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Synergies: University-Museum Collaborations

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Synergies: University-Museum Collaborations

2021

**NC STATE
UNIVERSITY**

**NORTH CAROLINA STATE UNIVERSITY —
DEPARTMENT OF MARINE, EARTH & ATMOSPHERIC SCIENCES
NORTH CAROLINA MUSEUM OF NATURAL SCIENCES**

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About This Report

The purpose of this report is to provide documentation of the University-Museums Synergies Initiative between NC State's Department of Marine, Earth, and Atmospheric Sciences (MEAS) and the North Carolina Museum of Natural Sciences (NCMNS).

The goals of this initiative were to 1) identify specific projects and opportunities that might be developed to strengthen the collaboration between institutions and 2) gain a better understanding of MEAS researchers' and Museum employees' perspectives on university-museum partnerships.

Together, this information has aided in establishing synergies between MEAS and NCMNS as well as in identifying potential strategies for forming a successful long-term partnership.



**Making
meaningful
connections and
forging long-term
sustainable
partnerships
between MEAS
and NCMNS**

The Institutions: MEAS

Within NC State's Department of Marine, Earth, and Atmospheric Sciences (MEAS), 34 faculty and ~300 students work together to investigate the fundamental forces of nature. Their research engages with real-issues and challenges, including areas such as climate change, natural hazards, pollution, and natural resources, utilizing the power of big data to enhance our understanding of natural processes.

Intense curiosity drives MEAS researchers, but they do not work solely to gain new knowledge for themselves. Their studies serve the greater good, and they put them at the public's disposal through an outreach network that touches people of all ages, all over North Carolina. They also share the results of their research by advising state and federal agencies, visiting schools around the state, interacting with the media, and through other outreach programs, including RiverNet and their work with the North Carolina State Climate Office and CMAST. Their research and outreach extends across the nation and on all seven continents.

MEAS is located in Jordan Hall on NC State's Central Campus. Jordan Hall is also the future home of the Natural Resources Library. Set to open in Fall 2021, the library will provide research and instructional support for the College of Natural Resources and the department of Marine, Earth, and Atmospheric Sciences. The library collection includes materials on forestry, natural resources, environmental sciences, sport management, parks and recreation, tourism, paper science and engineering, wood products, biomaterials and bioenergy, and marine, earth, and atmospheric sciences.

Information courtesy of the NC State University Department of Marine, Earth, and Atmospheric Sciences

The Institutions: NCMNS

The state's museum devoted to science and nature, the North Carolina Museum of Natural Sciences in central Raleigh is the largest institution of its kind in the Southeastern United States and, with over a million visitors a year, the state's most visited museum. Across three vibrant floors of laboratories and exhibitions, the Nature Research Center provides an unparalleled opportunity to see science in action by watching Museum researchers studying the natural world in real time. In the Nature Exploration Center, exhibits and live animal displays reveal North Carolina's rich natural habitats, wildlife and geology from the Appalachian Mountains to the Atlantic Ocean.

The 300,000 square-foot downtown campus is augmented by Prairie Ridge Ecostation and satellite facilities in Whiteville, Greenville and Contentnea Creek. Together, the Museum campuses provide a variety of curriculum-focused classes onsite, offsite, outdoors and online for pre-kindergarten through graduate students across the state. The state's students are also supported indirectly by providing professional development training for teachers, research opportunities for classrooms, and outdoor learning environments on school campus.

Information courtesy of the North Carolina Museum of Natural Sciences

Our Shared History

The history of collaboration between the department of Marine, Earth, and Atmospheric Science and the North Carolina Museum of Natural Sciences dates back to 1995 when the first joint appointment position between the two institutions was created for Dr. Dale Russell who would serve as a Research Professor at the MEAS, and Senior Paleontologist and curator at the Museum. This paved the way for future paleo-partnerships between the institutions that included multiple joint hires. The relationship additionally centered around the collaborative study of fossil specimens such as the well-preserved *Thescelosaurus* "Willo" that was once thought to show the first evidence of soft tissue preservation and a four-chambered heart.

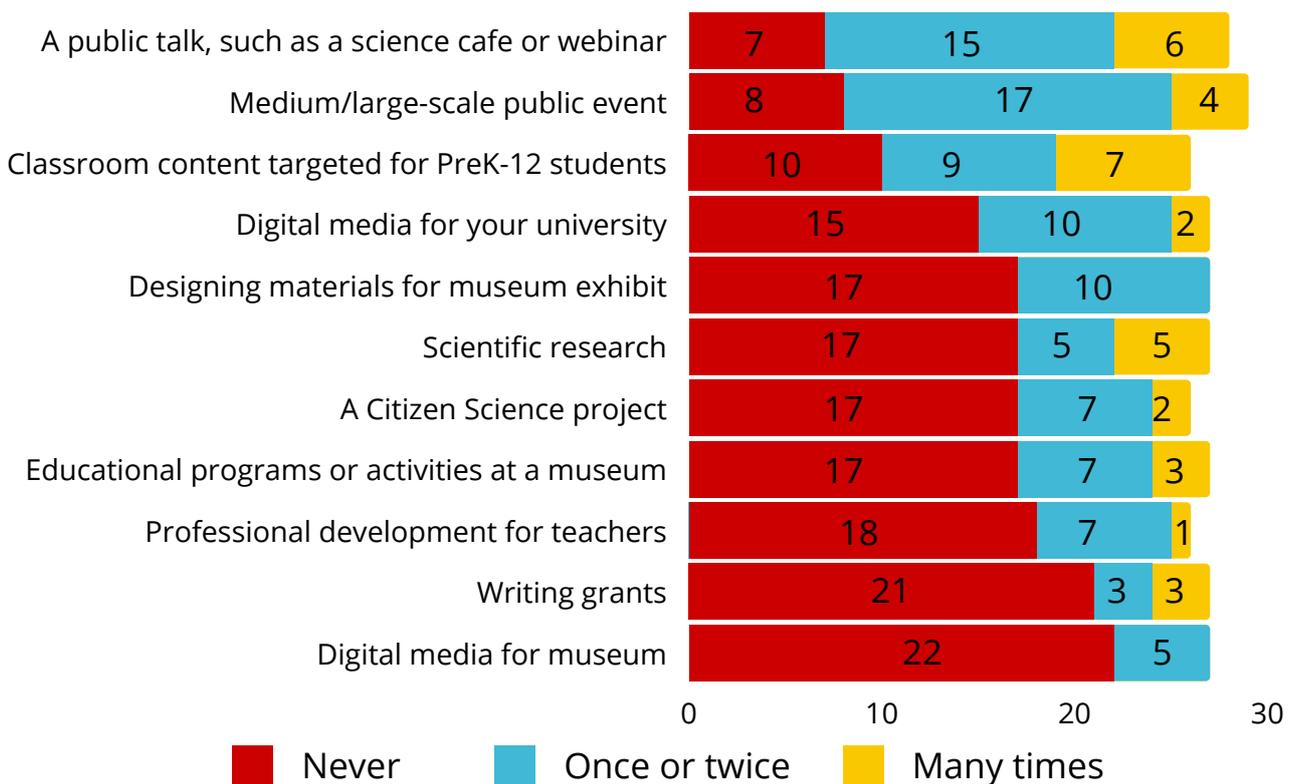
Professors Dale Russell, Len Pietrafesa, and Bill Showers were also instrumental in working with former Director of the Museum Dr. Betsey Bennett in planning the Museum's expansion and the opening of the Nature Research Center in 2012. Dr. Pietrafesa has been credited with helping to develop the idea of devoting the new wing to scientific research and integrating the research laboratories with exhibits by putting "scientists behind glass." Inside the Nature Research Center, visitors have the opportunity to "explore not just what we know about the natural world, but how we know it—the tools, techniques, and real live scientists that study the past, present, and future of our planet."

Information courtesy of Dr. Leonard Pietrafesa and the North Carolina Museum of Natural Sciences

Past collaborations between NCMNS and MEAS have included numerous joint appointments, collection accession and study, exhibit curation, science education programming, and communication of scientific research through various public events, talks, and programs.

Working Together

Figure 1. MEAS reports on past experiences working with informal science institutions. Numbers refer to the number of respondees.



- Past collaborations most frequently reported were medium / large scale public events and public talks such as Science Cafés, or webinars.
- Least reported collaborations included co-writing grants or collaborating on digital media for museums or informal science centers.

89%

Eighty-nine percent of MEAS researchers have collaborated with informal science centers in the past.

The Synergies Project

A significant challenge to inter institutional collaboration is longevity and sustainability of partnerships. Traditionally, universities and museums have the tendency to employ 'ad hoc' approaches where connections form based on accomplishing one, generally short-term, objective. Connections are often made as a result of cold-calling or through colleague referrals. While additional projects may arise between parties, they often do not engage additional collaborators from either institution. Notable challenges to ad hoc approaches include misalignment with individual institutional priorities, differences in operational approaches and timelines, funding constraints, and a lack of sustainability or future-focused planning.

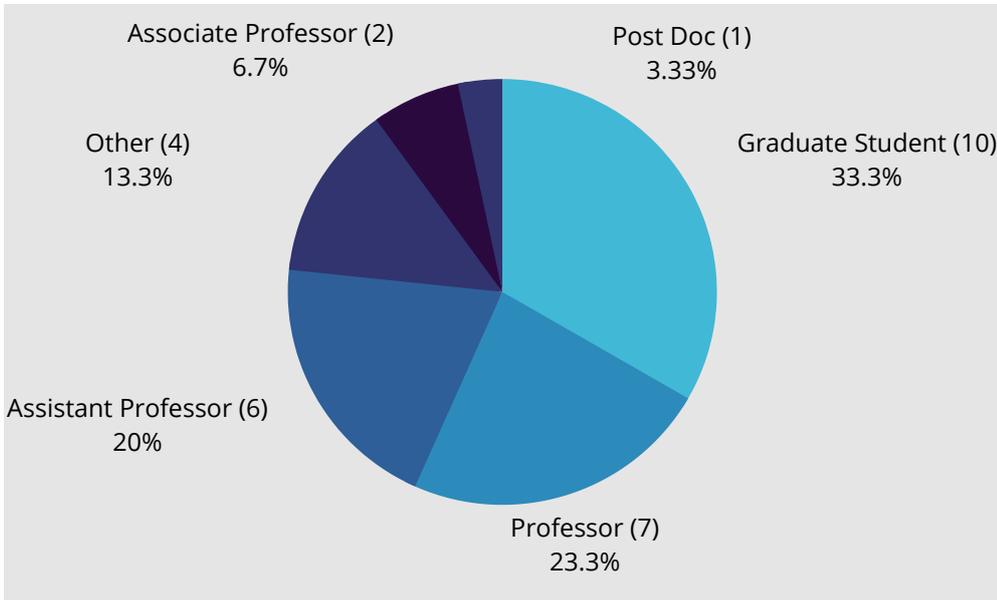
The goals of this initiative were to 1) identify specific projects and opportunities that might be developed to strengthen the collaboration between institutions and 2) to gain a better understanding of scientists' and Museum employees' perspectives on university-museum partnerships.

Members from both institutions were invited to take part in a survey and follow-up interviews. The survey invited participants to reflect on their perceptions of working with museums and provided them with the opportunity to list any ideas for current or future collaboration between MEAS and NCMNS. The follow up interviews explored responses provided in the survey and focused on identifying motivations and barriers for partnerships.

Together, this information has aided in establishing synergies between MEAS and NCMNS as well as in identifying potential strategies for forming a successful long-term partnership.

Project Participants

Figure 2. MEAS Survey Participants by Role (n = 30)

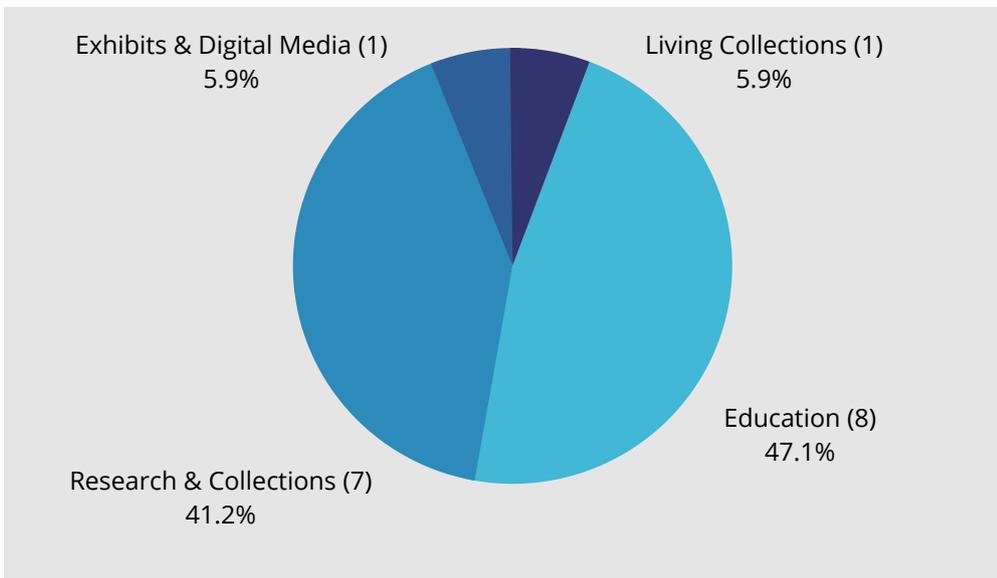


11
Students

19
Faculty

Note: "Other" includes self-reported titles such as Senior Research Scholar, Teaching Faculty, Lecturer, and Dean of the Graduate School.

Figure 3. NCMNS Survey Participants by Department (n = 17)



8
Educators

7
Researchers

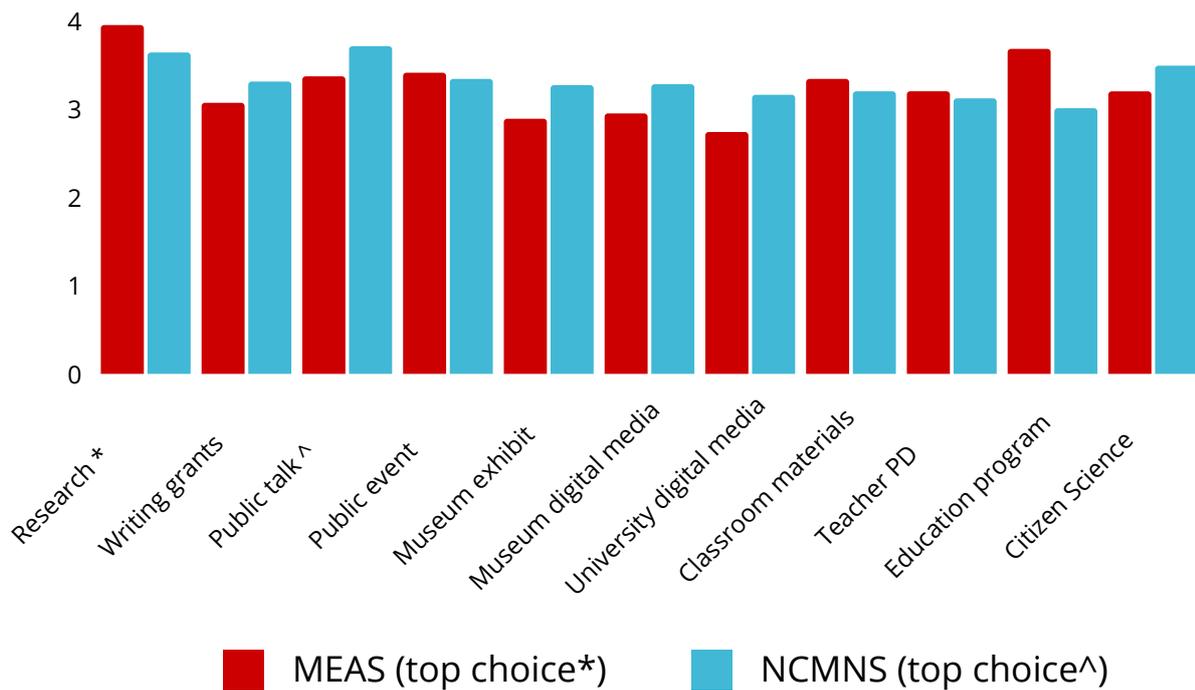
47

Individuals across MEAS and NCMNS participated in the survey.

Findings: Interest

Survey respondents from both the Museum and university were provided with a list of possible collaborative activities and were asked to rank their interest in participating in each on a scale of 1-5 with 1 being not at all interested and 5 being extremely interested (see Figure 4). In both the surveys and interviews, participants listed specific interests and ideas related to institutional collaboration. The results from each survey population are included in Appendix 01 & 02.

Figure 4. Mean interest in participating in collaborative activities.



Responses on a 5-pt Likert scale from not at all interested (1) to extremely interested (5); MEAS (n = 27), NCMNS (n = 17).

Interest Cont'd

The top two responses from MEAS respondents were 1) conducting scientific research and 2) collaborating on educational programs or activities at a museum (e.g., summer camps, after-school programs, laboratory programs, etc.) Collaborating on a public event, giving a public presentation, and developing classroom materials were also indicated as being of high interest. Museum staff indicated that 1) collaborating with MEAS researchers on public talks like Science Cafes was the area of highest interest followed by 2) partnering on scientific research and 3) Citizen Science projects.

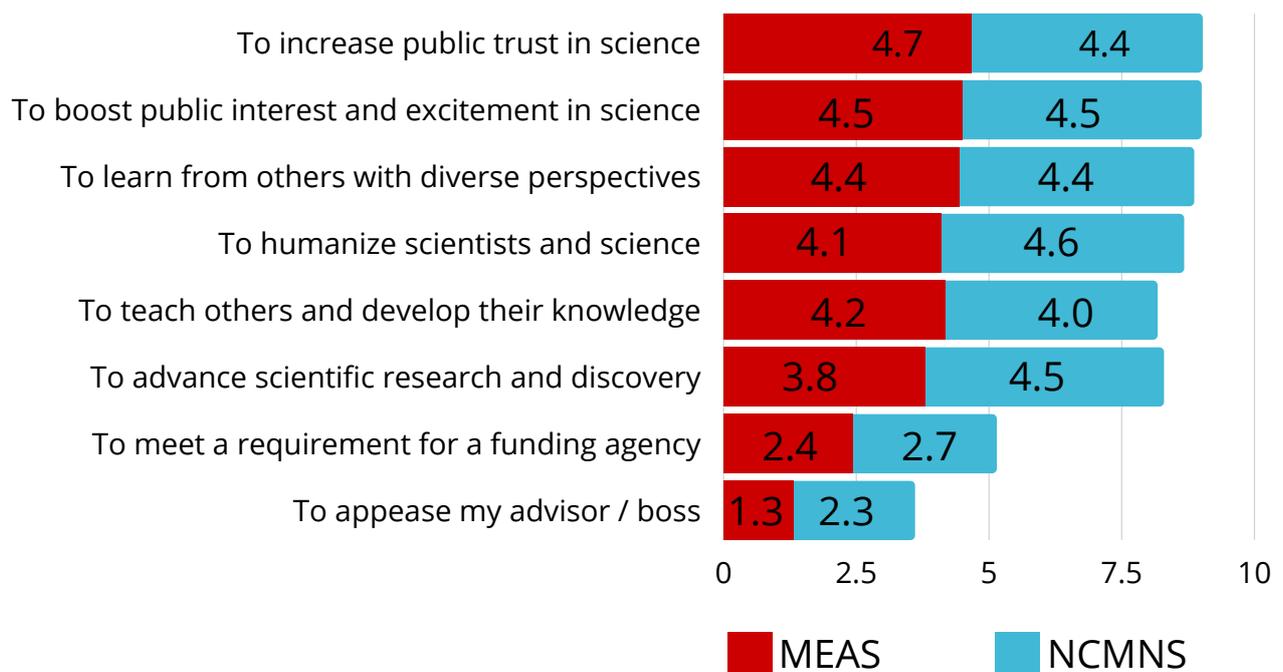
Table 1. Mean interest in participating in collaborative activities. Responses on a 5-pt Likert scale from not at all interested (1) to extremely interested (5).

	MEAS SCIENTISTS		NCMNS STAFF	
	Mean	SD	Mean	SD
Scientific Research	3.9	1.0	3.6	0.8
Educational Program	3.7	1.2	3.0	1.4
Public Event	3.4	1.1	3.3	1.2
Public Talk	3.4	1.2	3.7	1.3
Classroom Materials	3.3	1.2	3.2	1.2
Teacher Professional Development	3.2	1.3	3.1	1.1
Citizen Science Project	3.2	1.1	3.5	1.1
Writing Grants	3.1	1.2	3.3	1.3
Museum Digital Media Project	2.9	1.3	3.3	1.3
Museum Exhibit	2.9	1.1	3.3	1.4
University Digital Media Project	2.7	1.3	3.2	1.0

Findings: Motivations

When asked about their motivations to participate in inter institutional collaborations, both MEAS and NCMNS survey respondents indicated that they viewed partnerships as being integral to increasing public trust and interest in science. The least reported motivation was to appease an advisor or boss. The qualitative interviews with MEAS researchers revealed two potential influencing factors: 1) that engagement tended to be for altruistic reasons and for personal interest and 2) that outreach and engagement was not part of their job expectations, nor did it weigh into performance evaluations or the tenure process. Trends in the interviews revealed that newer hires in the department had a different perspective on outreach as a tenure component and noted more often that they felt more expectations and support for engaging in collaborative partnerships with the Museum than those who were mid-tenure track. Professors who had already received tenure reported more flexibility to engage in collaborations that did not have research and publication components.

Figure 5. Mean responses for the question: Below is a list of possible motivations to collaborate. How important is each reason to you, personally?



Responses on a 5-pt Likert scale from not at all important (1) to extremely important (5); MEAS (n = 27), NCMNS (n = 17).

Findings: Perceptions

In general, participants from both institutions tended to agree on items related to the usefulness and benefits of collaborations between MEAS and the Museum (see Table 2). Two notable trends were that neither group felt strongly that collaborative partnerships were something that they were or were not “expected to do” as part of their job expectations and that members from both institutions felt that their work and institutional missions were only somewhat understood by their collaborative counterparts.

Table 2. Mean perceptions of partnerships on a 7-pt Likert scale from strongly disagree (1) to strongly agree (7); MEAS (n = 27), NCMNS (n = 17).

MEAS	Mean	SD	NCMNS	Mean	SD
It is important for university scientists to collaborate with informal science centers.	6.3	0.9	It is important for informal science centers to partner with university scientists.	6.7	0.6
Others in my department believe that it is important to collaborate with informal science centers.	5.0	1.2	Others in my department believe that it is important to collaborate with university scientists.	6.5	0.6
My department encourages me to work with informal science centers.	5.2	1.2	My department encourages me to work with university scientists.	6.1	1.0
Working with informal science centers is something that I’m expected to do.	3.2	1.3	Working with university scientists is something that I’m expected to do.	5.3	1.3

Table Continued on Next Page

MEAS	Mean	SD	NCMNS	Mean	SD
I believe that working with informal science centers is a good use of my time.	5.8	1.0	I believe that working with university scientists is a good use of my time.	6.3	0.9
I believe that informal science centers can benefit from working with university scientists.	6.6	0.6	I believe that informal science centers can benefit from working with university scientists.	6.7	0.5
I believe that university scientists can benefit from working with informal science institutions.	6.5	0.6	I believe that university scientists can benefit from working with informal science institutions.	6.8	0.4
I think people at informal science centers understand my role and the work that I do.	4.7	1.1	I think university scientists understand my role and the work that I do.	4.0	1.4
I think people at informal science centers have an accurate understanding of the function and mission of research universities.	4.8	1.0	I think university scientists have an accurate understanding of the function and mission of informal science institutions.	4.6	1.3

Participants were also asked to explore their perceptions of current partnership experiences. In general, responses were positive and there was a high degree of agreement between survey groups. Results from the Museum participants were slightly more positive than MEAS researchers with the exception of the statement “When I work with university scientists we often have the same priorities.” The means both groups indicated that they only somewhat agree that their institutions share the same priorities. Additionally, on average, participants only somewhat agree that they receive adequate institutional support to engage in collaborative partnerships.

Table 3. Mean perceptions of current partnerships on a 7-pt Likert scale from strongly disagree (1) to strongly agree (7); MEAS (n = 27), NCMNS (n = 17).

MEAS	Mean	SD	NCMNS	Mean	SD
When I work with people at informal science centers, I learn from them as much as they learn from me.	5.4	1.3	When I work with university scientists, I learn from them as much as they learn from me.	6.0	0.8
I enjoy working with informal science centers.	6.2	0.7	I enjoy working with university scientists.	6.3	0.7
I feel confident working with informal science centers.	5.8	0.9	I feel confident working with university scientists.	6.0	0.8
It is easy to collaborate with informal science centers.	5.2	1.2	It is easy to collaborate with university scientists.	5.1	0.9
When I work with informal science centers we often have the same priorities.	5.1	1.3	When I work with university scientists we often have the same priorities.	4.5	1.2
I feel that I receive adequate support from others in my institution when planning and doing collaborations.	4.6	1.1	I feel that I receive adequate support from others in my institution when planning and doing collaborations with university scientists.	4.8	1.7

Findings: Barriers

MEAS

The qualitative interviews focused heavily on barriers to partnerships and collaborations. Trends indicated that time, money, low institutional encouragement to participate, and a lack of knowledge of inter-institutional needs and practices were the greatest barriers to collaboration.

According to MEAS researchers, time and money were often discussed in terms of the 'publish or perish' expectation of research universities. Participants reported that because outreach and engagement are not heavily factored into performance reviews or the tenure process that they find it difficult to find the time to engage in these projects, even if they are personally motivated to do so.

MEAS researchers who had no former experience working with informal science centers often mentioned they did not know how museums are structured or the variety of offerings that exist within the institution, or who to be in touch with to begin collaborations. Additionally, some MEAS researchers reported that they would be unable to offer suggestions for partnerships as the needs of the North Carolina Museum of Natural Sciences were unknown to them.

Findings: Barriers

NCMNS

From the museum perspective, the most cited barriers were a perceived lack of understanding on the part of the researchers as to how museums operate and what appropriate funding, time, and resource expectations are when it comes to doing collaborations. Museum staff indicated feeling like the ad hoc method is largely driven by grant requirements, generally leaving very little time to conceptualize a successful project in terms of expectations, outcomes, and financial support. Projects that are not funded generally do not come to fruition.

Museum professionals were typically in agreement that having no set practice, instructions, or procedures in place to facilitate institutional collaboration contributes to an ad hoc approach and limits both short-term and sustained partnerships and collaborations.

Outside of public talks, museum professionals also addressed institutional constraints to collaboration. Many reported having very limited flexibility to engage in projects such as large scale events, new educational programs, new exhibits, or creating digital media products, which were often discussed by MEAS interview participants as being areas of interest. A common challenge and goal cited by both institutions is to promote diversity and increase representation of historically excluded voices and perspectives in science through collaborative initiatives.

Recommendations

No. 01

Most Cited Partnership Ideas

1. Mutual need for youth and adult public talks, especially around climate change.
2. Field trips and Citizen Science projects for students, teachers, and the public.
3. Shared interest in outreach and research opportunities for NC State students.
4. Focus on increasing representation of historically excluded groups in science.

No. 02

Meet & Greet

Both the Museum and MEAS indicated an interest for regular meet and greets/speed-dating/symposia for sharing research and talking about project ideas and grant opportunities. It is recommended that these occur on an annual basis.

No. 03

What's on the Menu?

The museum suggests developing a "menu" for projects that are part of grant proposals. This menu would identify procedures for who to reach out to, timelines, costs, etc. It has been suggested that having a dedicated person to work with institutions to maintain connections, help with grant writing and science communication training, and doing research on outreach and engagement impacts would strengthen the partnership as well as future grant proposals.

No. 04

Incentives & Expectations

MEAS researchers indicated that the department could incentivize participation by encouraging an institutional culture that prioritizes collaboration. It was also suggested that restructuring of time expectations with regards to teaching and research duties would allow for more time to spend on outreach activities.

Acknowledgements

We would like to acknowledge the faculty, staff, and students from the Department of Marine, Earth, and Atmospheric Sciences (MEAS) and the North Carolina Museum of Natural Sciences who participated in this project and offered their ideas and perspectives. Contributors and facilitators include:

- Eric Dorfman, Director of the North Carolina Museum of Natural Sciences
- Lewis Owen, Head of MEAS at NC State University, Project Co-PI
- Kathryn Rende, Graduate Student at NC State University, Project Co-PI
- Stephanie Teeter, Graduate Student at NC State University, Project Co-PI
- Students and Faculty of MEAS at NC State University
- The Staff of the North Carolina Museum of Natural Sciences

We thank you for your continued support in making meaningful connections and working towards a long-term sustainable partnership.

Report prepared by:

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PhD Candidate in **phone.** 919-264-5544
Science Education
NC State University

Appendix 01

A. Collaborations — MEAS

Role; Department	Collaboration Idea
Faculty Atmospheric Science	Interactive exhibits, content, and public talks or events related to weather, threats of climate change (e.g., sea-level rise), and the growing skepticism towards science.
Faculty Earth Science	Adult Science Café presentations or exhibit about earth science; I would like to get my students involved in public outreach as well.
Faculty Marine Science	Presentation on general theme of my research on algae and harmful algal blooms.
Faculty Marine & Earth Science	Climate change impacts on water quality; exhibit or display; presentation; youth program.
Faculty Marine & Earth Science	Participation in public talks, programs, or events focused on my research; dual placements for students and student researchers; working with collections.
Faculty Earth Science	Fossil/Rock ID days for the community; Earth Science Café presentations / discussions with the public.

Table Continued on Next Page

Some responses have been edited for clarity and anonymity

Role; Department	Collaboration Idea
Faculty Earth Science	Collaborative research on learning in informal environments.
Graduate Student Marine Science	Inter institutional presentations or seminars to share research; classroom materials for K-12 students and teachers.
Faculty Earth Science	Science Café presentation; Citizen Science project focused on fossils and climate change; Collections usage for research and teaching.
Graduate Student Atmospheric Science	Science Café presentation explaining climate models; art + weather youth program (or general public program)
Graduate Student Earth Science	Always glad to have a conversation between organizations and cross-present geology research.
Faculty Earth Science	Installation and development of applications for GIS at the Museum and provide training and programs about landscape processes and human-nature interactions.
Graduate Student Marine Science	Citizen science project; climate advocacy initiative; temporary exhibit or walk-up education station/lab on aquatic microbes.

Table Continued on Next Page

Some responses have been edited for clarity and anonymity

Role; Department	Collaboration Idea
Faculty Marine Science	Science Café on climate change and human health; Citizen Science project about water quality.
Faculty Earth Science	Collaborative research, field trip, or citizen science project on the impacts of land-use and biogeomorphology on North Carolina streams.
Faculty Earth Science	Field trip for the public on the local geology; Science Café presentations about my research.
Faculty Atmospheric Science	Student placements or partnerships as part of program capstone projects; Science Café presentations about my research.
Faculty Marine & Earth Science	Science Café presentations on aquatic microbes; temporary exhibit or walk-up education station/lab on aquatic microbes.
Graduate Student Earth Science	Educational products and curriculum on the geosciences.
Faculty Atmospheric Science	Offer lectures for general public e.g. on climate change, air pollution.
Faculty Atmospheric Science	Climate change programming focused on different regions of the state and delivered in venues in those regions.

Some responses have been edited for clarity and anonymity

Appendix 02

B. Collaborations — NCMNS

Section	Collaboration Idea
Education General	Meetings, events, or symposia between institutions to share research agendas and goals; the Education Section of the Museum has a wide range of program options and audience types and I am confident that we will be able to find a variety of ways to collaborate.
Education Immersive Experiences	Developing dedicated pathways and practices for grant-based collaborations including NSF Broader Impacts; supporting an inter institutional facilitator to help both sides develop strong proposals, projects, and evaluations.
Education Immersive Experiences	Creating a tabletop activity, cart, or program for a diverse audience that focuses on sustainable textile and incorporates bio-inspired technologies as well as best practices to mitigate the environmental impact of textile production and fast fashion waste.
Education Outreach	Field experience demonstrating or showing a public group a research project.
Education Outreach	Would love to collaborate on getting educators into the field to learn about and assist with field research on natural science topics - i.e. doing real science and experiencing things first hand (rather than a simulation or talk).

Table Continued on Next Page

Some responses have been edited for clarity and anonymity

Section	Collaboration Idea
Education Youth Programs	We are looking for an April 2022 Teen Science Cafe presenter and since April has Earth Day we'd like to do something climate related. Speakers with diverse backgrounds from under-represented populations in science are a priority.
Education Youth Programs	Teen Science Café presentations and site visits for Café Coordinators; Speakers for Girls in Science and other middle school science programs, including the new ExperiMentors program and Junior Curator programs (onsite at the Museum or offsite at university facilities).
Education Youth Programs	The Teen Science Cafés are looking for presenters for the 21-22 school year. The Youth Programs team will also likely be looking for presenters for a new program called Professional Previews. If there are any ideas about promoting diversity within the Marine, Earth, and Atmospheric Sciences, I would love to be in contact with those people.
Education Elementary Education	Designing a curriculum correlated class for K-5th grade, collaboration on a summer camp, collaboration on a class offered by the Museum (non-curriculum correlated), possible creation of a birthday party theme in the content area.
Exhibits & Digital Media	I think that Earth Science is a core component of the modern MEAS Department and a greater featuring of this holistic approach to science is very important for the Museum.

Table Continued on Next Page

Some responses have been edited for clarity and anonymity

Section	Collaboration Idea
Research & Collections	The Museum's Geology Collection could provide an archive for samples from NSF-sponsored studies; undergraduate and graduate researchers can assist on projects and grants; Earth Science week at the Museum; job fair or career-focused event.
Research & Collections	Research combining genetics with spatial modeling or in coastal or marine species. I often need extensive sampling, and collaborate for advertising a start of a study for involvement that can be presented at a variety of venues.
Research & Collections	Interdisciplinary field trip focusing on the unique geology, flora, and fauna of the Uwharrie Mountains and/or other regions of North Carolina; lab placements for student researchers.
Research & Collections	I'd like to develop and teach history of geology courses at NCSU. Other ideas include study abroad Galapagos; Ichthyology joint appointment; Invertebrate Paleontology joint appointment; involvement with NCMNS geology collection.
Research & Collections	There are opportunities for undergraduate researchers to assist with research projects in my lab.

Some responses have been edited for clarity and anonymity

Appendix 03

A. MEAS Research Foci

NC STATE UNIVERSITY DEPARTMENT OF MARINE, EARTH, AND ATMOSPHERIC SCIENCES

EARTH IS A DYNAMIC PLACE.
THE OCEANS, ATMOSPHERE,
AND LANDSCAPES ALL
INFLUENCE ONE ANOTHER.

OUR RESEARCH

Faculty and researchers in our department work across these environments to tackle the grand scientific challenges of today and tomorrow.

CLIMATOLOGY

The study of climate and how it changes over time. Global, regional, and local climate modeling. Impacts of climate change.

AIR-SEA INTERACTIONS

LAND-OCEAN INTERACTIONS, SEA LEVEL CHANGE

Late Quaternary sea-level changes and their paleo-climatic and paleo-environmental implications, transport and accumulation in different continental margin environments, in particular those deltaic and clinoform deposits from the large rivers.

CLIMATE HISTORY AND IMPACTS

Investigating climate archives through time and across geologic settings; quantifying climate impacts on human, terrestrial and cryosphere systems; and developing tools for examining climate conditions and impacts in the past and future.

ENVIRONMENTAL GEOLOGY AND HYDROLOGY

Diagnostic, analytical and modeling studies of coupled atmospheric and oceanic processes in the coastal zone and the open ocean.

ATMOSPHERIC CHEMISTRY AND AIR QUALITY

Measurements and 3-D numerical modeling of emissions; transformation, transport and fate of pollutants; chemistry and dynamics of atmospheric aerosols and clouds, sensitivity and uncertainty analysis, and interactions among atmospheric chemistry, meteorology and climate change.

METEOROLOGICAL OBSERVATIONS AND INSTRUMENTATION

Radar, measurements of precipitation particle size distributions, field project planning and deployment of instrumentation; emphasis on the integration of information from multiple, diverse sensors.

WEATHER SYSTEMS AND FORECASTING

Enhanced understanding and forecasting of synoptic, mesoscale and convective weather systems via analysis of observations, theory and numerical simulations; formulation and refinement of conceptual models.

MESOSCALE PROCESSES

Emphasis on mesoscale waves, orographic clouds and precipitation, mesoscale organization of and response to convection, lee and coastal cyclogenesis, and the mesoscale structure of precipitation in cyclones.

TROPICAL METEOROLOGY

Structure of tropical storms and hurricanes, numerical modeling studies of the dynamics of the Indian southwest monsoon, and studies of the planetary

WATERSHED, ESTUARINE, AND COASTAL DYNAMICS AND MODELING

Assessment of land use, sediment budget, total maximum daily load (TMDL), water quality, ecosystem, coastal erosion, and barrier islands protection and development.

HARMFUL ALGAL BLOOMS

Field, laboratory and modeling studies of toxic dinoflagellates.

ESTUARINE AND COASTAL PROCESSES

Determining the effects of multiple stressors on marine ecosystems; determining the effects of multiple stressors on marine ecosystems; tidal-inlet dynamics; sea-level change and its impact on coastal processes or environs; estuarine and coastal hydrodynamics and nutrient dynamics.

GEOPHYSICAL FLUID DYNAMICS

Atmospheric turbulence and diffusion; forest fire dynamics and prediction index development; wake vortex dynamics and their implications for aviation safety; Mars atmospheric dynamics and modeling (both mesoscale and global); coastal fluid dynamics.

COASTAL OCEAN INITIATIVES

Air-sea interactions and their role in dictating coastal ocean circulation patterns and coastal weather fronts, relationships between water-column chemistry and benthic habitats of shallow carbonate depositional regimes; physical, geological and geochemical investigations of some of the world's largest dispersal systems.

MARINE ECOLOGY AND CONSERVATION PROGRAM (MAReCo)

Quantifying the flow and composition of ground and surface waters; monitoring and mitigation of environmental contaminants within diverse geologic settings.

SURFACE PROCESSES

Assessment of the processes shaping the terrestrial landscape; use and development of geographical information systems (GIS) for managing land use and change.

GEOSCIENCE EDUCATION

The process of learning (geocognition, teaching strategies), the incentives for learning and the development of learning from freshman to graduate student.

SOLID EARTH SYSTEMS

Investigations into the Earth's formation and evolution, including studies of regional tectonics, geophysical processes, volcanic systems and economic ore deposits.

GLOBAL BIOGEOCHEMICAL CYCLES OF CARBON AND SILICA

Animal-sediment interactions; benthic food webs; methane production; diagenetic transformations of organic carbon.

boundary layer structure and diffusion processes in the tropics.

CLOUD CHEMISTRY AND MICROPHYSICS

Microphysical and chemical properties of clouds and precipitation.

STORM STRUCTURE AND DYNAMICS

Analysis of convective and mesoscale data and simulations with the aim of improving our understanding of the structure and evolution of thunderstorms, mesoscale precipitation systems and their attendant severe weather.

CONVECTIVE DYNAMICS AND PHYSICS

Emphasis on thunderstorms, severe convective weather, squall lines, supercells and tornadoes, extreme local precipitation, small-scale precipitation variability and marine stratocumulus drizzle.

ATMOSPHERIC

Ecological research in marine ecosystems that addresses both basic ecological theory and important management issues so that results can be applied to conservation and sustainable resource use; educational outreach activities that promote scientific literacy, provide hands-on examples of the scientific method, and promote conservation of marine resources and ecosystems.

PALEOCEANOGRAPHY

Cenozoic climate change; carbon and oxygen stable-isotope stratigraphy, phosogenesis and related authigenic mineralization associated with ancient upwelling systems.

BENTHIC STUDIES

Focusing on the sources and sinks of ocean sediments, coastal hazards, paleoceanography and the formation of ocean basins.

MARINE

MARINE GEOLOGY AND GEOPHYSICS

Focusing on the sources and sinks of ocean sediments, coastal hazards, paleoceanography and the formation of ocean basins. Mapping of the seafloor and shallow subsurface using active source acoustic methods within the coastal ocean and mid-ocean ridge environments;

EARTH HISTORY

Focusing on the geological history of earth and relationships to resources, the environment, natural hazards, and climate change.

EARTH

Appendix 03

B. Atmospheric Science Faculty



Tropical Meteorology and Climate

Anantha Aiyyer, Gary Lackmann, Sarah Larson
Matthew Parker, Lian Xie, Sandra Yuter

Atmospheric Chemistry and Air Quality

Viney Aneja, Nicholas Meskhidze, Markus Petters, Russel Philbrick

Cloud Chemistry and Microphysics

Viney Aneja, Nicholas Meskhidze, Markus Petters, Sandra Yuter

Mesoscale Processes

Gary Lackmann, Matthew Parker, Lian Xie, Sandra Yuter

Weather Systems and Forecasting

Gary Lackmann, Matthew Parker, Lian Xie, Sandra Yuter

Climatology

Sarah Larson, Nicholas Meskhidze, Walter Robinson, Lian Xie

Satellite Remote Sensing

Viney Aneja, Nicholas Meskhidze, Sandra Yuter

Meteorological Observations and Instrumentation

Markus Petters, Russel Philbrick, Sandra Yuter

Geophysical Fluid Dynamics

Ruoying He, Lian Xie

Air-Sea Interaction

Sarah Larson, Lian Xie

Convective Dynamics and Physics

Matthew Parker, Sandra Yuter

Synoptic-Dynamic Meteorology

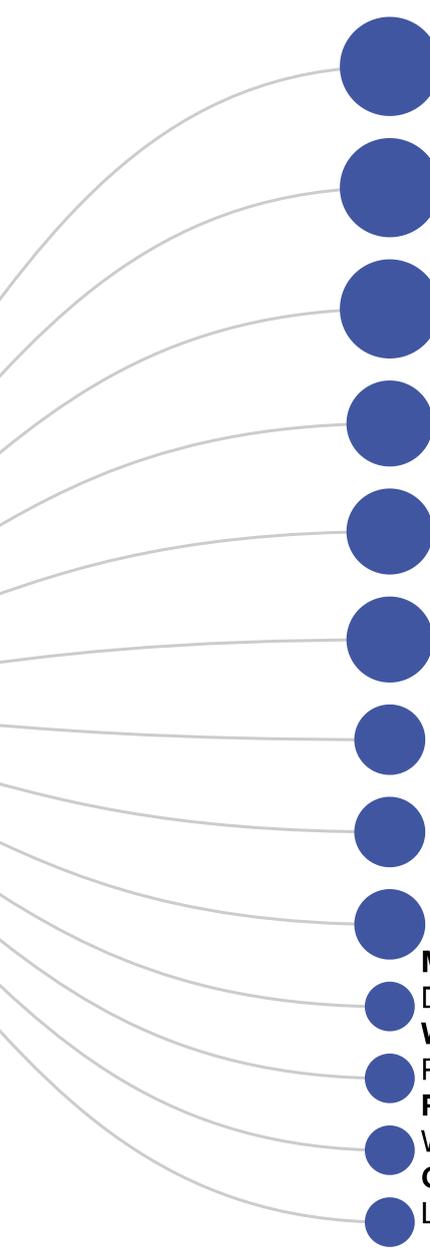
Gary Lackmann

Storm Structure and Dynamics

Matthew Parker

Appendix 03

C. Marine Science Faculty



Benthic Studies

Dave Eggleston, Lonnie Leithold, Christopher Osburn, William Showers

Estuarine and Coastal Processes

Dave Eggleston, Ruoying He, Ryan Paerl, Astrid Schnetzer

Global Biogeochemical Cycles of Carbon and Silica

Christopher Osburn, Ryan Paerl, Astrid Schnetzer, Carrie Thomas

Sea-Level Change

Carli Arendt, Lonnie Leithold, Paul Liu

Land-Ocean Interactions

Carli Arendt, Lonnie Leithold, Paul Liu

Harmful Algal Blooms

Ruoying He, Ryan Paerl, Astrid Schnetzer

Marine Geophysics and Underwater Acoustics

Del Bohnenstiehl, Paul Liu

Coastal Ocean Initiatives

Ruoying He, Lian Xie

Riverine/Estuarine Nutrient Dynamics

Ryan Paerl, William Showers

Marine Ecology and Conservation Program (MarECo)

Dave Eggleston

Watershed, Estuarine and Coastal Waters Modeling

Paul Liu

Paleoceanography

William Showers

Galapagos Oceanography

Lian Xie

Appendix 03

D. Earth Science Faculty



Surface Processes

Del Bohnenstiehl, Paul Bryne, Ethan Hyland, David McConnell
Helena Mitasova, Lewis Owen, Karl Wegmann

Environmental Geology and Hydrology

Carli Arendt, David Genreux, Lewis Owen, William Showers

Solid Earth Systems

Del Bohnenstiehl, Paul Bryne, David McConnell, Lewis Owen
Ariana Soldati

Marine Geology and Geophysics

Del Bohnenstiehl, Lonnie Leithold, Paul Liu, Christopher Osburn

Climate History and Impacts

Carli Arendt, Ethan Hyland, Lewis Owen, Catherine Davis

Earth History

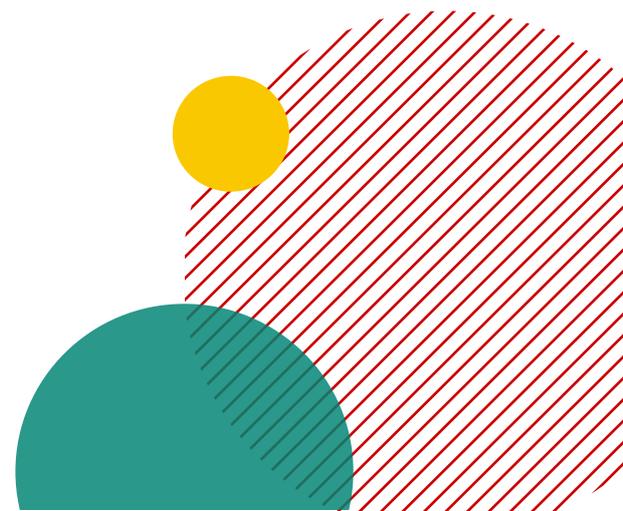
Ethan Hyland, Lewis Owen, William Showers

Geoscience Education

David McConnell, Carrie Thomas

MEAS Faculty Directory:

[https://meas.sciences.ncsu.edu/
group/faculty/](https://meas.sciences.ncsu.edu/group/faculty/)



Department Head Associate Dept Head
Dr. Lewis Owen Dr. Astrid Schnetzer

Appendix 04

A. NCMNS — Education

The Education Section develops and provides engaging, accessible, and inclusive experiences and resources that enhance the public's understanding and appreciation of science and the natural world and inspire its conservation. Our programs emphasize the use of real objects, live animals, and the outdoors as we provide our audiences, from infants to seniors, with experiential learning opportunities.

Early Childhood & Elementary Education

The ECEE Unit focuses on the natural science education of young and elementary age children, their families, and educators through programming and play.

Youth Programs

The Youth Programs Unit provides middle and high school learners with opportunities to learn about science, explore STEM careers, and gain leadership experience.

Immersive Experiences

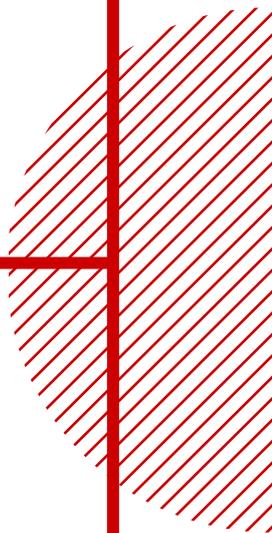
This Unit is responsible for coordinating three hands-on educational spaces in the Nature Research Center as well as four Museum-wide exhibit hall-based program series – Carts, Floor Interpreters, Live Shows, and Daily Planet Science Presentations and Cafés.

Outreach Unit

The Outreach Unit includes Teacher Education and professional development, Virtual and Offsite Outreach programs for communities across NC, and Lifelong Public Programs including staff lead in-person field experiences.

Descriptions courtesy of the North Carolina Museum of Natural Sciences

NCSU : NCMNS — Synergies Report 2021



Appendix 04

A. NCMNS — Education

Immersive Experiences

Katey Ahmann (Head)
Chris Smith (Science Programming)
Matthew Faerber, Aaron Poeate (Visual World iLab)
Collin Brammer, Nancy Loquet-Absillis (Micro World iLab)
Cindy Lincoln, Greg Skupien (Naturalist Center)
Bob Alderink, Deb Bailey (Exhibit Hall Experiences)
Kari Wouk, Miranda Dowdy, Hugo Romero-Sanchez (Public Events)

Outreach

Jerry Reynolds (Head)
Martha Fisk, Laura Beth Speer (Offsite and Virtual Outreach)
Luke Roller, Samantha Frigerio (Outreach)
Melissa Dowland, Megan Davis, Danielle Pender (Teacher Education)

Early Childhood & Elementary Education

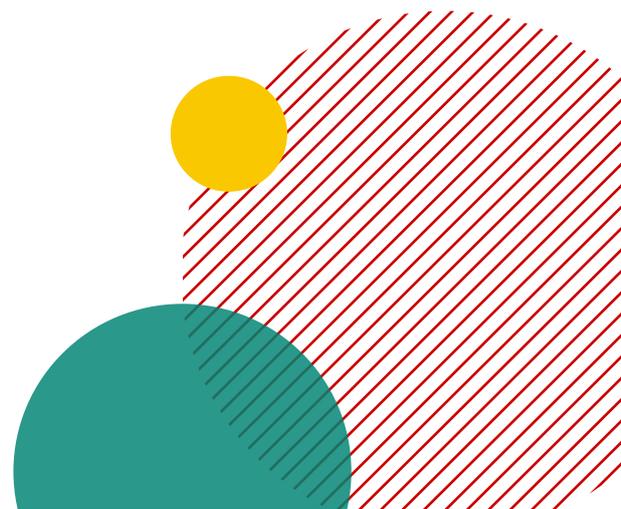
Jan Weems (Head)
Paige Schneider, Linda Saah (Elementary Education)
Laura Dameron (Summer Camps)
Sarah Safley (Discovery Room)
Beth Cranford (Family Programming)

Youth Programs

Lynn Cross (Head)
Erin Apple

RACE 2.0

Michael Lewis



Director of Education
Christy Flint

Appendix 04

B. NCMNS — Research

The North Carolina Museum of Natural Sciences' Research and Collections section strives to discover and document biological diversity, promote environmental awareness and relate the natural sciences to everyday life. Museum-based research projects have local, regional, national, and international scopes and add to our understanding and explanation of the natural world.

The Research Collections are a treasure-trove of historical information about the natural world, providing specimens and related information to the broader academic research community and promoting environmental stewardship efforts.

Fields of Research

Astronomy & Astrophysics

Genomics & Microbiology

Geology

Herpetology

Ichthyology

Malacology

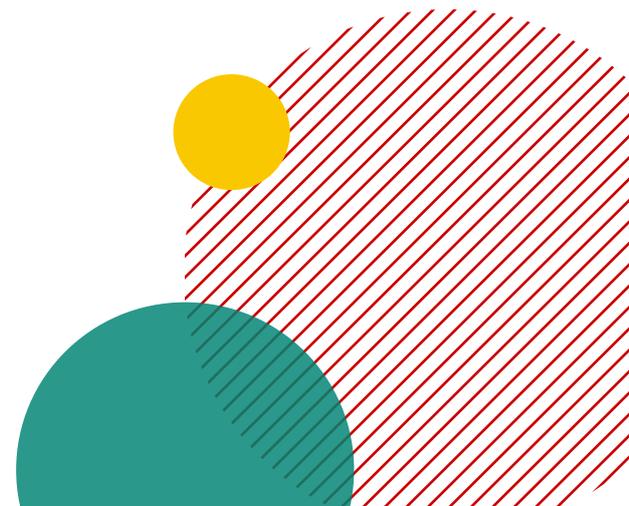
Mammalogy

Non-Molluscan Invertebrates

Zoology

Ornithology

Paleontology



Director of Research & Collections
Robert Wiese

Appendix 04

B. NCMNS — Research

Astronomy & Astrophysics

Research at the Astronomy & Astrophysics Research Lab (AARL) spans from understanding the early solar system and our own beginnings to the origin of galaxies in the Universe.

Genomic & Microbiology

The Genomics and Microbiology unit uses cutting-edge genomic technologies to explore the microscopic world of DNA inside a diversity of species from primates to planthopper insects, and the microbes associated with them.

Geology

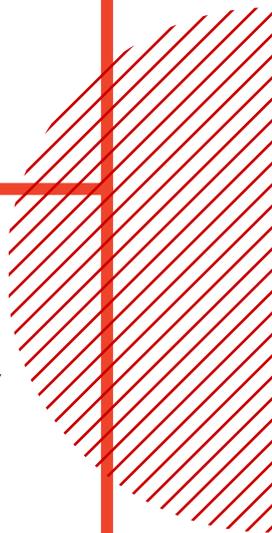
The Geology unit conducts experimental, analytical and field-based research in Mineralogy and Geochemistry, with a focus on apatite phases and the geology of North Carolina.

Herpetology

The Herpetology unit conducts collections- and field-based research on the diversity, distributions, natural history, evolutionary relationships, and conservation of amphibians and reptiles in North Carolina and around the world.

Descriptions courtesy of the North Carolina Museum of Natural Sciences

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Ichthyology

Why are fishes so diverse? From the sunfish and gars of North Carolina, to the enigmatic species of Antarctica and the deep-sea, our staff investigate the factors that have generated and continue to maintain this amazing biodiversity using an integrative approach that combines field, laboratory, and collections based research.

Malacology

The primary foci of the Malacology research unit are freshwater bivalves, freshwater gastropods, and the terrestrial gastropods and marine mollusks of North Carolina.

Non-Molluscan Invertebrate Zoology

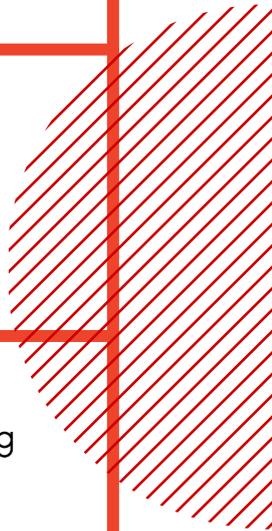
Non-molluscan Invertebrate Zoology encompasses active research being undertaken by several Units and Laboratories throughout the Museum. Topics and fields of study vary widely, and include astacology, entomology, and paleontology.

Ornithology

The Ornithology unit maintains an active field research program involving banding, radio telemetry, field surveys, and specimen collection and preparation.

Paleontology

The Paleontology unit maintains an active research program consisting of staff, students, interns, postdoctoral research scholars, volunteers, and adjunct researchers. Collectively, our staff cares for a regionally impactful and globally unique fossil collection that is growing in number, reputation, visibility, and usage. Our research garners worldwide recognition, and we strive to serve the public through educational outreach and programming.



Appendix 04

B. NCMNS — Research

Paleontology

Aaron Giterman, Lisa Herzog, Christian Kammerer,
Eric Lund, Mary Schweitzer, Lindsay Zanno

Non-Molluscan Invertebrates Zoology

Megan McCuller, Adrian Smith, Trish Weaver, Bronwyn Williams

Genomics & Microbiology

Heather Evans, Julie Horvath, Bryan Stuart

Mammalogy

Michael Cove, Lisa Gatens, Roland Kays

Ornithology

John Gerwin, Roland Kays, Brian O'Shea

Astronomy & Astrophysics

Rachel Smith, Patrick Treuthardt

Herpetology

Bryan Stuart, Jeffrey Beane

Malacology

Arthur Bogan, Jamie Smith

Geology

Chris Tacker

Ichthyology

Gabriela Hogue

Appendix 04

C. NCMNS — Collections

Geology

The North Carolina Museum of Natural Sciences' Geology Collection contains an excellent representation of the gemstones, minerals, and ore deposits of the state of North Carolina with approximately 7,500 specimens.

Herpetology

A collection of approximately 265,000 specimens of amphibians & reptiles dating back to the late 1800s, with strong representation of the Southeast U.S. (especially the Carolinas) and mainland Southeast Asia. The collection houses fluid-preserved specimens, skeletons, skins, tissues for molecular analyses, and supporting materials.

Ichthyology

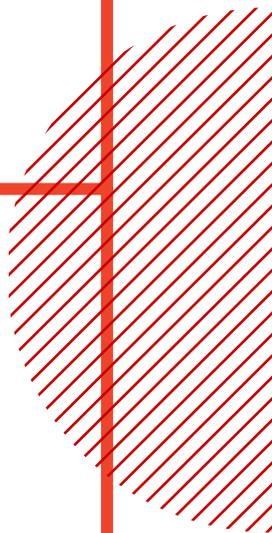
The North Carolina Museum of Natural Sciences' Ichthyology Collection contains approximately 1.3 million specimens. These collections span 42 countries and also represent one of the largest and most complete regional collections in the United States.

Invertebrate Paleontology

The North Carolina Museum of Natural Sciences' Invertebrate Paleontology Collection contains approximately 56,000 specimens (11,000 lots) representing more than 1400 species. Founded in the late 1800s, the collection consists of approximately 80% North Carolina material, although a total of 40 states and 39 countries are represented.

Descriptions courtesy of the North Carolina Museum of Natural Sciences

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Appendix 04

C. NCMNS — Collections

Mammalogy

The North Carolina Museum of Natural Sciences' Mammalogy Collection contains approximately 20,000 specimens and is one of the largest regional mammal collections in the Southeast. The specimens are primarily from North Carolina and the southeastern United States.

Meteorites

The North Carolina Museum of Natural Sciences' Meteorite Collection consists of a diverse array of samples that provide a comprehensive view of the early solar system and planet formation.

Mollusks

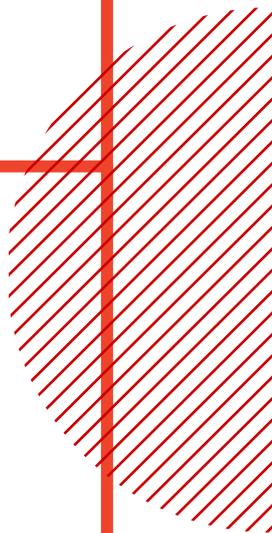
A collection of over half a million specimens that is comprised 83% freshwater species (mussels, fingernail clams and snails), 10% marine species and 7% terrestrial species (snails).

Non-Molluscan Invertebrates

The North Carolina Museum of Natural Sciences' Non-molluscan Invertebrates Collection houses well over 250,000 specimens representing more than 20 phyla. It includes one of the largest collections of freshwater crayfish in and of the southeastern United States, and one of the largest and most historically important collections of marine invertebrates in the Mid-Atlantic region.

Descriptions courtesy of the North Carolina Museum of Natural Sciences

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Appendix 04

C. NCMNS — Collections

Ornithology

The North Carolina Museum of Natural Sciences' Ornithology Collection is one of the three largest of its kind in the southeastern United States and is the only collection of significant size in North Carolina. Its 20,000 specimens represent 26 of 27 orders, 135 families, 598 genera, and 1,500 to 2,000 taxa.

Paleobotany

The North Carolina Museum of Natural Sciences' Paleobotany Collection contains approximately 1600 specimens representing 109 genera. Founded in the early 1900s, the collection consists of approximately 21% North Carolina material as well as material from 25 other states and 13 countries.

Vertebrate Paleontology

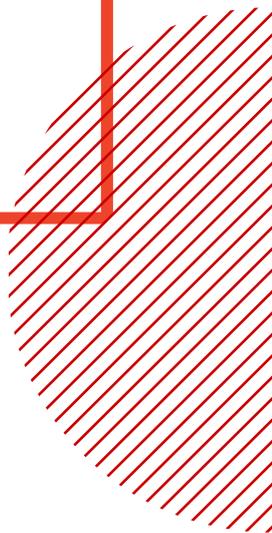
The North Carolina Museum of Natural Sciences' Vertebrate Paleontology Collection contains approximately 63,000 specimens representing more than 400 genera. Founded in the early 1900s, this collection consists of approximately 89% North Carolina material, although a total of 31 states and 21 countries are represented.

NCMNS Staff Directory:

[https://naturalsciences.org/about/
staff-directory](https://naturalsciences.org/about/staff-directory)

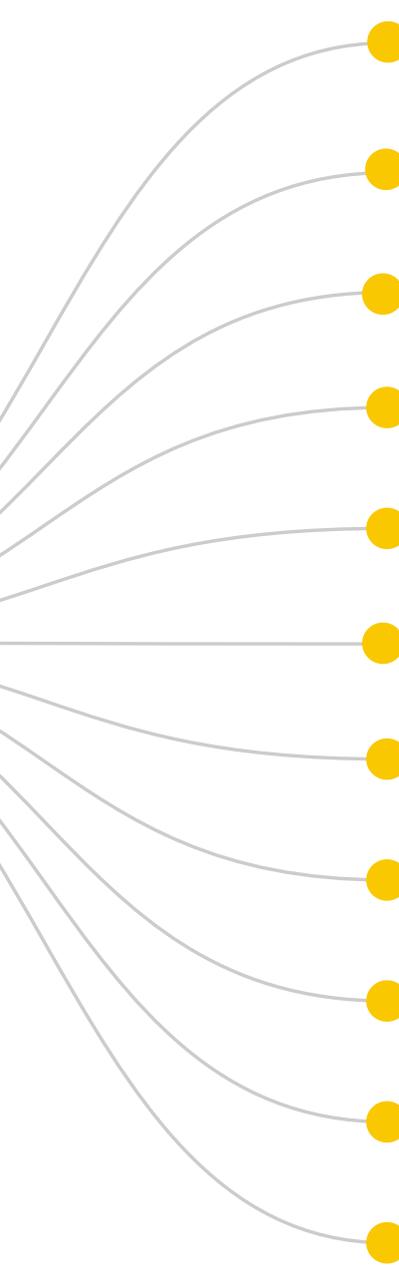
Descriptions courtesy of the North Carolina Museum of Natural Sciences

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Appendix 04

B. NCMNS — Collections



Geology

Chris Tacker, Sean Moran, Ben Norton

Herpetology

Bryan Stuart, Jeffrey Beane, Aubrey Wiggins

Ichthyology

Gabriela Hogue

Invertebrate Paleontology

Christian Kammerer, Sean Moran

Mammalogy

Michael Cove, Lisa Gatens

Meteorites

Rachel Smith

Mollusks

Arthur Bogan, Jamie Smith

Non-Molluscan Invertebrates Zoology

Megan McCuller, Bronwyn Williams

Ornithology

John Gerwin, Brian O'Shea

Paleobotany

Christian Kammerer, Sean Moran

Paleontology

Christian Kammerer, Sean Moran