Assessing the MMA Intern Program's Impact on Science

Appendices

An Interactive Qualifying Project submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements for the
Degree of Bachelor of Science

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Appendix A: Survey

The following survey was emailed to all former interns that could be identified within the time frame of the study. The survey's purpose was to collect information on the intern's time at the MMA, professional accomplishments after the internship, and general demographic information.

Note: Survey questions related to age, ethnicity, and race were developed using language from the United States Census Bureau to ensure that each group is accurately represented. For example, the question asking whether a person is Hispanic, Latino, or of Spanish origin is separate from the question asking participants to identify race. This is because, according to the US Census Bureau, "this question is asked separately because people of Hispanic origin may be of any race(s)" (US Census Bureau, 2023).

Maria Mitchell Association Internship Impact Survey

Start of Block: Introduction

Q1
Dear Friend –

Greetings! My name is Joanna Roche and I am the Executive Director at the Maria Mitchell Association. You are reading this because you were once an MMA Intern. We are working with a team of four students from Worcester Polytechnic Institute to conduct a survey of all interns who have worked at the MMA, (1914-2023). We're very excited to compile this list of amazing talent in one place, to be able to communicate with you going forward, and to begin to understand the role your internship may have played in your life. We recognize that you are doing good work out there in the world and we want to know about it! This project will help the MMA understand your impact and achievements. This survey will include questions about your experiences during your MMA internship, questions about your career journey after completion of your MMA internship, and demographic questions about your personal background. Responses from this survey will be used to compile a database of former interns for the purposes of improving and publicizing the MMA internship program and benchmarking our impact on science over the last 100 years.

Before participating in this survey, please read the Informed Consent Form found here (paste into browser): https://drive.google.com/file/d/1GJKrK5LwYAye6qMaX9WNquXOeGHJlIRb/view?usp=drive_link. It can also be found in the introductory email you may have received. By agreeing to participate in this survey, you are indicating that you have read the Informed Consent Form and understand your rights along with the risks and benefits of participation.

This survey will take approximately 10-20 minutes to complete. The survey will be open until November 27th, 2023. We truly appreciate your time and look forward to reading your responses.

Thank you,
Joanna

Q2 You may choose whether or not to answer any of the following questions. You may also stop completing the survey at any time. Please select one of the following statements:

- ○ I understand the above statements. If I stop completion of this survey before answering all questions, my responses may still be used for this study. (1)
- ○ I understand the above statements. If I stop completion of this survey before answering all questions, my responses may NOT be used for this study. (2)
- ○ I do NOT understand or accept the above statements and do NOT wish to continue completing this survey at this time. (3)

Skip To: End of Survey If Q2 = I do NOT understand or accept the above statements and do NOT wish to continue completing this survey at this time.

Page Break

Q3 Thank you for participating in the survey! Please select one of the following statements:

- ○ I consent to having my name, contact information, and other personally identifiable information shared with the MMA, which the MMA may use for future contact. (1)
- ○ I do NOT consent to having my name, contact information, or other personally identifiable information shared with the MMA, which the MMA may use for future contact. (2)

Q4 First Name

_____

Q5 Last Name

_____

Page Break

Q6 Has your name changed in any way since your internship?

- ○ Yes (1)
- ○ No (2)

Display This Question:
If Q6 = Yes

Q7 Please write the name used during your internship here.

_____

End of Block: Introduction

Start of Block: Internship Experience

Q8 The following section of the survey will ask about your experiences during your internship(s) with the Maria Mitchell Association.

Page Break

Q9 What year(s) did you participate in your MMA internship?

_____

Q10 What was your internship?

- [ ] Aquarium Internship (1)
- [ ] Assistant Discovery Camp Director (2)
- [ ] Communications & Marketing Internship (3)
- [ ] Environmental Education Intern (4)
- [ ] Event Planning and Development Internship (5)
- [ ] Mitchell House Internship (6)
- [ ] Natural Science Internship (7)
- [ ] Natural Science Museum Internship (8)
- [ ] NSF-REU Internship in Astronomy (9)
- [ ] Post-Baccalaureate Research Fellowship (10)
- [ ] Returning Environmental Education Intern (11)
- [ ] Other (12) _____

Q11 If you'd like to include your CV or resume, please feel free to upload the file below.

Q12 What level of education were you at during your first internship?

- ○ High School (1)
- ○ Undergraduate (2)
- ○ Graduate (3)

Q13 What was the duration of your first internship?

- ○ Summer (1)
- ○ Full year (2)
- ○ Other (3) _____

Q14 During a typical week, approximately how many hours did you dedicate to your internship/fellowship?

- ○ 0-5 (1)
- ○ 6-10 (2)
- ○ 11-15 (3)
- ○ 16-20 (4)
- ○ 21-25 (5)
- ○ 26-30 (6)
- ○ 30+ (7)

Page Break

Q15 Rate your level of agreement with each statement:

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I enjoyed my time on Nantucket (regardless of my experience at the MMA). (1)	○	○	○	○	○
My MMA internship experience influenced my future career decisions. (2)	○	○	○	○	○
I feel my MMA internship was valuable to me. (3)	○	○	○	○	○
My satisfaction with my MMA internship experience became more positive as I furthered my career. (4)	○	○	○	○	○
The interns and staff I worked with had a positive impact on my internship experience. (5)	○	○	○	○	○

Page Break

Q16 Rate your level of agreement with each statement:

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
The training I received during my MMA internship was applicable to my first paid (non-internship) position in my field after the internship. (1)	○	○	○	○	○
The training I received during my MMA internship is applicable to my current job. (2)	○	○	○	○	○
I learned transferable skills during my MMA internship. (3)	○	○	○	○	○
My overall experience at MMA was positive. (4)	○	○	○	○	○
I am likely to recommend a MMA internship to others. (5)	○	○	○	○	○

Page Break

Q17 Why did you decide to participate in a MMA internship?

Page Break

Q18 What is your favorite memory from your MMA internship?

Page Break

Q19 What is your favorite memory from your time on Nantucket (outside of the internship)?

Page Break

Q20 Do you have any suggestions on how the MMA can improve the internship program?

Page Break

Q21 If you could add a new internship field, what would it be?

_____

End of Block: Internship Experience

Start of Block: Career

Q22 The following section of the survey will ask about your experiences after the completion of your Maria Mitchell Association internship(s).

Page Break

Q23 Have you participated in any internships outside of the MMA? If yes, please list them.

_____

_____

_____

_____

_____

Page Break

Q24 What was your first paid (non-internship) position in your field after completing your MMA internship(s)?

_____

Q25 Rate your agreement with this statement:

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
My MMA internship(s) helped me acquire my first employment following the internship. (1)	○	○	○	○	○

Page Break

Q26 Please list all the positions you've held in your career. Please use the format Title/Company.

_____

_____

_____

_____

_____

Page Break

Q27 What is your current position?

_____

Q28 What company do you currently work for?

_____

Q29 What location (country, state) are you currently based in for your job?

_____

Page Break

Q30 Have you worked in academia, the public sector, or the private sector (check all that apply)

- ☐ Academia (1)
- ☐ Public Sector (2)
- ☐ Private Sector (3)

Q31 Have you ever worked at a non-profit organization?

- ○ Yes (1)
- ○ No (2)

Page Break

Q32 Have you ever performed research of any kind?

- Yes (1)
- No (2)

Display This Question:
If Q32 = Yes

Q33 What field(s) have you conducted research in?

_____

Q34 Have you published any papers?

- Yes (1)
- No (2)

Display This Question:
If Q34 = Yes

Q35 List the titles of any papers you've published:

_____

Q36 Have you published any books?

- Yes (1)
- No (2)

Display This Question:
If Q36 = Yes

Q37 List the titles of any books you've published:

_____

Q38 Have you given any TED, TEDx, TED-Ed talks?

- Yes (1)
- No (2)

Display This Question:
If Q38 = Yes

Q39 List the titles of any TED talks you've given:

_____

Q40 Have you been awarded any prizes for your professional achievements

- Yes (1)
- No (2)

Display This Question:
If Q40 = Yes

Q41 List any prizes you've been awarded:

_____

Q42 Have you ever held a patent?

- Yes (1)
- No (2)

Display This Question:
If Q42 = Yes

Q43 List any patents you have held:

_____

Page Break

Q44 What is your current total annual income?

- $0-$30,000 (1)
- $31,000-$60,000 (2)
- $61,000-$90,000 (3)
- $91,000-$120,000 (4)
- $120,000+ (5)

Q45 What is the highest annual income you've ever received?

- $0-$30,000 (1)
- $31,000-$60,000 (2)
- $61,000-$90,000 (3)
- $91,000-$120,000 (4)
- $120,000+ (5)

Page Break

Q46 Rate your agreement with this statement:

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
My MMA internship aided my professional development. (1)	○	○	○	○	○

Q47 Did you return for a permanent position at the MMA after your internship(s)?

- ○ Yes (1)
- ○ No (2)

Page Break

Q48 What is your proudest career achievement?

_____

_____

_____

_____

_____

Page Break

Q49 In your own words, how would you define success in your field?

_____

_____

_____

_____

_____

Q50 Do you consider yourself an expert in your field?

- Yes (1)
- No (2)

Display This Question:
If Q50 = Yes

Q51 What field do you consider yourself an expert in?

_____

End of Block: Career

Start of Block: Personal Background

Q52 The following section of the survey will ask for your personal and academic background.

Page Break

Q53 How would you best describe your gender identity?

- Male (1)
- Female (2)
- Non-binary or third gender (3)
- Prefer not to say (4)
- Prefer to self-describe (5) _____

Q54 What category includes your age?

- 16-20 (1)
- 21-29 (2)
- 30-39 (3)
- 40-49 (4)
- 50-59 (5)
- 60+ (6)

Page Break

Q55 Are you of Hispanic, Latino, or Spanish origin?

- ○ Yes (1)
- ○ No (2)
- ○ Prefer not to say (3)

Q56 What is your race? Check all that apply:

- ☐ American Indian or Alaska Native (1)
- ☐ Asian (2)
- ☐ Black or African American (3)
- ☐ Native Hawaiian or Other Pacific Islander (4)
- ☐ White (5)
- ☐ Prefer not to say (6)
- ☐ Prefer to self-describe (7) _____

X→

Q57 In what country were you born?

▼ Afghanistan (1) ... Zimbabwe (1357)

Display This Question:
If Q57 = United States of America

Q58 In what state were you born?

▼ Alabama (1) ... I do not reside in the United States (53)

Page Break

Q59 Please select all levels of education you have completed:

- [ ] High School Diploma (1)
- [ ] GED or Equivalent (2)
- [ ] Currently Attending College (3)
- [ ] Bachelor's Degree (e.g. BA, BS) or Associate's Degree (4)
- [ ] Master's Degree (e.g. MA, MS, MEng, MEd, MSW, MBA) (5)
- [ ] Professional Degree beyond Bachelor's Degree (e.g. MD, DDS, DVM, LLB, JD) (6)
- [ ] Doctoral degree (e.g. PhD, EdD) (7)

Display This Question:
If Q59 = High School Diploma

Q60 What school did you attend for high school?

_____

Display This Question:
If Q59 = Bachelor's Degree (e.g. BA, BS) or Associate's Degree
Or Q59 = Currently Attending College

Q61 What school did you attend for your undergraduate degree?

_____

Display This Question:
If Q59 = Bachelor's Degree (e.g. BA, BS) or Associate's Degree
Or Q59 = Currently Attending College

Q62 What was your major for your undergraduate degree (put all that apply)?

_____

Display This Question:
If Q59 = Master's Degree (e.g. MA, MS, MEng, MEd, MSW, MBA)

Q63 What school did you attend for your Master's Degree?

_____

Display This Question:
If Q59 = Master's Degree (e.g. MA, MS, MEng, MEd, MSW, MBA)

Q64 What was your major for your graduate degree?

_____

Display This Question:
If Q59 = Professional Degree beyond Bachelor's Degree (e.g. MD, DDS, DVM, LLB, JD)

Q65 What school did you attend for your Professional Degree?

_____

Display This Question:
If Q59 = Professional Degree beyond Bachelor's Degree (e.g. MD, DDS, DVM, LLB, JD)

Q66 What was your field for your Professional Degree?

_____

Display This Question:
If Q59 = Doctoral degree (e.g. PhD, EdD)

Q67 What school did you attend for your Doctoral Degree?

_____

Display This Question:
If Q59 = Doctoral degree (e.g. PhD, EdD)

Q68 What was the field for your Doctorate?

_____

Page Break

End of Block: Personal Background

Start of Block: Contact Info

Q69 To aid in future communication with you, we would like to record contact information within a database. This database will then be shared with the MMA as part of this study.
Secondly, survey respondents will be selected to participate in a follow-up interview with the purpose of creating profiles of former interns' experiences during and after their internships. These will be for the MMA to use and share. Some profiles may also be created without a follow up interview based on survey responses. These profiles will not be kept anonymous.

Page Break

Q70 Please indicate if you consent to the following. By clicking the box next to the statement, you consent. By not clicking the box next to the statement, you do NOT consent. You may choose not to check any/all boxes.

- ☐ To use contact information to further communicate with you about the use of your data and future events from the MMA. (1)
- ☐ To create a promotional profile for the MMA using your responses to this survey. (3)
- ☐ To use identifiable data (name, position, year, etc) from this survey in a database for the MMA. (5)
- ☐ To use non-identifiable data (numeric ratings) from this survey in a database for the MMA. (6)

Q71 We will be conducting a small number of follow-up interviews with select former interns. These interviews will expand on survey questions regarding career and life experiences. If you would be interested in potentially participating in an interview, please check the following box. This is not binding in any way.

- ○ Yes, I would be interested in potentially participating in an interview (1)

Page Break

Q72 Please answer the following questions:

	Uninterested (1)	Neither uninterested or interested (2)	Interested (3)
How interested would you be in an in-person reunion event for former MMA interns? (1)	○	○	○

Page Break

Display This Question:

If Q70 = To use contact information to further communicate with you about the use of your data and future events from the MMA.

Or Q70 = To create a promotional profile for the MMA using your responses to this survey.

Or Q70 = To use identifiable data (name, position, year, etc) from this survey in a database for the MMA.

Or Q70 = To use non-identifiable data (numeric ratings) from this survey in a database for the MMA.

Q73 Please provide your most recent phone number:

_____

Display This Question:

If Q70 = To use contact information to further communicate with you about the use of your data and future events from the MMA.

Or Q70 = To create a promotional profile for the MMA using your responses to this survey.

Or Q70 = To use identifiable data (name, position, year, etc) from this survey in a database for the MMA.

Or Q70 = To use non-identifiable data (numeric ratings) from this survey in a database for the MMA.

Q74 Please provide your most recent email address:

_____

Display This Question:

If Q70 = To use contact information to further communicate with you about the use of your data and future events from the MMA.

Or Q70 = To create a promotional profile for the MMA using your responses to this survey.

Or Q70 = To use identifiable data (name, position, year, etc) from this survey in a database for the MMA.

Or Q70 = To use non-identifiable data (numeric ratings) from this survey in a database for the MMA.

Q75 Please provide your most recent address:

_____

Display This Question:

If Q70 = To use contact information to further communicate with you about the use of your data and future events from the MMA.

Or Q70 = To create a promotional profile for the MMA using your responses to this survey.

Or Q70 = To use identifiable data (name, position, year, etc) from this survey in a database for the MMA.

Or Q70 = To use non-identifiable data (numeric ratings) from this survey in a database for the MMA.

Q76 Please feel free to insert links to any web pages that further detail your life and accomplishments.

_____

End of Block: Contact Info

Start of Block: Communication

Q77 Have you stayed in touch with other MMA internship alumni? Who?

_____

Page Break

Q78 We'd love to stay in touch with you! Here are some great ways to stay up to date on current Maria Mitchell Association events!

Connect with fellow MMA interns:
LinkedIn Alumni group: https://www.linkedin.com/groups/9261387/

Stay up to date on MMA events and programming:
MMA newsletter: https://lp.constantcontactpages.com/su/s5kEUqj
Facebook: https://www.facebook.com/MariaMitchellAssociation
Instagram: https://www.instagram.com/mariamitchellassociation/
Twitter: https://twitter.com/MMA_Nantucket
YouTube: https://www.youtube.com/channel/UCS5DwRA-3yGNrFokyH7VIKg
Pinterest: https://www.pinterest.com/mitchellhouse/

Lastly, please share this survey with any other Maria Mitchell Association interns or encourage them to contact us at:
WPIStudy@mariamitchell.org

End of Block: Communication

Appendix B: Interview Guide

The following guide was developed as a basis for our interviews with select former MMA interns. The guide was designed to enable consistency among all interviews, while allowing for individualistic changes based on who we are interviewing.

Introduction:

- Express gratitude for interviewee joining us for the interview
- Remind interviewee of the purpose of the interview
    - Learning more about their MMA internship and career achievements
- Researcher introductions
    - Name
    - Major
    - Hometown
    - Interests

Consent:

- Overview of ethical considerations
    - Can opt out of being audio-recorded
    - Can end interview at any time
    - Can choose not to answer any question
- Ask interviewee if they read and understood the consent form
    - Provide a paper copy of the consent form if the interviewee would like to read/ review
    - Answer any questions the interviewee may have
- Request verbal consent
    - Having read and understood the consent form, do you consent to taking part in this interview?
    - Do you consent to being audio recorded?

Connecting with the interviewee:

- Do some research on the interviewee beforehand
    - Ask about extra-professional activities
    - Invite interviewee to share anything that would like to about their life, family, interests, etc.

During internship:

- Begin asking questions about the interviewee's time at the MMA and on Nantucket
    - How did you first hear about the MMA?
    - What field did you work in during your internship?
        - What topics?
        - What was your favorite topic/ project/ assignment that you worked on at the MMA? Why?
    - What were your tasks and responsibilities during your internship?

- Did you enjoy being on the island of Nantucket?
    - If so, do you have a favorite memory of the island (ask more targeted questions if interviewee already detailed their favorite memory in the survey)?

After internship:

- Invite the interviewee to discuss their career journey
    - How one opportunity may have led to another
    - Changes in focus/ interests along the way
- Did you learn any skills at the MMA that you found particularly useful in your further studies/ career?
    - If so, what skills (technical and nontechnical)
- Researchers should already have information about first job from survey
    - Do you feel that your MMA internship helped you to obtain this role (through skills learned, connections, etc.)?
        - Note: Perhaps the MMA internship helped the interviewee obtain future internships, which ultimately led to a job
        - Note: Perhaps the MMA internship inspired the interviewee to pursue a higher degree, which ultimately led to a job
- Do you feel that your MMA internship made you more confident to pursue career opportunities that you may otherwise have not?

Additional targeted questions:

- Researchers should know the interviewees proudest career achievement from the survey
    - What led to this achievement?
    - Are there other career achievements you would like to discuss?
    - How have your career/ achievements impacted you or others?
- Invite interviewee to discuss any awards, books, publications, etc. that they mentioned in the survey in more detail

Conclusion:

- Was there anything not covered in this interview that you would like to discuss?
- In the event that a profile is created based on this interview, is there any specific information that you would like us to highlight?
- What advice would you give to future MMA interns?
- Thank interviewee for their time

Appendix C: Survey Consent Form

The following document is the consent form sent to former interns to obtain their consent to use information gathered from the survey in the database and for profiles.

Informed Consent Agreement for Participation in a Research Study Investigator: Fred Looft and Susan Jarvis

Contact Information:

Title of Research Study: Assessing the MMA's Intern Program Impact on Science

Sponsor: Maria Mitchell Association

Introduction

You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks, or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study:

This study will look at the impact of former Maria Mitchell Association interns on the scientific community. By surveying and interviewing these former interns, a database will be created to organize the experiences and accomplishments of former MMA interns. The MMA will then use this information to improve and market the internship program.

Procedures to be followed:

You will complete a short survey which will take approximately ten to fifteen minutes. This survey will feature questions about your experiences during your time at the MMA, your career journey, and personal and demographic questions. Survey questions may be multiple-choice, open-ended, or scale-based. Completing this survey will share your responses with the investigator for use in a report to the Maria Mitchell Association.

You may choose not to answer any questions; you may stop participating in the survey at any time. Your data will be kept confidential and anonymous within our report unless otherwise stated within the survey.

Risks to study participants:

This survey will include questions about your experiences at the MMA and during your career. This may cause you to think about experiences from your life that were uncomfortable in some way. Please be aware that this is a possibility when answering questions that ask you to consider your career and personal journey.

Completing this survey may also involve sharing personal information such as personal demographic details or contact information. This information will be kept anonymous unless otherwise stated, but there is the possibility that anonymous data may still be used to identify you in the future.

Benefits to research participants and others:

Participants will gain minimal benefits from this study. Completing this survey may lead to further communication with the Maria Mitchell Association, which may include networking or social opportunities. Select participants may be selected for highlighted profiles within MMA marketing materials, which could lead to increased publicity and professional visibility.

The project investigators and the Maria Mitchell Association will gain information that can be used to improve and market the MMA internship program. This information may lead to increased funding and opportunities for the internship program resulting from this survey.

Record keeping and confidentiality:

Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor, or its designee, and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you unless specifically stated within the survey.

Data will be recorded in two separate databases by the project investigators. One database will include survey answers pertaining only to your experiences during and after the internship program, including minimal identifying information. The second database will include demographic and other identifying information. These databases will be kept separate to protect confidentiality when possible. Both databases will be shared with the Maria Mitchell Association as part of our final report.

Some information may be included in anonymous statistics reported to the MMA as part of our final report, or to the general public as part of MMA marketing materials. This information will have no attached identifying information of any kind.

Compensation or treatment in the event of injury:

This study involves minimal risk of injury or harm to participants. In the case of injury or harm, there is no available compensation. You do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

Project Investigators

- Email: [*placeholder email*]
- Phone: [*placeholder phone*]

WPI Institutional Review Board Manager, Ruth McKeogh:

- Email: [irb@wpi.edu]
- Phone: [508-831- 6699]

WPI Human Protection Administrator, Gabriel Johnson, at:

- Email: [gjohnson@wpi.edu]
- Phone: [508-831-4989]

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

Appendix D: Interview Consent Form

The following document is the consent form sent to former interns to obtain their consent to use information gathered from their interview in the database and in-depth profiles.

Informed Consent Agreement for Participation in a Research Study Investigator: Fred Looft and Susan Jarvis

Contact Information:

Title of Research Study: Assessing the MMA's Intern Program Impact on Science

Sponsor: Maria Mitchell Association

Introduction

You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks, or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study:

This study will look at the impact of former Maria Mitchell Association interns on the scientific community. By surveying and interviewing these former interns, a database will be created to organize the experiences and accomplishments of former MMA interns. The MMA will then use this information to improve and market the internship program.

Procedures to be followed:

You will complete an interview which will take approximately thirty to sixty minutes. This interview will include questions about your experiences during your MMA internship and during your career. Questions will be open-ended; the goal of this interview is to allow you to expand in detail on your life story as it pertains to the purpose of this study.

You may choose not to answer any questions; you may stop participating in the interview at any time. Your data will be kept confidential and anonymous within our report unless otherwise stated within the survey.

This interview will be conducted virtually over Zoom. The interview audio will be recorded to ensure accurate transcriptions. You may choose at any point to not have your interview recorded, at which point paper-and-pencil note-taking will be performed by one of the interviewers.

Risks to study participants:

This interview will include questions about your experiences at the MMA and during your career. This may cause you to think about experiences from your life that were uncomfortable in some way. Please be aware that this is a possibility when answering questions that ask you to consider your career and personal journey.

Completing this interview may also involve sharing personal information such as personal demographic details or contact information. This information will be kept anonymous unless otherwise stated, but there is the possibility that anonymous data may still be used to identify you in the future.

Benefits to research participants and others:

Participants will gain minimal benefits from this study. Select participants may be selected for highlighted profiles within MMA marketing materials, which could lead to increased publicity and professional visibility. Completing this interview will increase the possibility that you will be selected for one of these profiles.

The project investigators and the Maria Mitchell Association will gain information that can be used to improve and market the MMA internship program. This information may lead to increased funding and opportunities for the internship program resulting from this survey.

Record keeping and confidentiality:

Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor, or its designee, and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you unless specifically stated within the survey.

Data will be recorded in two separate databases by the project investigators. One database will include interview answers pertaining only to your experiences during and after the internship program, including minimal identifying information. The second database will include demographic and other identifying information. These databases will be kept separate to protect confidentiality when possible. Both databases will be shared with the Maria Mitchell Association as part of our final report.

Some information may be included in anonymous statistics reported to the MMA as part of our final report, or to the general public as part of MMA marketing materials. This information will have no attached identifying information of any kind.

Compensation or treatment in the event of injury:

This study involves minimal risk of injury or harm to participants. In the case of injury or harm, there is no available compensation. You do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

Project Investigators

- Email: [*placeholder email*]
- Phone: [*placeholder phone*]

WPI Institutional Review Board Manager, Ruth McKeogh:

- Email: [irb@wpi.edu]
- Phone: [508-831- 6699]

WPI Human Protection Administrator, Gabriel Johnson, at:

- Email: [gjohnson@wpi.edu]
- Phone: [508-831-4989]

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

Appendix E: Survey Recruitment Email

The following is the email sent out to former interns requesting for them to complete the survey. The survey link is included within the email.

Dear [*intern's name*],

We hope this email finds you well. We are excited to reach out to you as a former [*internship name*] [*intern/fellow*] at the Maria Mitchell Association. If you were not associated with the Maria Mitchell Association in the past, our apologies for the mistake. In that case we would greatly appreciate if you could reply to this email so that we are able to remove your contact information from our records.

We are inviting you to complete a short survey to help us better understand the impact of the MMA's interns and fellows on science. This study is being conducted by a group of student researchers from Worcester Polytechnic Institute on behalf of the Maria Mitchell Association.

This survey will include questions about your experiences during and after your internship. There will also be a brief set of questions about your personal background to help us contextualize your answers within the overall history of the MMA. We value your thoughts and stories about these experiences, and completing this survey will help us best understand how the MMA can continue to improve and publicize the internship program going forward.

The survey will take approximately ten to fifteen minutes to complete. Your responses will remain confidential unless otherwise stated; you may choose to not answer any question and you may stop completing the survey at any time.

We invite you to access the survey through the following link: [*survey link*].

The survey will be open until 11:59 p.m. EST on November 27th, 2023, so please complete it at your earliest convenience. If you have any questions or require assistance with any part of the survey, please contact us at WPIstudy@mariamitchell.org.

If you choose to complete the survey, we also ask you to review the attached informed consent form. This form will outline in detail the benefits and possible risks associated with this study, and explain the specific usage of any data you may provide to us in this survey. The survey will include questions to confirm your consent to various aspects of this survey as outlined in the consent form.

We are grateful for your participation in our [*internship/fellowship*] program, and we appreciate your time in sharing your story with us. We hope to hear from you soon and get the chance to continue to build the future of the MMA together.

Best,
Mike Conroy, Alysha Creelman, Taylor Fiore, and Josh Keselman
Research Team, Worcester Polytechnic Institute

Maria Mitchell Association
[*MMA Email*]
[*MMA Phone Number*]
[*MMA Website*]

Appendix F: Interview Recruitment Email

The following is the email sent out to former interns who we were interested in interviewing to create in-depth profiles. All participants who received this email had already completed the survey and had indicated an interest in being interviewed.

Dear [*intern's name*],

Thank you for completing our survey. We are glad to hear that you would be interested in a follow-up interview with us. This interview will explore in more detail your experiences during and after your internship, with a focus on hearing your unique story and views on the MMA internship program.

This will be a 2-on-1 interview with two members of our team. The interview will take approximately 30 minutes; at any point during the interview, you may choose to end the interview if you feel uncomfortable or do not wish to continue for any reason.

If you choose to participate in an interview, we also ask you to review the attached informed consent form. This form will outline in detail the benefits and possible risks associated with this study, and explain the specific usage of any data you may provide to us in this interview. If you agree to complete an interview, you will need to give verbal confirmation of having read this form to begin the interview.

If possible, we would like to audio record this interview to ensure that we can accurately transcribe your responses. You may choose not to consent to this recording; if you initially give consent to a recorded interview, you may at any time rescind consent, at which point the recording will be immediately stopped.

Please reply to this email with times that would be available for you to interview with us, between [*start date of interview period*] and [*end date of interview period*]. We will then decide on a time and format for this interview.

We are grateful for your willingness to further contribute to this study. We cannot wait to get the chance to meet with you and hear your story.

Best,
Mike Conroy, Alysha Creelman, Taylor Fiore, and Josh Keselman
Research Team
Worcester Polytechnic Institute

Maria Mitchell Association
[*MMA Email*]
[*MMA Phone Number*]
[*MMA Website*]

Appendix G: LinkedIn Message

The following is the message sent out to former interns through LinkedIn requesting for them to provide an email for us to send the survey to.

Dear [*intern name]*,

My name is [*name of sender*], and I am representing the Maria Mitchell Association on a project to assess the MMA intern program's impact on science. As part of this assessment, we are working back through the MMA internship records to identify former interns and then sending out surveys to learn more about their time at the MMA and their subsequent career accomplishments.

Based on the MMA's records, we have identified you as a former intern in one of their programs, but we were unable to find any current contact information aside from your LinkedIn information.

If you are willing to respond with your email address, we would like to send you the survey.

Please feel free to respond to this message or email WPIStudy@mariamitchell.org with any questions. We appreciate your time and we hope to hear back from you soon!

Sincerely,

[*name of sender*], Worcester Polytechnic Institute

Appendix H: Interviewee List

The following is a table including the name, internship field, and year(s) of each former MMA intern interviewed during this study. Interns are listed in the order in which their interview occurred.

Intern Name	Internship Field	Year(s) of Internship
John Weaver	Astronomy	2015
Andrew McKenna Foster	Natural Science	2004, 2005, 2006
Eric LoPresti	Natural Science	2011
Ann McMahon	Astronomy	1977
Patrick J La Riviere	Astronomy	1993
Tiffany Devlin-Perry	Marine Science	2013
Patricia Henneberger	Marine Science	2014
Nancy Remage Evans	Astronomy	1964
Elizabeth Donelan	Natural Science	2006
John Briggs	Astronomy	1977
Sarah Bois	Mitchell House, Science	1998, 1999, 2000
Andrew Royer	Administration	2010
Helen Cheng	Marine Science	2009, 2011
Jana Davis	Marine Science	1995
Karen Meech	Astronomy	1981
Meredith MacGregor	Astronomy	2009
Meg Thacher	Astronomy	1986
Jonathan Shuster	Natural Science	2008, 2009
Erik Thogersen	Astronomy	1992
Bonnie Buratti	Astronomy	1973
William Evans	Education	2022
Paige Collins	Education	2013

Appendix I: Intern Profiles

The following is a table including the name, internship field, and year(s) of each former MMA intern profiled during this study. Interns are listed alphabetically. Following the table, all profiles are listed, in the same order as the table.

Intern Name	Internship Field	Year(s) of Internship
John Wright Briggs	Astronomy	1977
Bonnie Buratti	Astronomy	1973
Helen Cheng	Marine Science	2009, 2011
Paige Collins	Environmental Education	2013
Nancy Remage Evans	Astronomy	1964
Ann McMahon	Astronomy	1977
Karen Meech	Astronomy	1981
Cecilia Payne-Gaposchkin	Astronomy	1924
Andrew Royer	Marketing and Public Relations	2010
Jonathan Shuster	Natural Science	2008, 2009
Meg Thacher	Astronomy	1986
John Weaver	Astronomy	2015

John Wright Briggs

Astronomy, 1977

John Briggs[1], a lifetime lover of astronomy, found that the MMA was well known in his circle. With the Maria Mitchell Association being connected to the American Association of Variable Star Observers (AAVSO) and heavily publicized in magazines like Sky & Telescope, John couldn't help but know of the organization. At the time of his internship in 1977, the program was offered exclusively for women; despite this, he had the courage to apply to the very prestigious astronomy internship. With luck and a heavy push from Dorrit Hoffleit, the Director of Astronomy at the time, John Briggs became the first male intern at the MMA, an opportunity he felt very fortunate for.

John made the most of his time at the MMA. Tasked with tracking the changing light of variable stars, John would assist with pulling glass plates taken by the MMA telescope and estimating the brightness relative to the field of view. In his off time, he discovered literature on the history of telescopes and astronomy, reading by candlelight in the attic of the MMA's Hinchman House. The history of astronomy turned into a special interest of his, that he's pursued throughout his life.

John indicated that his internship experience reinforced his love for astronomy, stating that his experience at the MMA was a "steppingstone" on his path to the subject. He traveled to any astronomy conference he could reach, often driving for hours or days. John recalls only one instance of ever doubting his pursuit for the stars, quickly reminding himself that his love for the subject is worth the effort he's put into it. Despite never pursuing a graduate degree, John took every opportunity he could find to work at an observatory, gaining practical experience with the instruments and building an impressive resume. John states one of his favorite observatories to work at was Mt. Wilson Observatory, located in California. He currently works as an instrumentation engineer for astronomical machinery. One of his positions landed him as far as South Pole station in Antarctica. A team of three, including John, spent the year on what he described as "another planet" in order to explore South Pole Station's potential for astronomical observations.

John has returned to the MMA multiple times to both maintain the telescopes and speak at the organization. Now located in New Mexico, at the age of 65, John holds a collection of telescopic artifacts and historical literature, as well as other astronomical paraphernalia, one of his top picks being a large refracting telescope from 1868. The self-made "grown-up amateur astronomer" leaves this advice for the next generation of young scientists: you don't need to follow the established path if you're patient, take time to find your strengths and build your confidence, and above all, encourage the pursuit of each other's interests.

[1] Image from https://www.aavso.org/node/85883

Bonnie Buratti

Astronomy, 1973

Bonnie Buratti[2] has been interested in astronomy since the third grade. Through her hard work and dedication, she was admitted to the Massachusetts Institute of Technology to study Earth and Planetary Sciences in the 1970s. In her interview with the research team, Bonnie stated that "back then, it was hard for girls to get positions at observatories for various reasons; some observatories just outright didn't take female interns." Despite this barrier, Bonnie received an offer to work as an intern in the Maria Mitchell Observatory. Bonnie's MMA experience gave her "lifelong friends and colleagues," and was the first place that she was able to conduct research. Bonnie stated that during her research experience at the Maria Mitchell Observatory, she "found out that [she] was good at research and liked it," which "solidified that [she] should go on to get [her] PhD."

During her interview, Bonnie spoke very highly of Dorrit Hoffleit, director of the Maria Mitchell Observatory at the time of her internship. Bonnie described Dorrit as being "larger than life," and went on to state that "when [she] became a practicing scientist and had [her] own students," she "applied what [she] learned about how to mentor students" from Dorrit Hoffleit. Bonnie has taken the education of her students very seriously, stating in her survey that she would define success as "mentoring younger scientists and leaving a legacy." In her interview, Bonnie added "you have to give back, and the giving back is to teach and pass on [knowledge]." Bonnie strives to teach her students the "joy of discovery," which she felt for her first time through her research on variable stars at the Maria Mitchell Observatory. Currently, Bonnie is focused on educating underrepresented students, as she understands that "a mentor can make a lot of difference in someone's life."

Bonnie has spent her career working in planetary science, a field of astronomy that sparked her interest during her graduate studies at Cornell University. When asked about her goal as an astronomer and scientist, Bonnie stated: "If you were standing on one of the planets or moons, what would it look like? And by telling what it looks like, you can tell what its history is and tie it in with bigger processes in the solar system." Bonnie is currently the Deputy Project Scientist on the Europa Clipper Mission at NASA's Jet Propulsion Laboratory. In her interview, Bonnie explained that the Europa Clipper mission will be launched in about a year, "then in another five years, it will arrive on Jupiter and do a detailed exploration of Europa," one of Jupiter's largest moons. The mission will be the "first detailed look at an ocean world" that "may have habitable environments similar to Earth."

In 2022, Bonnie received the Gerard P. Kuiper Prize: an extremely prestigious award given to one individual per year for their contributions to the field of planetary science. Bonnie was also the 2018 recipient of the Sagan Medal from the Division of Planetary Sciences of the American Astronomical Society for her outreach and communication to the public. Bonnie's popular book, "Worlds Fantastic, World Familiar: A Guided Tour of the Solar System" is yet another example of her success and passion for astronomy.

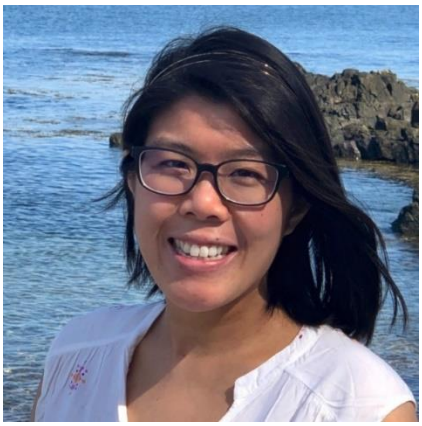
Bonnie wants to continue empowering women and others who are underrepresented in STEM to pursue their dreams. Despite any adversity, Bonnie continues to pursue a meaningful career and has made contributions in planetary sciences that have had a major impact on the world of science.

[2] Image from https://science.jpl.nasa.gov/people/buratti/

Helen Cheng

Marine Science, 2009

Bay Scallop Research, 2011



Helen Cheng[3] has had an incredible journey through her career so far, originating with her time on Nantucket at the Maria Mitchell Association. Originally just looking for any internship that would pertain to her interest in marine science, the MMA internship caught her eye as it was one of the most well-supported marine science internships at the time. Helen initially participated in an MMA aquarium internship for just one year, though a few years later returned for the more specialized Bay Scallop Research Internship, where she was able to devote her time to the focused research of scallops on Nantucket. Helen described how wonderful and unique Nantucket was for research, stating that due to its self-contained environment, it is "a living laboratory."

Helen noted that her MMA scallop research was able to give her invaluable skills and experience for her future career, both simply through gaining experience performing field research and learning practical skills, like how to drive a boat. This experience also introduced her to presenting her own research at a conference. While the first aquarium internship was still a valuable experience for Helen, her assistance with a horseshoe crab research project upon her return to the MMA is what ultimately gave her the experience required for her Master's research on horseshoe crabs.

Recently, in 2020, Helen went back to school to earn her PhD at Northeastern University in Marine Environmental Sciences with a focus on social ecological impacts on fisheries. There, she performs research on the impacts of range expanding species such as black sea bass and blue crabs. A particular point of enjoyment with this research for Helen is working with the fishermen in the New England region.

Just like Maria Mitchell herself, Helen Cheng dedicates her work to being able to help and educate others. She describes how the ability to share her research during and after its completion is very important to her, and loves being able to see others get excited about her work. Helen always makes sure to take plenty of pictures throughout her research, as it gives people not versed in the field a chance to engage in a greater way.

From her own experiences facing resistance in a male-dominated field, Helen tries to encourage the next generation of scientists to persevere through the toughest times. When speaking to high school students she tries to "inspire them that this isn't just a field for one demographic" and show that anyone who wants to can thrive in the sciences. When asked what advice she would give to young scientists in a similar position to her at the beginning of her internship, Helen said it is important to remember to take pictures, saying "taking photographs is a great way for me to look back and see how far I've come," giving more inspiration to keep going.

Helen discussed how being a woman of color in such a male dominated field can be incredibly difficult; many people she encounters doubt her expertise. Helen, however, has persisted through any adversity in pursuit of her goals. Helen talked about how her mentors have been a major source of inspiration and motivation throughout her career, saying "it reminds me that others have seen what I've gone through and don't want to see me give up."

[3] Image from https://www.linkedin.com/in/helcheng/

Paige Collins

Environmental Education, 2013

While studying abroad in Denmark where "the sun rises at 10 AM and sets at 3 PM," Paige Collins[4] realized that she wanted to spend the summer "somewhere warm and by the beach." With a background in science and working with children, Paige took to the internet in an attempt to find an internship that was applicable to her studies and would allow her to work outside. Eventually, she stumbled upon the Maria Mitchell Association Environmental Education Internship, an opportunity that "married [her] interest in marine biology with [her] past work as a camp counselor."

Paige's MMA internship proved to be everything she had hoped. In her interview, Paige explained that her job as an environmental education intern "was fulfilling, relevant to [her] interests," and provided her with "a little family" for the summer on Nantucket. Paige explained that during the summer, the environmental education interns would work in groups of two to plan lessons for the summer camp children, which generally involved some type of outdoor activity such as using "big nets to pull in tidal animals and put them in a pool." Paige discussed how day-to-day, she would wake up in the Hinchman House, eat breakfast with the other interns, load the MMA van with all necessary supplies for the day, and head to the local schools to pick up the eager children. Paige noted in her interview that she enjoyed the independence given to her and the other interns when making lesson plans for each day.

Paige described her summer on Nantucket as "one of [her] favorite times of [her] life so far." When asked why this summer was so memorable, she explained that her and the other interns "were on this beautiful island and really made the most of it." One of Paige's favorite MMA memories is going to Steps Beach after work every day with her fellow interns to watch the sunset and swim. Paige had such a great experience on the island that she decided to return the summer after to lifeguard at the White Elephant resort on Nantucket.

When asked about ways to improve the MMA internship, Paige noted that during her summer on Nantucket, herself and the other environmental education interns befriended other island interns from a "bike tour group, which was an external organization." Paige noted this friendship between interns as one of the highlights of her time at the MMA, and encourages future MMA interns to "look even broader" than the MMA to build connections with interns across the island. Paige also encourages the MMA to continue hosting mixers and other events for interns and staff members to connect.

While Paige loved her summer educating children at the Maria Mitchell Association, she was also interested in pursuing other career opportunities in business and marketing. Paige has worked in a variety of marketing roles at e-commerce and tech companies. In these roles, she has been able to leverage her background in science to take a "scientific approach to marketing," which has had a major influence on the companies she has worked for. Paige explained that "if you can work with numbers, think, and write," you have the tools necessary to begin a successful career in the field of marketing. Paige "likes the flexibility of working in business, tech," and similar fields and hopes to continue making a positive impact on the organizations that she is a part of.

[4] Image from https://www.linkedin.com/in/planecollins/

Nancy Remage Evans

Astronomy, 1964

Nancy Evans[5] first became interested in astronomy in her sophomore year at Wellesley College, soon finding the Maria Mitchell Association to participate in their internship program. During this time, Nancy began to learn about Cepheid Variable stars: stars that change in brightness, temperature, and diameter over time. When first learning of them, she had believed that everything there was to learn about Cepheids had already been discovered, so though she was interested in the topic, Nancy did not initially consider it an area of research to delve into. That was, however, until a mentor in graduate school pushed her to follow the topic; Nancy has been studying Cepheid Variable Stars for the majority of her career since.

Through her research with Cepheid stars, Nancy was able to learn more about how other galaxies relate to our Milky Way Galaxy; they are "the first step in extragalactic distance monitoring." More recently, the work Nancy was doing with Cepheid stars helped to determine the mass of several Cepheids. By studying and determining the mass of stars, much more can be learned, as "the mass is the most fundamental property [of a star]; once you know the mass and chemical composition, you can predict a lot about its future existence." Through examining this, Nancy has discovered some interesting properties over the years. For example, in binary star systems, the two stars can sometimes shed or swap masses with each other.

Dr. Evans' research has brought her much renown and allowed her to conduct observations using many different satellites such as the International Ultraviolet Explorer, Hubble Space Telescope, Chandra, and more; Nancy even claimed we are in the "golden age of satellites." Nancy was a staff scientist on the IUE and Chandra Satellite projects. She has used many tools for research throughout her career, like using interferometry, a way of using multiple telescopes together in order to detect disruptions in waves. Throughout her career, Nancy has taught at the University of Toronto and was the associate director of the Space Astrophysics Laboratory at the Institute for Space and Terrestrial Sciences at York University. She is also a fellow of the American Astronomical Society.

Still years after her internship with the MMA, Nancy Evans has adopted Maria Mitchell's ideals of education through her work with the next generation of astronomers. While working with a group of post-doctorate researchers, Nancy was able to teach some of what she has learned throughout her own career, as well as learn from the young researchers herself. Nancy discussed how they knew many things that she had not gotten a chance to learn yet.

Even after such a long and impressive career, Nancy Evans still looks back fondly at her time on Nantucket at the Maria Mitchell Association. Nancy noted that though it is a lot of work and takes many hours, the MMA internship was a great addition to coursework and is incredibly rewarding. Nancy cited the experience as a wonderful first journey into completing research in the field of astronomy, particularly noting it was her first time learning how to use a telescope, something she would continue to do for decades to come.

[5] Image from https://hea-www.harvard.edu/~evans/

Ann McMahon

Astronomy, 1977

As a rising senior in high school, Ann McMahon[6] spent the summer at the Maria Mitchell Observatory (MMO) studying variable stars. Utilizing historical research and real-time data taken through the MMA's telescopes on Nantucket, Ann was able to classify a star that had never been classified before. This work led to the publication of a paper released in the journal of the American Association of Variable Stars.

Following the completion of her MMA experience, Ann used her research and published paper to enter local and national science competitions. Her hard work paid off as she was awarded two $4000 scholarships that helped her pay for an education that otherwise may have not been financially feasible for her family. Ann wrote in an email to the team that "the research [she] did at MMO, by virtue of the funds and opportunities awarded to [her] in the subsequent science competitions, paid for [her] undergraduate education and launched [her] career." She continued in her interview, adding that the MMA "truly opened up college opportunities that [she] never would have had."

Following her education in engineering, Ann began working as an engineer at McDonnell Douglas (now The Boeing Company) "designing electronics packaging and performing thermodynamic analyses." With her family growing, Ann decided to shift her career toward education and found a passion for teaching youth about the natural world. For the remainder of her career, Ann would devote herself to educating others and training teachers in the best practices to support and inspire students. Among many other achievements, Ann wrote and won a National Science Foundation grant to "revamp the science and math program" at the school district where she had been working, allowing her to be recognized by other organizations. Ann has made her mark on a variety of communities through her work at the Pacific Science Center, Smithsonian Science Education Center, University of Washington, and her own education company (Ann P McMahon, LLC). Ann's education career was also supplemented with a variety of public speaking events relating to science, education, and her own life experiences. In 2016, Ann was featured in the TEDx Talk "Empathy in engineering," where she discussed her career journey.

In addition to her work as an engineer, educator, and public speaker, Ann is also committed to giving back through community service. In her interview, Ann stated that "serving organizations that help other people understand nature has always been important to [her]." Ann continued, adding that "because of the opportunity that the Maria Mitchell Association gave to [her], [she] has always felt passionate about paying it forward."

Following her retirement, Ann is still an avid amateur astronomer, maintaining the curiosity for the sky that she has had since she was a young girl. She shared in her interview that she and her husband enjoy chasing aurora borealis when the conditions are right. Looking back on her career, Ann encourages others to "ask a lot of questions" and "be curious about the people that are introduced to you, what they're doing, and why they are doing it."

[6] Image from https://www.linkedin.com/in/ann-p-mcmahon-ph-d-08b1b37/

Karen Meech

Astronomy, 1981

Karen Meech[7] has come a long way. From her birthplace in Colorado, Karen traveled to Rice University in Texas for her undergraduate degree, and in 1980, she traveled to Peru to complete an Earthwatch scholarship. A year later, in 1981, Karen made her way north, to Nantucket, for another Earthwatch internship at the Maria Mitchell Association. While at the MMA, she worked on variable stars, cataloging glass plates and "resolving issues with questionable variables" under the tutelage of Dorrit Hoffleit, the Director of the Maria Mitchell Observatory at the time.

After she completed her undergraduate degree, Karen returned to the Northeast, splitting time between work at the American Association of Variable Star Observers under Janet Mattei (another former MMA intern) and post-graduate research on occultations with Jim Elliot at MIT. Karen then switched to work on cosmic travelers, comets, earning a Ph.D. in planetary science from MIT in 1987. That same year, she once again crossed the country to take a faculty position at the University of Hawaii; it was there she began to work in earnest on what would become the central topic of her career: understanding the origins of Earth's water in relation to comets. She works there now as an astronomer and astrobiologist, and she is the primary investigator for the NASA Astrobiology Institute's Lead team at the university.

Karen worked on multiple NASA missions leading the space and ground-based observing of small bodies. As a result of this work, in 2017, she was one of the first astronomers contacted when fellow University of Hawaii researcher Richard Wainscoat discovered the first interstellar object (an object from another solar system found within ours). Karen was able to pull together her network, built over years of research and collaboration, to get increased observatory time to study the object and fast-track publications on 'Oumuamua, as the object was named. Karen highlighted the significance of this discovery, calling 'Oumuamua (and other interstellar objects) "a building block of the process of building planets in another solar system).

Beyond her research, Karen has also been a leader in astronomy education. In order to secure funding to support graduate researchers in her lab, Karen applied for and received a series of grants from NASA and independent donors, in exchange for the creation of student-teacher workshops in Hawaii. These workshops helped bring together underrepresented scientists from across the Hawaiian islands, who came together to learn and connect with Karen and other leading astronomers, including Janet Mattei. Despite the immense complexity of planning these workshops and meeting the guidelines established in the grants, Karen persevered to bring science education to over 360 teachers and students from across Hawaii and Micronesia, giving them valuable skills and modern equipment for their own teaching careers, a process she described as "very rewarding."

Moving forward, Karen has served for a few years as an interim director for University of Hawaii's astronomy program, a role in which she hopes to "reimagine astronomy and space science at UH, because we have all these oases of good space science" that she would like to connect. She also wants to start applying for new missions that can help continue her search for the origins of Earth's water.

In 1996, Asteroid 4367 was named Meech in honor of her work in small-body astronomy. Karen has won the 1988 Annie Jump Cannon in Astronomy, the 1994 American Astronomical Association Department of Planetary Sciences Harold C. Urey Prize, and in 2023, she was awarded the Dannie Heineman Prize for Astrophysics from the American Astronomical Society.

[7] Image from https://manoa.hawaii.edu/speakers/karen-meech/

Cecilia Payne-Gaposchkin

Astronomy, 1924

Cecilia Payne was born in 1900, in Wendover, England, the daughter of a British lawyer and historian and a Prussian artist[8]. When Cecilia was four, her father died, leaving her mother Emma to raise the family; Emma taught Cecilia to love science and the arts, and when Cecilia was twelve, moved the family to London to give Cecilia and her siblings more opportunities. In high school at St. Paul's Girls' School, Cecilia showed an early aptitude for chemistry; she wrote that she would often visit the science lab for "a little worship service of my own, adoring the chemical elements."

In 1919, Cecilia entered Newnham College at the University of Cambridge on a full-ride scholarship. She initially studied botany, physics, and chemistry. It was at Cambridge that a chance encounter with astronomer Arthur Eddington, who recounted his recent expedition to study an eclipse and attempt to prove Einstein's Theory of General Relativity, that Cecilia's love of astronomy and physics was truly ignited. She later recalled that after this lecture "the result was a complete transformation of my world picture. When I returned to my room, I found that I could write down the lecture word for word."

With Eddington's encouragement, she attended lectures in astronomy on top of her coursework in physics, but Cambridge (and England in general at that time) held no options for women in science other than teaching, and she was barred from receiving an undergraduate degree in astronomy. It was here again that fate struck; a friend introduced her to Harlow Shapley, the recently appointed Director of the Harvard College Observatory. After corresponding with him, in 1923, Cecilia traveled to America, where she would live the rest of her life. At Harvard, she was part of a group of women known as the Harvard Computers, who did work conducting astronomical calculations for male professors; many of these women, including Cecilia, were supported by financial grants and observatory data from the Maria Mitchell Association.

Two years later, in 1925, she became the first person to earn a Ph.D. in astronomy from Harvard University's Radcliffe College. In her thesis, entitled "*Stellar Atmospheres; A Contribution to the Observational Study of High Temperature in the Reversing Layers of Stars*," she made a series of observations about the stellar spectra (wavelengths of light) of stars, and came to a startling conclusion. Contrary to popular belief at the time, according to her study of the wavelengths of light produced by stars, Cecilia claimed that stars were composed primarily of hydrogen and helium, rather than elements like silicon and carbon. This staggering discovery was initially met with resistance; astronomer Henry Norris Russell, who in 1914 had published an article asserting once again that the chemical makeup of stars was similar to that of planets like Earth, called her results "spurious" and "clearly impossible."

Four years later, Cecilia's work was generally accepted as correct. Fellow astronomer Otto Struve called her paper "the most brilliant PhD thesis ever written in astronomy." Russell himself derived similar results, and in his publication noted Payne's earlier work. Yet Russell was and is given much of the credit for this discovery, downplaying not only Payne's momentous achievement but his own role in burying her work. Cecilia's story, of a woman whose remarkable work in science was largely credited to a man, is all too common and reinforces the need for Maria Mitchell's own work in expanding equality within research.

[8] Information for this profile comes from the following sources: https://tinyurl.com/yuda73xz, https://tinyurl.com/5dkuh5ze, https://tinyurl.com/5n7j53f7, https://tinyurl.com/4haehv4t, https://tinyurl.com/5ty8hr84, https://tinyurl.com/mv4cskb6

In 1933, luck struck once more; on a journey through European observatories, she attended a lecture in Germany where she met a young Russian scientist named Sergei Gaposchkin. On her return to America, she fought to get him a visa to leave war-torn Europe and immigrate to the States. A year later they married, and she took the name Cecilia Payne-Gaposchkin. Their partnership led to years of research into variable stars, with nearly 4 million observations made between 1938 and 1975.

In 1956, after years of brilliant work done as a mere "technical assistant," Cecilia became a full professor at Harvard, and chair of the Astronomy Department there. She was the first female professor and department chair in Harvard's history. Among the many prizes she was awarded for her research were an honorary Degree of Science from Cambridge University, and, in 1976, the Henry Norris Russell Prize from the American Astronomical Society. In her acceptance speech for the Russell Prize, she said, "The reward of the young scientist is the emotional thrill of being the first person in the history of the world to see something or to understand something." Cecilia Payne-Gaposchkin died in her adopted hometown of Cambridge, Massachusetts on December 7, 1979. While she had to fight for many of the opportunities and acclaim that she deserved, her pioneering work into understanding our universe stands as a beacon of scientific achievement. Her work was often overshadowed by that of male colleagues, but over time her talent for insight and observation shone through. Her obituary opened by calling her "a pioneering astrophysicist and probably the most eminent woman astronomer of all time," an apt descriptor of a remarkable life.

Andrew Royer

Marketing and Public Relations, 2010

While working towards his Master's degree in history museum studies, Andrew Royer[9] had to find a paid internship for the summer after his second year. Though having not heard of the Maria Mitchell Association before, Andrew had been interested in visiting New England, eventually finding the MMA; this internship on a small island in which he could work with museum management, administration, and fundraising was a golden opportunity for him.

While Andrew primarily worked in the administration building during his internship, he was still able to visit the MMA aquarium and natural science museum frequently. Along with this, Andrew assisted the education interns with summer camp tasks and occasionally helped out at the museum gift shop. One of the highlights of Andrew's time at the MMA was his work with the MMA Summer Soiree: an important event for the Maria Mitchell Association to raise funds and display the success of the organization to all annual doners. This event was Andrew's first exposure to the planning and administration of large events. Being at the end of the summer, the Soiree was a great way to celebrate the internships coming to an end while also providing interns like Andrew an opportunity to network with other interns and MMA staff members.

Before ever coming to the MMA, Andrew was originally interested in becoming a teacher as a history major at Gettysburg College. He soon diverted from this, though, when realizing that he did not want to teach in such a formal environment; he instead sought to educate the community in a more interactive, hands-on setting. After working at the MMA, Andrew got a full-time position at the New Art Center, working in administration and marketing. Andrew discussed how his internship at the Maria Mitchell Association helped him get this position, saying that New Art Center was looking for "someone who could do it all." Andrew's internship prepared him well for this position, as he described himself as a "one-man team at the MMA."

Throughout his career, Andrew Royer has worked at multiple different non-profit organizations. In his interview, Andrew described how he likes working with non-profits because it encourages creativity since everyone "really cares about what they're doing there." Andrew continued, discussing how his non-profit work gives him a much better work-life balance than some of his friends who work in sales and production.

One of Andrew Royer's proudest career achievements is his work in setting up the Young Professionals group at the New England Aquarium. The aquarium had attempted to establish a similar program multiple times in the past, but these attempts failed due to time constraints. Andrew, when working on this project, made sure to take the time needed to make it as perfect as possible. He greatly enjoyed being able to take his time with the project and put in the proper research to ensure the project was successful, looking into other similar groups and talking with the younger employees at the company. The launch party for the Young Professionals program was much more popular than anticipated; over 700 people attended to celebrate the new program and Andrew's hard work.

[9] Image from https://www.linkedin.com/in/andrew-royer-97878a32/

Jonathan Shuster

Natural Science, 2008-2009

In his search for an internship that could provide opportunities to work in natural science, Jonathan Shuster[10] stumbled upon the Maria Mitchell Association in 2008. While Jonathan had never been to Nantucket before, the charm and beauty of the island would soon draw him in. Following his return to the MMA for a second internship, Jonathan remained on Nantucket for several years, working for the Nantucket Conservation Foundation and Manomet Center for Conservation Sciences. His MMA experience eventually led him to a Conservation Fellowship at Mass Audubon's Coastal Waterbird Program. In his interview, Jonathan emphasized the natural splendor of Nantucket, noting that about half the island is permanently protected open space. While Jonathan has since left the island to pursue opportunities in mainland Massachusetts and New York, he looks back on his Nantucket experience very fondly.

During his time at the MMA, Jonathan worked in the Hinchman House as a natural science intern, working with native species and educating tourists and community members who visited the museum. One of the highlights of Jonathan's time as an intern was collaborating with visiting scientists on studies relating to snakes and the American burying beetle. In his survey, Jonathan wrote that the "MMA enabling these scientists to visit and do their research created fantastic opportunities for interns to learn while working on these projects." In his interview, Jonathan added that "the connection [he] made with one visiting scientist in particular, Scott Smyers of Oxbow Associates... eventually led to [him] getting into environmental consulting." Jonathan's MMA internship also led to other opportunities, such as co-authoring a research paper with the MMA Natural Science Director at the time, Andrew McKenna-Foster.

Jonathan currently works for TRC, an environmental consulting firm with over 7,000 employees, composed of "wildlife ecologists, wetland scientists, engineers," and other specialists. As Environmental Operations Manager, Jonathan leads a team based out of Lowell, Massachusetts in the Planning, Permitting, and Licensing division, which works with clients to understand their project, assess the resources at their site, and ultimately permit their project. Jonathan added that these resources can range from wetlands to cultural resources including indigenous artifacts and historic structures. Jonathan provided an example of the problems TRC consultants work to solve: "How do you permit a large solar field in an area that might have rare species?" Some of the rare species that Jonathan has worked with include eastern box turtles, wood turtles, tiger beetles, dragonflies, shorebirds, and grassland birds.

When asked about the importance of environmental consulting, Jonathan stated that it is a "very important piece of the puzzle when someone wants to build something or do something in or near a resource area." Jonathan continued, discussing how there are a variety of local, state, and federal regulations that must be followed, which can be tricky for clients to navigate on their own. When discussing his role as a consultant, Jonathan mentioned that "there is a big element of environmental education," which is a skill that he learned during his time at the Maria Mitchell Association. Jonathan navigates how to explain the importance of environmental considerations to clients who may not fully understand the relevant regulatory hurdles for their projects. As a consultant, Jonathan has recently permitted projects on Nantucket and appreciates opportunities to work in one of his favorite places.

Jonathan and other environmental consultants play a key role in protecting rare species and natural resources. Geared with a foundation in natural science that he learned partially at the Maria Mitchell Association, Jonathan continues to advocate for our environment one project at a time.

[10] Image from https://www.linkedin.com/in/jdshuster/

Meg Thacher

Astronomy, 1986

Meg Thacher[11] considered the few MMA internships offered in 1986 attainable and took the leap to apply. With a love for the beach atmosphere and a desire to learn whether an astronomy research path fit her, Meg spent the summer in Nantucket, dedicating her time to tracking the changing light of variable stars. She was given the task of creating the light curve of a star with very little data. She carefully took measurements and compared its light over the entirety of the summer to update information on the star. Meg mentioned that she vividly remembers waking up in the middle of the night, prepared to observe the stars, only to hear fog horns indicating there was too much cloud cover to go out that night.

Along with her research, Meg also found herself running open house nights at the Maria Mitchell Observatory. She reminisces about the weekend beach trips with other interns, and she enjoyed being able to interact with a plethora of different college students on the island for the summer, ranging from bartenders, to chambermaids, to Greek life students, recalling that Nantucket is "a little world of its own".

Enjoying her internship immensely, Meg wanted to go into astronomy research, and did for quite some time. However, partway through graduate school at the University of Massachusetts, Meg was offered an opportunity to teach at Smith College. This opportunity changed her life; Meg claimed that something clicked with teaching, feeling like a cosmic gear of the universe "being dropped in the right place," and so, 7 years into graduate school, she dropped out to pursue a career in education.

Meg has now been teaching for 24 years, for the most part classes on introductory observational astronomy, which are centered around those who are unfamiliar with astronomy. Meg says that her favorite part of teaching is introducing science to people who aren't scientists. She states that astronomy can be a "gateway science" for those who are unfamiliar or uninterested, and often inspires fascination from the individuals she teaches.

Meg Thacher returned to the MMA once for a talk on her book, *Sky Gazing: A guide to the Moon, Sun, planets, stars, eclipses, constellations*. For this book, Meg was awarded the 2022 American Association for the Advancement of Science (AAAS)/Subaru prize for excellence in hands-on science children's books. Meg recalls getting the idea for a picture book on vacation one day, as she admired the moon. She was fascinated by how many different cultures have stories of images on the moon, such as the man on the moon or a rabbit etched into its surface. She wanted to share this love and wonder with children, prompting her career in children's literature. Meg is currently working on a new children's book surrounding exoplanets, which are planets outside of our current solar system.

Upon her return to the MMA, Meg Thacher was happy to see that the program was still running smoothly, particularly mentioning she's excited that they've now included more than variable stars research in the astronomy internship. While Meg hasn't remained in contact with most of her fellow interns, she's still fond of the sleepless nights they spent together on the island. Because of this, her advice for the next generation of young scientists in her position is that it's not all about the science; just as much of the experience is about the people you meet and learning everything you can with and from them.

[11] Image provided by Meg in an email to the research team

John Weaver

Astronomy, 2015

Before coming to the island, let alone beginning his internship at the Maria Mitchell Association, John Weaver[12] had a familiarity with Nantucket. His father had spent time on the island when he was younger, so John had known about Nantucket most of his life and eventually visited, where he met the then-director of the MMA. This led to him applying for the NSF-REU astronomy internship the following year; John would join the MMA that summer.

At the beginning of his internship, John Weaver was introduced to a task that would then become "the bread and butter of [his] career." During his first job at his MMA internship, John was given images of a distant galaxy with many spots believed to be star formations and used a software to determine if each shape was truly a star formation or just random noise in the instrument measurements. John discussed how though he was always interested in astrophysics, he didn't know what particular field he was interested in until this job, where it clicked that this was what he loved doing. He stated, "since leaving the MMA program my appreciation for that project has only grown."

John's internship not only inspired him to do what would eventually become a major part of his own career, but it also gave him incredible opportunities that he would not have been able to gain elsewhere. Through his Maria Mitchell Association internship, John was given the chance to present at a conference with his research. Later in his academic and professional career he would discover how fortunate he was to be able to participate in this, mentioning how many PhD candidates would have been unable to say they presented at a conference while he had just two years into his undergraduate education. Through this and other connections from his internship, John was able to get his foot in the door for an internship the next year, which directly got him his current job. Because of this progression, John cites that "without the MMA [he] probably wouldn't have the job [he has] now."

Moving beyond the Maria Mitchell Association, John Weaver lead the COSMOS2020 project, a catalog of the distances and properties of extragalactic bodies. By using the James Webb Space Telescope (JWST), John, in 2023, was able to discover more than ever before possible for the content of this catalog. The type of light detected can determine how much information you can get when looking at extremely distant galaxies; blue light will show newer stars that are still forming, while red light will show older, more established systems. The JWST can see redder light than ever before, allowing John and the team with COSMOS2020 to document more information on these galaxies than had been possible in any previous editions of the catalog.

John, like many astronomers today, is very excited for the new potential research that can be completed using the James Webb Space Telescope. Specifically, a new instrument on the telescope that is more sensitive to red light. The near infrared camera has allowed the JWST to look at extremely distant galaxies with spatial resolution. When discussing ways that the telescope will impact the future of astrophysics research, John highlighted the initial batch of released images, which included many galaxies with characteristics previously considered impossible. He is excited to get to research further into these new galaxies and uncover the unexplored physics behind their existence.

[12] Image from https://www.linkedin.com/in/astroweaver/

Appendix J: Infographics

Below are the infographic pages created for the Maria Mitchell Association to use for fundraising and promotional purposes.

Maria Mitchell Association

Curiosity can Change the World

Incredible Interns

The MMA has hosted over 850 interns and fellows over the last 109 years

Of the 190 former interns who responded to our survey...

85% of interns have **conducted research**

65% of interns have **published papers**

42% of interns have **won prizes** for professional achievements

38% of interns went on to receive a **doctoral degree**

148 **book contributed to** by interns

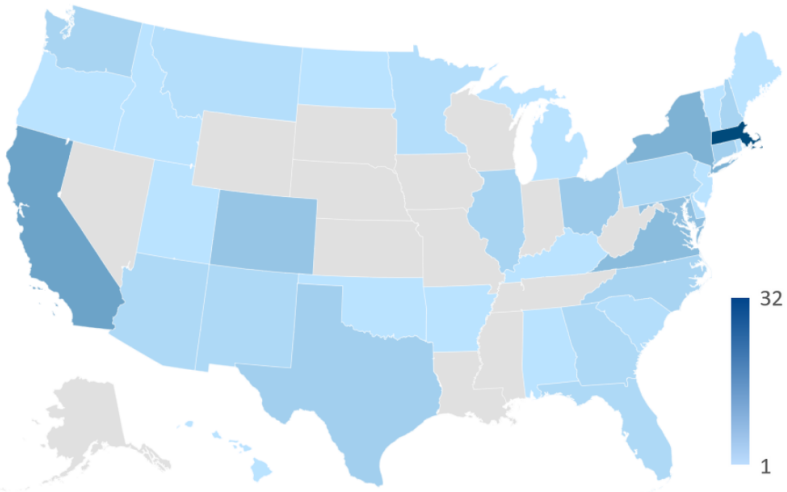
39 **patents held** by interns

5 **TED Talks given** by interns

"I truly owe my career and all the wonderful twists and turns, and the life I've had as a scientist and an educator, to the Maria Mitchell Association."

- Ann McMahon, 1977 Astronomy Intern

Where are the MMA Interns now?



Internship Fields:

- Astronomy
- Education
- Marine Science
- Natural Science
- Marketing
- Event Planning
- Historic Preservation

Curiosity can Change the World

Astronomy

Of the 93 astronomy survey respondents...

99%

of astronomy interns agree their **MMA experience was valuable**

56%

of female astronomy interns went on to receive a **doctorate degree**

40%

of former astronomy interns currently work as **educators**

95%

of astronomy interns have **conducted research** in their career

51%

of astronomy interns have **worked at a non-profit**

38

patents held by former astronomy interns

58

books/ co-authored **books published** by former astronomy interns

2

former astronomy interns have given **TED Talks**

"My proudest career achievement is doing what the MMA taught me to love."

-Tess Jaffe, 1992 MMA Astronomy Intern

"My favorite part of the MMA is the amazing people and a strong sense of belonging."

-Kim-Vy Tran, 1993 MMA Astronomy Intern

Curiosity can Change the World

Wonderful Women

Women have been underrepresented in the STEM field throughout history, making up 38% of the US workforce, but only 8% of the STEM workforce in 1970.[1] Since 1914, the MMA has carried on the legacy of Maria Mitchell by supporting women in the pursuit of STEM careers through internship and fellowship opportunities. Below are some of these wonderful women:

1924: Cecelia Payne-Gaposchkin

Published groundbreaking thesis about chemical makeup of stars, first woman to head a department at Harvard

1964: Nancy Remage Evans

Studies the properties of variable stars and star formation, major contributor to Galactic Cepheid Database

1969: Janet Akyüz Mattei

Head of the American Association of Variable Star Observers for 30+ years, worked to make astronomy more available to educators and non-professionals

1970: Marcia Jean Rieke

Considered one of the founding mothers of infrared astronomy, currently the principal investigator of the James Webb Space Telescope

1973: Bonnie Buratti

2022 recipient of the Gerard P. Kuiper Prize for her contributions to planetary science, current research fellow at NASA's Jet Propulsion Laboratory

1978: Karen Meech

Researcher studying how the Earth became habitable, former president of the International Astronomical Union Commission on Bioastronomy

[1] US Census Bureau. (2021, October 8). Women making gains in STEM occupations but still underrepresented. Census.Gov. https://www.census.gov/library/stories/2021/01/women-making-gains-in-stem-occupations-but-still-underrepresented.html

Curiosity can Change the World

Wonderful Women

While astronomy has long been a primary focus of the Maria Mitchell Association, many interns have had incredible careers in fields outside of astronomy. From marine biology to marketing and administration, the MMA has created opportunities for interns to learn and gain hands-on experience across disciplines. Below are some of the wonderful women who have passed through the MMA:

1986: Mary-Ann Steiner

Natural Science Museum Intern: University of Pittsburgh researcher on out-of-school education; Identifying approaches to starting climate change conversations

1995: Jana Davis

Marine Biology Intern: President of the Chesapeake Bay Trust, a watershed restoration group; former aquaculture researcher at Scripps Institute of Oceanography

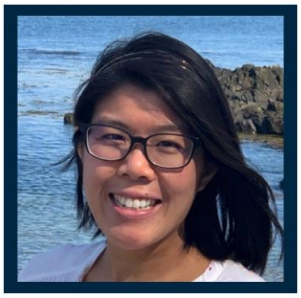
2006: Elizabeth Donelan

Natural Science Intern: Member of the Center for Conservation and Research of Endangered Wildlife at Cincinnati Zoo; Studying rhinos, polar bears, small cats, and salamanders

2008: Courtney Bridges

Environmental Education Intern: Lifelong educator and entrepreneur focused on supporting non-profits, schools, and start-ups; Former Director of Artists Association of Nantucket

2009: Helen Cheng



Marine Biology Intern: Researcher at Northeastern University and the National Oceanic & Atmospheric Administration studying the impacts of ecological change on fisheries

2013: Paige Collins

Environmental Education Intern: Applies her knowledge of science to marketing; Customer Retention Marketing Manager at a tech company analyzing user behavior and engagement