth in the study report that they can imagine someone of their background doing the work of scientists.** They also enter college maintaining this mindset, which combats experiences with stereotype threat that many students of underrepresented backgrounds face while pursuing STEM degrees.

Deliberate Change Over Time

Many programs have moved to more intentional partnerships with high schools rather than open applications. Programs have removed barriers to apply such as requiring recommendation letters, limiting eligibility with GPA thresholds, and teacher nominations.

Programs select students who are interested in STEM but have not had experience.

Community

Program activities and events foster a strong, supportive community among youth, mentors, alumni, and staff. Programs build community through:

- explicit community guidelines and norms
- field trips and events
- family orientations and events
- community building workshops and activities
- events for students to gather regularly
- opportunities for students to connect with alumni
 - A state
- caring staff
- group celebrations



Belonging to a community includes building a STEM identity

Deliberate Change Over Time

While always a feature, community is now explicitly a guiding principle and programs have deepened their emphasis on explicit community building.



Bringing the Guiding Principles to Life Scaffolded Supports

To build skills, confidence, and agency, youth complete a minimum of 30 hours of STEM competency learning on foundational scientific concepts, lab skills, and exposure to professional scientists outside of their direct research projects. They participate in activities that foster fluency in science communication, including reading, writing, and verbal skills. Programs also provide academic and career guidance.

Deliberate Change Over Time

In their preparatory courses, many programs now focus on building a scientific foundation that allows students to then specialize during their mentored research.



Authentic Engagement Over Time

Youth complete at least 100 hours of mentored research experiences alongside a scientist mentor. These projects:

- span an array of STEM disciplines, including: ecology, conservation, genomics, biotechnology, engineering, astronomy, oncology, anthropology & chemistry
- allow students to develop technical and workplace skills
- prepare students to present their research in formal and informal settings, through papers, talks, videos, and poster presentations

Authentic Research

Pursuing questions of interest to researchers in the discipline; engaging in projects where results are not yet known; utilizing up-to-date techniques current in the field.

IMPACT: RESEARCH FINDINGS

Our longitudinal research study found that youth report opportunities to learn science practices while engaging in authentic research at statistically significant higher rates at their research sites than at their schools. These science practices include: • design/plan science investigations

Exploring th

- read & discuss published research literature
- collect & analyze data
- learn why research is important
- develop explanations or representations of research findings
- share research findings



Bringing the Guiding Principles to Life Mentor Preparation

Scientist mentors are provided ongoing support and preparation to work with NYC youth. Mentors are provided training in the following aspects of equity and inclusion in STEM and the foundations of youth development:

- Connecting as people
- Youth Development and working with teens
- Creating inclusive environments
- Aligning expectations
- Defining the research project
- Making the research accessible

RESEARCH FINDINGS

Mentors and youth articulated many reasons

for their participation in mentored research, including the desire for empowering and

- Helping students learn technical skills
- Identifying clear goals
- Giving frequent feedback
- Addressing conflicts

IMPACT:

authentic experiences.

Paying students AND mentors is an important aspect of equity.

Authentic engagement is supported by a variety of mentorship structures

- In most programs, students work directly with a career researcher such as a faculty member, postdoc, doctoral student, or research associate
- Sometimes near-peers (undergraduates) serve as the direct mentor, and they are in turn guided by a more experienced researcher
- In some cases, a career researcher and a near-peer (undergrad) work as a mentoring team to support the students

Deliberate Change Over Time

Programs have adopted a broader definition of who may be considered a scientist mentor and many now include undergraduate "near peer" mentors.

Compensation

All youth are paid to participate. Mentors are either paid directly or their labs are provided a stipend.

Why we pay students: Providing stipends is a matter of equity: many students are not able to spend their available time on an activity that doesn't pay. Many need to get jobs that pay. Compensation contributes to students feeling respected and valued in the space, and promotes a culture of professionalism and accountability.

Why we pay mentors: Compensation promotes a culture of professionalism and accountability and indicates that mentorship is valued work to be taken seriously.

I wanted the students to feel empowered in their research work, to use high-tech lab equipment and create original data, outcomes and interpretations. -Scientist mentor

Being paid made me feel like I was really working and that my work was being appreciated. -Youth Participant

EXPANSION STUDY



With support from the Sloan Foundation, in 2024 the American Museum of Natural History (AMNH) is now embarking on a **12-month planning project** to <u>develop a strategy</u> for expanding the AMNH-led New York City Science Research Mentoring Consortium in two major directions:

1) Explore opportunities for students in <u>new geographic areas</u> within New York City

While the Consortium draws students from across NYC, there are pockets of the city from which few students are attending Consortium programs. How can we make scientific research and mentorship more accessible across all of NYC?

- Find youth-serving organizations in or near these areas that may be interested in developing mentored science research programs.
- Identify ways for existing programs to expand their reach to these neighborhoods.



2) Explore opportunities for students to engage with <u>emerging</u> <u>technologies</u> (e.g. quantum, AI) and NYC <u>growth industries</u> (e.g. biotech).

The Consortium currently encompasses a wide range of scientific disciplines, yet does not include many opportunities for students to work within growing tech fields like **quantum and AI**, or directly connected to the growing economy of **Life Sci and biotech**. How might we design new internship structures that allow youth to gain direct experience in these fields?

- Find companies and organizations with expertise in these fields who are interested in education, outreach, and mentorship.
- Explore models of internships that retain Consortium values yet connect with new types of organizations such as for-profit companies.



NYCSRM CONSORTIUM

www.studentresearchnyc.org

In Summer 2024, the Consortium includes the following programs:

American Museum of Natural History: Science Research Mentoring Program Albert Einstein College of Medicine: BEYOND ALBERT **BioBus: BioBus Junior Scientists** Bronx River Alliance: Environmental Enrichment and Leadership for Students City College CREST: High School Initiative in Remote Sensing for Earth Systems Cold Spring Harbor DNA Lab: Urban Barcoding Research Program Columbia University Lamont Doherty: Secondary School Field Research Program Columbia University Zuckerman Institute: BRAINYAC CUNY Baruch: STEM Research Academy CUNY Brooklyn: STEM Research Academy CUNY City College: STEM Research Academy CUNY City Tech: STEM Research Academy CUNY LaGuardia Community College: STEM Research Academy CUNY Lehman College: STEM Research Academy CUNY Queens College: STEM Research Academy CUNY Queensborough Community College: STEM Research Academy CUNY York College: York STEM Research Academy Genspace: BioRocket Hudson River Park Trust: Science Leadership Program Hypothekids: Bioforce and Hk Makerlab Memorial Sloan Kettering Cancer Center: Science Enrichment Program Mt Sinai School of Medicine: Center for Excellence in Youth Education, Lloyd Sherman Scholars Natural Areas Conservancy: Urban Ecology and Environmental Science Internship NYU Tandon: Applied Research Innovation in Science and Engineering Rockaway Initiative for Sustainability and Equity: Environmentor Rockefeller University/ RockEdu: LAB Jumpstart Wave Hill: Woodland Ecology Research Mentorship Wildlife Conservation Society, Bronx Zoo: Project TRUE



www.studentresearchnyc.org

American Museum Of Natural History





Memorial Sloan Kettering Cancer Center

Lamont-Doherty Earth Observatory Columbia University | Earth Institute



COLUMBIA | Zuckerman Institute



The City College of New York







DNA LEARNING CENTER



Albert Einstein College of Medicine **Montefiore Einstein** Comprehensive Cancer Center



HUDSON RIVER PK



BRONX river alliance









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