

Through the Glass: A Glimpse into the Management of Visible Labs

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Abstract

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Visible labs are an emerging practice in museums and little is known about the operations, management, staffing or impact of these labs. This research addressed these questions: What do the management and operations of visible labs look like? What is the nature of the work that is viewed in the visible labs? How do visible labs interact or communicate with visitor about what they are seeing? Data was collected through semi-structured interviews with ten museum professionals working in or with a visible lab and observations of six visible labs between two different institutions.

Key results include: The labs are managed and operated by a combination of scientists, volunteers and additional staff who are hired and trained specifically to work in the labs. The research taking place in these labs is selected or designed not only to engage the public but also to contribute to research in the associated disciplines of the labs with results often published in peer and museum publications. Running a lab is complex and typically involves collaborations between different departments and may involve lots of logistical variables that the lab manager or curator might not control. Although not a focus of this study, there was a suggestion that visitors may not realize they are watching scientists and not actors.

More research is needed on the impact of these labs on the professionals who work in them, the visitors who view them and the institutions that host them.

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Chapter 1: Introduction

Making current scientific research a part of the visitor's experience has been a growing trend in the last two decades (Farmelo, 2004). Visible laboratories have become "another way for the public to understand research" (Einsiedel, 2004, p.76). Visible laboratories are used to exhibit the everyday work of the museum as well as its research and collections staff using glass walls or windows. Museums are adopting this strategy to create a sense of transparency and connectedness between the museum's research departments and the public (Fong, 2013).

Recently, the University of Nebraska State Museum announced that they will be renovating their current space to include a working paleontology laboratory (UNL Today, 2015). The Nature Research Center (NRC) at the North Carolina Museum of Natural Sciences has taken visible labs a step further. The NRC has glass walls everywhere and very little solid walls, allowing visitors to have a better view of researchers working in the labs. The Burke Museum of Natural History and Culture (Burke) is planning to do something similar to the NRC for their new building but are adding exterior glass walls.

As an exciting but emerging practice, little is known about the management and operations of visible labs and if they truly do reflect the everyday work of the museum, research, and collections staff. One study found that two of the labs intended messages--to see what goes on behind the scenes and to make science more accessible-- were not found in the visitors' responses (Gavigan, 2007). Another study suggests that some research operations and processes cannot be done in the lab due to its arrangement, safety, and possible contamination issues (Fong, 2013). These issues have brought some professionals to question the methods by which information is being presented in visible labs. In a review of the NRC at North Carolina Museums of Natural Sciences, Heimlich observes that what people see in the visible labs "is a

limited perspective" (2013, p.134). Heimlich supports the ideals of visible labs but questions what is lost when only a limited perspective is viewed within the lab (2013).

In the midst of the excitement around visible labs, little research has looked at the organizational structures of these labs and how they fit within the museum's overall organization and operations, and yet, museum management is fundamental in the expansion and advancement of a museum (Edison, 2004). The American Alliance of Museums' (AAM) standards regarding leadership and organizational structure state, "the governing authority, staff, and volunteers have a clear and shared understanding of their roles of their responsibilities" (2008, p. 40). AAM states having an effective operation within a museum reflects the strength of the infrastructure within the museum. Good facilities management "takes into account the needs of the people who work within the organization, the preservation and exhibition of objects in the museum"(Genoways, 2003, p.197). The staff and the management in visible labs are a significant aspect in accomplishing the communications between the mission and visitors. This research looked at management and operations and daily activities of these labs.

Significance

Visible labs are used to communicate with visitors the importance of the work being done in museums. The function of the visible labs is significant to accomplish the museum's mission. Increasing our understanding the management and operations of these labs, may help museums that are considering or are currently hosting visible labs. The purpose of this research was to examine the management and operations of visible labs.

Chapter 2: Literature Review

Connecting to the Public

Within the last of the 20th Century, American museums were being substantially reshaped from focusing internally on the growth of collections to focusing more towards the community and their perception of the collections (Weil, 2002). As part of this change, museums have had a prominent role in educating the public and have focused on being experienced based (Lord & Lord, 2001). As museums began to change their role within society, professional associations became more focused on this new role (Weil, 2002). The Association of Science-Technology Center (ASTC) was created to help not only museums, but other organizations to create innovative approaches in science learning (Association of Science-Technology Center, n.d., p. 3).

ASTC is “dedicated to furthering public engagement with science among increasingly diverse audiences” (Association of Science-Technology Centers, 2016). Visitors can partake in STEM knowledge at museum and science centers, “who are uniquely positioned to raise awareness, understanding, and interest levels in science and other STEM disciplines” (Association of Science-Technology Center, n.d., p. 7). Museums and science centers use excitement to lead visitors in understanding complex scientific principles and ideas (n.d.).

Museums and science centers are giving visitors access to current research by having scientists communicate to the public about their research.

Science is dependent on society for financial and political support, and reliable knowledge produced by science is of practical importance for members of the general public. So it is in scientists’ best interest to communicate their work to a broad audience, and in the public’s best interest to understand both established science and emerging research (Davis, Horn, & Sherin, 2013, p. 31).

Since the late 20th Century, scientists have been encouraged to inform and communicate their disciplines with the public (Miller, 2001). Museums double as research institutions and their scientists double as curators (Davis et al., 2013). “On the whole, though, contact between scientists and the general public is only very occasionally direct, and most often several steps removed” (p.32). Although, some scientists have taken an active role in shaping how science is portrayed to the public through museums (2013).

Many museums are giving visitors a behind-the-scenes view of research activities for the benefit of the visitor’s experience (Farmelo, 2004). There is a trend within natural history museums to make current scientific research a part of the visitor’s experience (2004). Since the 1990s “museum visitors have demonstrated an appetite for contemporary science programming ... institutions are becoming less focused on the past, and more responsive to the future” (p.4). The public’s understanding of research needs to be a collaboration between museum professionals and the research scientists.

Having “face-to-face interactions as a valuable and viable method of connecting public audiences with current research and providing unique, personal experiences for museum visitors” (Selvakumar & Storksdieck, 2013, p. 70). The Pacific Science Center created the Portal to the Public:

A program is an effort designed to assist informal science education institutions as they seek to bring scientists and public audiences together in face-to-face interactions that promote an appreciation and understanding of current scientific research and its application (p. 69).

The program provides a framework to bring scientists and visitors together and become actively involved simultaneously (2013). It not only creates the relationship between the visitor and the scientist, but also the relationship that they share with the institution as a whole. The

program assists scientists to “develop communication skills and have a venue to share their work with the public” (p. 75). At the same time, the museums must maintain their educational value.

Opening Collections/ Visible labs

Most museums have collections held in trust for the public. “Collections come in many forms and represent the most sacred and profound of a society’s cultural heritage or embody the common elements of everyday life” (Edson, 1996, p. 67). The American Alliance of Museums’ (AAM) *National Standards & Best Practices* states the purpose and importance of collections is to be “held in trust for the public and made accessible for the public’s benefit...A museum’s collections are an important means of advancing its mission and serving the public” (American Association of Museums, 2008, p. 46). Many museums have implemented a method that makes collections more easily accessible to the public and advances the museum’s mission. The method is a type of exhibit that allows the public to have a view of behind-the-scene work of museums, called visible storage.

Visible storage is used to reveal museum objects that were previously held in unseen storage areas behind the museum's walls. “It is the most effective way to increase the percentage of works on display” (Molineux, 2014, p. 129). Many museums have furthered access to the objects in visible storage by having digital access to the museum’s catalog data and additional research information (Maxima, 2014). This allows visitors to search for the knowledge and meaning of the objects on their own (2014). As an exhibition, visible storage is one of the most important ways that museums establish their relationships with different communities (Lord & Lord, 2012).

Exhibits are one of the principal ways that a museum or an institution communicates with its public: exhibitions are often how people find out about the mission and mandate of a museum, the kinds of research and services the institution is working on, and the collections of the museum (p.104).

“A number of museums have experimented with visible storage to make a larger percentage of their collections accessible to the public” (Hilberry, 2002, p. 36). Visible storage increases public support because visitors gain a better understanding of the museum’s responsibilities and true social identity (Thistle, 1990). The focus of visible storage has two concepts to fulfill the fundamental goals (Hilberry, 2002). The first is to display a large number of objects available for close examination by the public (2002). The second is to advance the museum’s mission and make visible collections exciting for the public to grasp the importance of the objects (2002). As the community begins to have a better understanding of museums and perceives them as part of the community, the museum becomes fully integrated into the community’s life (Thistle, 1990).

Museums are taking a step further in being transparent with visitors by installing visible labs in their facilities. The Burke Museum of Natural History and Culture and the University of Nebraska State University are two examples of museums creating visible labs in their facilities (Kehl, 2015; UNL Today, 2015). The Burke Museum of Natural History and Culture (Burke) is planning to do something similar to the NRC for their new building but are adding exterior glass walls. In an interview, the Burke’s project manager, Eldon Tan, said the purpose of the new Burke is for Washingtonians to get a sense of the objects in collections and if that is not the case then “the Burke can’t fully execute its mission and vision” (Kehl, 2015, p.43).

Visible labs are working labs viewable to the public within an institution. Visible labs were created for two purposes. The first is to complete the work that needs to be done within the museum (Fong, 2013). The second is to ensure that they are educating the public about the research or conservation efforts done in the visible labs (2013).

Visible labs are usually separated into three different types of labs: fossil preparation, conservation, and research. Museums in the United States have been installing viewable working laboratories since the 1970s (Gavigan, 2007). One of the more prominent types of a visible lab is the paleontology preparation lab because of its popularity with visitors (2007). “In the 1990s, working laboratories appeared in natural history museums with the goal of disseminating paleontological research to their public” (p. 44). Many museums within the United States added fossil preparation labs such as the Denver Museum of Nature and Science and the Field Museum (2007). Due to the popularization of fossil preparation labs, museums began to build other types of visible labs.

Towards the end of the 20th Century and the beginning of the 21st Century, art museums also began to reveal the work of conservators (Alexander & Alexander, 2008). In 1996, the Walter Art Gallery revealed to visitors the tasks performed by the institution's conservators (2008). The exhibition explained to the visitors the “importance of the decisions made the conservator, and in another level the investment if the museum as a public institution in caring for objects for public benefit” (p.229). The National Museum of American History exhibited conservation efforts on the original Star Spangled Banner and had text labels for visitors to understand the decision making process for restoring the banner (2008). Within the last decade, conservation efforts have become permanent exhibits in museums as another type of visible lab. The Smithsonian’s American Art Museum installed the Lunder Conservations Center. There “visitors have the unique opportunity to see conservators at work in five different laboratories and studios” (Smithsonian, 2006). This is an effort for the public to understand the importance of conservation and the important work done in museums.

Fossil preparation and conservation labs are not the only types of labs viewable to the public. There are research labs which make current research viewable and accessible to the public. Observing scientists while they conduct research in the museum itself is another way for the public to understand research in science (Einsiedel & Einsiedel, 2004). “Bringing the human dimension of a science museum comprising of active research...to the forefront of display is a remarkable exercise in public communication of science” (Bouquet, 2012, p.144). Having scientists work in visible labs brings out an invisible dimension of the museum itself and makes the scientists’ world visible to the public (2012). Doing so creates a connection between scientists and the public. Visible labs that are for conducting research give science a voice and presence in the museum, and a public interface and to explain their research to a layperson (2012). Some of the visible labs that are utilized for research allow visitors to participate in a scientist’s research study.

A number of institutions are helping scientists actively interact with visitors. Some institutions are giving visitors access to participate in scientific studies (Poirier, 2014). Visitors are participating in real scientific research as subjects allowing one-on-one conversations between scientists and visitors (2014). This gives an opportunity for scientists to explain “how research impacts their [visitors’] day-to-day lives, while playing a genuine role in the process of scientific discovery” (p.52). In some institutions, visitors view scientists’ or volunteer citizen scientists’ work with samples of DNA while participating and speaking to the scientists or volunteers about the study (2014). Each type of visible lab involves different disciplines and they each have to be managed differently.

Museum Management

Museum management is fundamental in the expansion and advancement of a museum (Edison, 2004). Museum management was once viewed as an irrelevant aspect of running a museum (Moore, 1994). At one point, museums “were traditionally not managed at all, but they were administered” by curators and directors (p. 3). Very few museum professionals today view themselves as management. Most refer to themselves by their title, such as curator or educator (Holmes & Hatton, 2008). “In one way or another [management] is regarded as an important part of the work and responsibilities of most professional staff and... not just of the director and his or her deputies.”(Edison, 2004, p. 133)

Management has become an increasingly integral part of museum practice and, consequently, mission statements, strategic plans, staff development initiatives and performance measurement systems are now familiar aspects of everyday working life for most practitioners (Sandell & Janes, 2007, p. 101).

Since the late 1990s, academic researchers and museum professionals have increased the body of literature in museum management. One aspect that has been written about is strategic museum management, which consists of organizing, planning, and monitoring museum work (Reussne, 2007). Museum work involves collections, research, exhibits, and public programming to assist in the museum’s objectives (2007). The strategic museum management model described by Reussne (2007) involves goal development, strategic analysis, strategic orientation, strategic planning, and implementation. The proposed strategy is meant to:

Change the focus of strategic museum management towards including cultural policy guidelines and the principles of visitor-orientation, in order to overcome the tension between the strategic demand to develop visitor-oriented museum services and the duties of museums as public institutions (p. 159).

The International Council of Museums’ (ICOM) *Running a Museum: A Practical Handbook* was created to improve or enhance the knowledge in different areas of the museum (2004). The

author of the chapter on museum management, Gary Edison (2004), states that management plays a role in creating public interest and trust, and adds value and recognition in the museum's service to society. "Effective museum management is a responsibility that embraces all the resources and activities of the museum, and involves all the staff" (p. 134). Edison emphasizes for management to draw principles and best practice from different professions such as business and public service.

Key aspects of good management are: (1) selecting the right personnel for the job, (2) determining the work to be done, (3) deciding the way the work is to be accomplished, and (4) managing the relationship between the persons doing the work and the other elements of the museum they are fundamental to the management process (p.134)

It is also important for management to highlight the importance of the employee's role within the museum.

Another author in the handbook recommends management "explain the significance of employee's work in relation to the overall aims and programs of the museum" (Boylan, 2004, p.149). Under ICOM's Code of Professional Ethics, it is important for staff to be properly trained (International Council of Museums, 2013). Another aspect of management is ensuring a safe working environment for the staff, paid or unpaid, and visitors (Boylan, 2004).

The American Alliance of Museums' (AAM) National Standards & Best Practices regarding leadership and organizational structure states, "the governing authority, staff, and volunteers have a clear and shared understanding of their roles of their responsibilities" (2008, p. 40). AAM states having an effective operation within a museum reflects the strength of the infrastructure. An important element is ensuring the museum's programs and services advance the mission. However, AAM is not the only one to emphasize the use of the mission in museum management.

The Manual of Museum Management by Barry Lord and Gail Lord (2009) serves as a definite text to effectively use on the management and function of a museum. Both Lords are founders and co-presidents of Lord Cultural Resources, a prominent company in the planning and management of museums. Lord and Lord state that “the purpose of management in museums is to facilitate decisions that lead to the achievement of the museum’s mission, the fulfilment of its mandate, and the realization of its goals and objectives for all of its function” (Lord & Lord, 2009).

Most of the literature speaks about the importance of the main museum staff but “volunteers are vital to the life of many museums” (p.44). Volunteers bring multiple work experiences and their acquired knowledge to the museum (2009). As such, museums utilize volunteers in different areas of the museum. Lord and Lord suggest that volunteers should be addressed as workers and should be rewarded with individual development and social recognition. Volunteers should be treated with the same respect that the main staff receive, as well as the necessary training and recognition of their work from the director and board members of the museum (Lord & Lord, 2009). Their recruitment should involve the same careful selection as the main staff and they should be interviewed (2009). The interview process should determine their interests and their ability to communicate the museums objectives, resulting in the success of the museum and serving as a link to the community (2009).

Interns also have an important role within the museum. Lord and Lord describe an intern to be “a source of mostly youthful energy and enthusiasm, and newly minted knowledge that can be invaluable to a museum department” (p. 47). Interns should be treated the same as volunteers when it comes to training and professional development (2009). Both volunteers and interns should grow within the museum no matter the period of time they are there for.

Another important aspect of museum management is outlining the organization of the museum's staff. An organizational diagram gives staff members a quick visual reference and it can enhance the flow of museum work (Genoways, 2003). Genoways states the “internal organization of the museum can either enhance or inhibit the museum’s ability to fulfill its mission” (p.46). Ultimately, a museum manager must understand the mandate of the institution.

Chapter 3: Methods

Research Goal

The purpose of this research was to examine the management and operations of visible labs. This research was guided by the following questions:

1. What do the management and operations of visible labs look like?
2. What is the nature of the work that is viewed in the visible lab?
3. How do visible labs interact or communicate with visitors about what they are seeing?

This study applied a case study design with two methods: Semi-structured interviews and observation of activities in the visible labs.

Sampling

Research was conducted on seven visible labs at two different institutions. These sites were selected based on two criteria: The museum needed to have one or more visible lab and at least one person in charge of one or more of the visible labs. A total of forty- four possible sites were identified in the United States (Appendix A). Of these institutes, I selected the Denver Museum of Nature and Science in Denver, Colorado because the institute has had a visible lab for over 20 years and the Research Science Center at the North Carolina Museum of Natural Science in Raleigh, North Carolina because in contrast it is newer and has several visible labs. Museum professionals representing the two institutions participated in this study.

Professional participants

Individuals were selected based on the fact that they currently work for one of the selected institutes and are involved with the visible labs. Potential individuals were emailed a brief description of the purpose of this study, the process of the interview, and an explanation that their involvement was voluntary. Seven participants were contacted and introductions were

referenced from personal acquaintance and through email addresses obtained from the museum's website. Three additional individuals were invited by other employees to participate in the interviews. A total of ten individuals participated in the study; five Lab Heads, one assistant lab head, one preparator, two educational coordinators, and one volunteer coordinator.

Data Collections and Analysis Procedures

Interviews. Semi-structured interviews were conducted with participants. Interviews were conducted in person or over the phone and lasted approximately thirty minutes to an hour. Interview questions investigated the institution's management and operations of the visible lab. All interviews were digitally recorded on an HP laptop. The interview guide is contained in Appendix (B).

Interview data was transcribed and coded and iterative readings were done to identify themes and patterns. Codes were related to categories according to the research questions and some were separated into subcategories. The primary categories represented general classification that fell within the domain of each research question. A few of the categories were separated into subcategories relating to common factors of notes. The coding rubric is included in Appendix (C).

Observations. Observations were done in six of the seven labs using a check list to identify activities done in the visible labs (Appendix D). One of the visible labs was not observed because the research program was still being developed and it was not fully staffed yet. I used a checklist I created to record the types of activities that were taking place in the labs including workspaces used by volunteers, researchers, and staff that is not seen by the public.

The observations were done in two hour blocks with observations recorded every 15 minutes. During that time, I would scan the visible lab for activities taking place. The descriptions of the

activities were written down and checked under one of the four categories— collection use, relating to the to the handling of an object from the museum’s collection; public engagement, interaction with the public; museum work, activities relating to answering the phone or anything related to the everyday function; and other, activities that were not thought about by the researcher. The “Other” category was used for activities that did not fall into the three initial categories such as research, which quickly became the most significant entry under “Other.” Finally, I used Microsoft Excel to quantify the activities observed in the visible labs at each institution.

Limitations

The data collected represents the management and operations of seven visible labs between two different institutions. The result from this study can be used for other institutions as a baseline in considering installing a visible lab. However, it does not reflect the management and operations in the field at large.

Chapter 4: Results and Discussions

Two institutions were chosen for this research: the Nature Research Center at the North Carolina Museum of Natural Sciences and the Denver Museum of Nature and Science. Seven visible labs, between the two institutions, participated in the study. Through interviews with ten museum professionals working in or with visible labs at each institution and observation of activities performed in the visible lab, data was compiled to address the three research questions of this study. This research addressed these questions: What do the management and operations of visible labs look like? What is the nature of the work that is viewed in the visible labs? How do visible labs interact or communicate with visitor about what they are seeing?

Nature Research Center in the North Carolina Museum of Natural Sciences

In April 2012, the North Carolina Museum of Natural Sciences opened a new wing called the Nature Research Center (NRC). The NRC is an 80,000 square foot state of the art facility allowing visitors to explore how we learn about the natural world (“Nature research center: North Carolina museum of natural sciences,” 2015). The facility allows visitors to have a hands-on experience with scientific research and provides opportunities to participate in active research. The exhibits provide insight into how scientists learn about the natural world. Investigation labs, or iLabs, are hands-on science labs where visitors use real scientific equipment to perform scientific research. There are five visible research labs where visitors can observe active research by scientists. The SECU Daily Planet is a three story theater with a 42-foot-tall screen, where guest speakers and scientists from the visible research labs give presentations to the public about their research.

Denver Museum of Nature and Science

The Denver Museum of Nature and Science (DMNS) has two visible labs. The Schlessman Family Laboratory of Earth Sciences is a paleontology prep lab in the *Prehistoric Journey* exhibit and the Genetics of Taste Lab is a citizen scientist-driven research lab in the *Expedition Health* exhibit. The Schlessman Family Laboratory of Earth Sciences opened in 1990, before *Prehistoric Journey* in 1995. *Prehistoric Journey* was internally designed to “make the prep lab visible at the end of the exhibit” so that the visitor “[begins] their journey [3.5 billion] years ago and you [visitor] end your journey in present day. Where you are watching scientists work on the past.”

The Genetics of Taste Lab is a genetic research lab where citizen scientists gather data by crowdsourcing museum visitors (“The genetics of taste Lab : Denver museum of nature & science,” 2015). The genetics lab opened in 2009, as part of *Expedition Health*. It “was designed specifically to include the public in both research and education through observation, participation, programming and citizen-science” (“Results of three-year pilot study on bitter taste: Denver museum of nature & science,” 2016). Once a study is complete the public has access to the papers published by the lab’s geneticists and their partners

Research Question 1: What do the management and operations of visible labs look like?**Role of Visible Lab**

All seven visible labs share three main roles within the institution. One role is to expose the public to active research in the museums. A great deal of the research conducted by museum scientists is not typically available to the general public. Ordinarily, people think museums “are just [places] that stores a bunch of old dead stuff that doesn’t do stuff anymore.” The labs are a

“means of inviting the public and giving the public points of access to research.” As one

Assistant Lab Head explained:

If you go to any museum and there is research going on you have no idea where or what is going on because there is no visible display of it like exhibits that you could see but no researchers. You don't see people walking around and things like that so this [visible lab], is actually trying to show people that research is going [on] in museums and this is what it looks like as best we can.

The Schlessman Family Laboratory of Earth Sciences has a large glass window allowing visitors to view staff working on fossils. Visitors are able to interact with staff when the windows are open. The Genetics of Taste Lab has a large glass wall with doors allowing visitors to participate in the study and view the staff at work. The labs at the NRC have glass walls from floor to ceiling, giving visitors the opportunity to see scientists conducting research.

The second role of the visible labs is to conduct research that contributes to academic disciplines such as paleontology, genetics, astrophysics, and other natural sciences. During my observations, the staff in the NRC were using laptops to access data, using tools to remove fossils from a matrix, and working with samples. At the back of some of the NRC labs, office doors have glass inserts that allow visitors to view staff writing papers, sending emails, or doing other work. Visitors cannot see exactly what staff is working on, but they can view them working at their desks.

The third role of visible labs is to “break down the barrier between science and society” and to “invite the public to learn more about the scientific process.” All of the labs give opportunities for people to volunteer. Citizen scientists are involved as volunteers in both visible labs at DMNS. The volunteers in the Schlessman Family Laboratory of Earth Sciences are citizen scientists trained to specifically work in that lab. The Genetics of Taste Lab not only has

citizen scientists trained to work in the lab but have visitors participate in the study done there.

The education coordinator explained

We [the lab] have been working to open the doors a little both physically and figuratively [by] saying you're [visitors] welcome to come in and you're welcome to do to science with us because that is what we know visitors want from evaluation.

Some of the research in the NRC labs involves data analysis of citizen science projects. A project called eMammal uses "camera traps", where participants borrow a camera and place it in their backyard or in the woods and share the photos with the lab. They also have a cat tracking project: cat owners place a tracker on their cat to track their movements and see where they go. The lab has other similar projects where people from the community survey or collect information to share with the staff.

Staff

Permanent staff. Each institution's permanent staff is selected differently depending on the position of the staff. Interestingly the NRC Lab Heads are joint appointments between the institution and a university within the state of North Carolina. "That means half of our salaries [the Lab Heads] is paid by the university and half is paid by the museum." Essentially each Lab Head has two bosses and "writes reports to two different people." One Lab Head thought that this "adds a real solid link between the university and the museum which otherwise [would] be nebulous." Furthermore the Lab Heads manage the labs similar to other labs not seen by the public. They must apply for grants to pay interns, purchase equipment for their research, and to obtain materials to create displays with information about the lab to visitors. They also do outreach, such as creating a programs for citizen scientists and programs for special events.

Candidates for positions in the paleontology lab at DMNS needed "a proven history of fossil preparation and a proven history in field work but they also needed to be able to work and

supervise a large group of volunteers.” In the Schlessman Family Laboratory of Earth Sciences there are around 125 volunteers that the candidate needs to work with and supervise.

Volunteers and Interns. The number of volunteers and interns in each visible lab varies depending on the capacity of the space and the work that needs to be done. Volunteers and interns can be anyone from middle school students, if there is not an age limit, to retired people, although most labs rarely have middle or high school students because they can only come in for one or two hours, or on the weekends. That is not enough time to properly train them and most of the labs are closed on the weekends. Interns are anywhere from undergraduates, graduates, and post-docs interested in working with the lab head or curator. Some of the interns are undergraduates earning college credit. Often it is the interns that are seen working in the visible lab or university students who are considered volunteers.

Both DMNS and the NRC have a similar application process for volunteers. Volunteers must submit an online application and must go through a background check. Each institution has their own set of commitments and requirements to be a volunteer. Volunteers working in visible labs at DMNS are referred to as citizen scientists. In both labs at DMNS volunteers must be 18 years of age or older to be citizen scientists.

Interns usually submit paperwork to the institution and directly contact the Lab Head or curator. One Lab Head at the NRC mentioned some of the interns are paid by grants funded through Friends of the Museum which is a 501(c) (3). Most Lab Heads want their interns to be interested in the research being done in the labs but they also want the interns to communicate and engage with the public about the research. A couple of Lab Heads mentioned that if the intern does not know how to engage or communicate with the public, then they train them.

Operational structure

At the NRC, each visible lab has a different operational structure. Most of the visible labs have two permanent staff members and the rest are volunteers and interns. The Lab Head is responsible for everything that happens in the visible lab and everyone who works within the lab reports to them. A step below the Lab Head is the Assistant Lab Head who assists in supervising volunteers and interns. The Assistant Lab Head is a full time paid employee of the museum. At times, some of the volunteers aid the interns with the research project and report to them on their progress.

In the Genetics of Taste Lab at the DMNS everyone in the lab reports to the Curator/geneticists of *Expedition Health*. The lab manager trains the volunteer citizen scientists and oversees operations of the visible lab. The volunteer citizen scientists interact with the visitors and assist with some of the scientific research.

In the paleontology preparation lab at DMNS, the curator oversees the visible lab. The lab's lead preparator supervises the volunteer citizen scientists. A second preparator primarily supervises volunteer citizen scientists in a separate lab within the museum but also assists in the visible lab. Finally, there are the volunteer citizen scientists who work in the visible lab.

Training of staff

When discussing the training of staff in the visible labs, participants most commonly mentioned one or more of the following areas of training: research process, public communication, and collection handling.

Research Process. Collectively, active research is done in all seven of the visible labs. Lab Heads at the NRC train depending on the project and the individual's experience in processing data and samples. One Lab Head explained "we train them in that aspect [doing research] just

like we would in any academic institution - you know, use hypothesis-driven research, the ways we go about the scientific process.”

In the Genetics of Taste Lab citizen scientists help process DNA swabs and enroll visitors in the research study. Citizen scientists are trained by the lab manager for the “science content side” and the education coordinator for the “guest experience side of things.” Before allowing citizen scientists to enroll visitors in the study they have to familiarize themselves with a script and say scientific terms correctly. Then they “test out” between the lab manager and the education coordinator. The lab pairs together an educator and a lab manager to give visitors a “really scientific accurate experience” and an “engaging experience.” When citizen scientists are not enrolling visitors in the study they process, prepare, and sequence DNA samples and enter data in the database.

Public Communication. Some of the labs in the NRC train their interns and volunteers to communicate with the public. But much of the time “it’s just by getting experience,” getting involved in social media, talking to the media, and using the SECU Daily Planet to talk about the research. One Lab Head described the training for university volunteers/interns to be “a little more tense in the earlier stages of someone’s degree but it varies by the person and their comfort level.” They have different levels of training depending on the intern’s/volunteer’s knowledge of the research.

We [the lab] have one of those cart programs set and so for the whole day there will be a cart outside of my lab... So then the volunteer that we are training can watch me interact and watch how I [Lab Head] say things, what I do, and then we give that person an opportunity to interact with public. Then I watch and once I feel that they are comfortable and they are pretty well set with that, then they can go on their own in the future and do more sessions in talking to people. For undergrads we sort of go through that routine.

If the student is “very versed in the research and so maybe they’ll give a talk in the Daily Planet and I’ll [Lab Head] watch it once and give them pointers and then [if I, Lab Head] feel like they’re comfortable [they, students, can] go on their own.”

Another Lab Head mentioned that during the summer they “lead a science communication workshop once a week where they [university volunteers/interns] learn different aspects of science communication.” They also train the students to give talks in the SECU Daily Planet and use social media to interact with the public about research. The undergraduates in their lab help run a cat-tracking project and it has received a great deal of media attention. Part of their training is to talk to reporters to gain experience in talking to the media.

Collections Handling. Some visible labs mentioned training in handling collections, particularly in the paleontology labs. In the paleontology lab at the NRC volunteers are “trained to handle and care for specimens until we [the lab] put them in collections” and it is a “hands on process.” They are also working on a creating a certification program to formalize the training. In the Schlessman Family Laboratory of Earth Sciences volunteers must take a methods course in fossil preparation and pass a 20 hour practicum given by one of the preparators. Once the volunteer passes the 20 hour practicum, the volunteer works in the lab and is a citizen scientist. Occasionally, in prep labs volunteers and interns will go into the field with the permanent staff to collect specimens.

Operational Hours

Interview subjects acknowledged that ideally they would like to have people working in the labs the entire time the institution is open, but it is not always possible for a number of logistical reasons. The NRC is open seven days a week from 9 a.m. to 5 p.m. and the institution is heavily attended on weekends but most of the visible labs are closed on the weekends and sometimes

during the week because, permanent staff are not always available to supervise the labs. Some permanent staff members alter their schedule to work one day during the weekend, usually for research purposes, but the labs are often closed on weekends. One Lab Head stated “we [Lab Heads] were all hired with this academic kind of schedule” and are mostly only there during the weekdays and even then, they may be working out in the field. The labs aren’t open without permanent staff available for security reasons. Some labs have

sensitive equipment in the lab that’s very expensive and we [the lab] don’t want to just put pretend people in there who might look like they’re doing something when they’re just doing pretend things, because we feel that is not authentic and we also don’t want people in there who might break something or something happened when one main staff wasn’t there. That could be a problem too.

At DMNS, labs are mostly open 364 days a year, sometimes with just volunteers. The Schlessman Family Laboratory of Earth Sciences is “part of an exhibit therefore it should be open” and “we [the museum] require for all the exhibits to be open.” This means the Genetics of Taste Lab is also open whenever the museum is open, although there are rare occasions when the lab is closed. Citizen scientists in the prep lab work mostly in two shifts, morning and afternoon, with a 15 minute break in between.

When permanent staff in Schlessman Family Laboratory of Earth Sciences are out in the field collecting more material.

there are times when it is just the volunteers taking care of themselves, and then it’s been volunteers that have been here 10, 15, 20 years answering questions and helping out [other] volunteers that have been here a couple of months. It is also setup that if you’re [citizen scientists] not comfortable moving forward with this project there are other projects to start on.

The door into the lab is only accessible by badge and all the citizen scientists that work in the lab have their own badge. When the lab manager has the day off in the Genetics of Taste Lab the volunteer citizen scientists run the study. If the lab is closed volunteers outside the lab in the

Biology Space Camp “talk to people about the study and encourage them to email genetics@DMNS.org to make an appointment to participate in the study.”

Research Question 2: What is the nature of the work that is viewed in the visible lab?

Research

Nearly all the activities seen in the labs at the NRC are related to research. Each Lab Head has created a research program that involves various projects under the lab’s discipline. Members of the permanent staff assist in creating a few of the research projects. Staff is often sitting at the lab tables working on their laptops or pipetting genomic data. Other times scientists working on equipment to gather data or to look at samples. Many of the Lab Heads stated the work done in the lab is not selected based on what would be exciting to the visitor. The scientists does “whatever work we [staff] need to [in order] to move our research forward.” Scientists do keep in mind if they need to use certain equipment they will use the ones closest to the glass wall.

Being strictly research labs, many of the labs have items that would be considered research collections. A Lab Head mentioned having an egg project which involves the staff member “looking at environmental contamination by bird eggs” and another project done by graduate students involves scat dissections. Another Lab Head has a volunteer working on cataloging thin sections to display on the museum’s website. Others have living insects, microbes, and genetic samples as part of their research collection.

Due to realities of the research, certain work cannot be seen by the public. When staff does “extremely biohazardous work that needs [to] be done in a contained hood like a biological safety cabinet” the work is done in a separate space away from the public. Many of the scientists are often in the field. Some labs compensate for staff absence by using Skype to present in the SECU Daily Planet and/or have live feed through a website created for the lab.

Periodically, staff can be observed working in their offices in the visible lab (Figure 1). The Lab Heads work considerably in the labs, but a few subjects voiced having difficulty focusing when it comes to writing in the lab. There is background noise from the exhibits and the voices of visitors. The offices do have doors but because of the glass insert many of the acoustics in the museum can still be heard with the door closed.

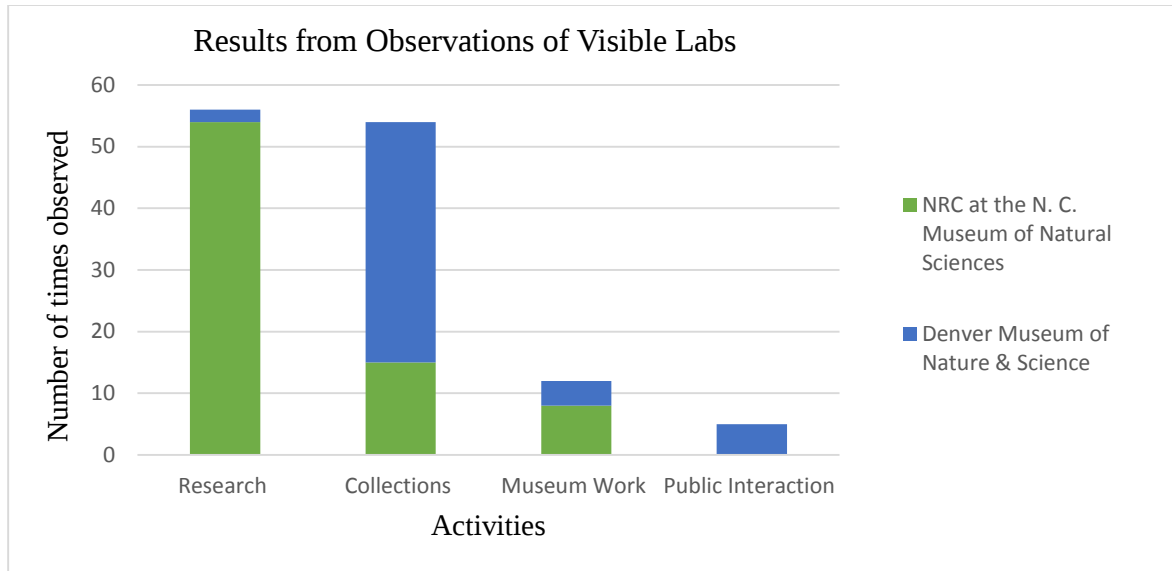


Figure 1

The Genetics of Taste Lab at DMNS has a “designated team of staff and volunteers that work and conduct the research that we are doing.” The lab made significant changes in their research programming after learning that visitors wanted to spend less time participating in the study because “they are only visiting or it’s their [visitors] only free day they can come and we [the staff] want to be respectful of that.” They reduced the time to enroll each visitor from an hour and a half to around 30 minutes. They have managed to reduce the time to complete studies from four years to nine months by “getting their citizen scientists up to par on what we want them doing and narrowing down the research we [lab] are collecting.”

Collections

The second most observed activity in visible labs is collection work, particularly in at DMNS in the paleontology labs (Figure 1). Typically the entire processing of an object- from when the specimen arrives in the lab to when it has to be sent to collections - is done in the visible lab. At the NRC specimens come into the lab straight from the field wrapped in plaster jackets. The plaster jackets are cut open to be prepared by staff. Once the fossils are taken out of the matrix they are put in boxes and sent to collections.

After four years of collecting specimens the shelves inside the lab are now full and some of the specimens have to be sent straight to collection storage, explained the Lab Head. This resulted in the development of a priority list: specimens expected to be prepared soon are sent straight to the visible lab. The Lab Head mentioned there is very little work not seen in the visible lab with the exception of using equipment not in the facilities, such as CT scanning of fossils.

Similar to the NRC's paleontology lab, at DMNS, specimens collected in the field are taken directly to the Schlessman Family Laboratory of Earth Sciences for preparation. Some of the work not done in the lab includes molding and casting and preparation of oversized specimens. "There is no confidentiality that would stop us [staff] from preparing anything, it is environmental constraints" within the lab. The third floor is not reinforced for oversized specimens, so they are prepared in another lab space. Volunteers remove pieces of the matrix until the specimen is light enough to move to the Schlessman Family Laboratory of Earth Sciences. Casting and molding of the fossils needs to be done in a clean environment and the visible lab produces a lot of grime.

Although most of the work is done in the visible lab, the shape of the lab space does not allow visitors to view some aspects of the preparation process such as screen washing of the fossils and other work requiring the use of a sand box. Exceedingly, all of the work done in both fossil preparation labs is collections work, but while preparing the fossils the staff is also doing research. At DMNS, some of their volunteer citizen scientists have been coauthors on papers published by the lab scientists.

One lab at the NRC invites collection departments related to their discipline to work with bird and mammal specimens to prepare skins, skeletons, and other specimen directly behind the glass wall. Visitors are captivated in viewing this process and the Lab Head has plans to have it done more often. The lab has also invited the museum's veterinarians to necropsy the animals who have died in the living collection. This is also a success among visitors and is done whenever possible.

Policies and procedures

All of the visible labs follow policies according their respective disciplines such as the standards of the Occupational Safety and Health Administration (OSHA) for handling chemicals and sharp objects and the Association of Materials and Methods in Paleontology. When handling certain biohazardous micro-organisms at the NRC staff wears lab coats, gloves, and goggles to protect themselves as well as avoiding contaminating the specimen. At the Genetics of Taste Lab, items are labeled as to whether they need gloves to be touched. All citizen scientists are properly trained by the lab manager to handle the DNA samples.

One lab at the NRC has live organisms that require permits because some of them are from out of the state and labs that have multiple research projects may have unique procedures. Items

that are part of the collections research are locked in safe areas by permanent staff members and staff need to log onto computers before data can be updated.

Research Question 3: How do visible labs interact or communicate with visitors on what they are seeing?

Visual Interface

Use of technology. Technology is used in many of the visible labs to communicate with the public. To the side of the Genetics of Taste in the Biology Space Camp visitors can watch a two minute video about the ongoing study. Afterwards visitors can make an appointment or if a volunteer citizen scientist, or lab manager is available they can enroll the visitor. Above the lab are two screens with images of staff working in the lab (Image 1). Displayed on the left side of the research lab are published results of past studies done in the lab (Image 2). Inside the lab a chart displays the age range and sex of participants and a few words about the study.



Image 1: Screens above the Genetics of Taste Lab



Image 2: The entrance of Genetics of Taste Lab.

All of the institutions provide some type of visual interpretation through various technologies including screens and iPads, text panels, display tables, and white boards. At the NRC all information must be displayed behind the glass walls and information on the public side of the wall is managed by the exhibits department. On the exhibit floor visitors use an interactive screen, projected on a large screen (Image 3). However, one person mentioned “if you [the researcher] sat out there long enough you can see no one really uses it. We recognize that is not effective and so that is one of the things we talked about in our meeting, what could we do better with that?”



Image 3: Interactive screen projected on lab glass.

Nearly all the visible labs have display tables directly behind the glass wall displaying objects with information about the lab's current research. The Biodiversity Lab has iPads with slideshows explaining some of the projects and how the visitor can become a citizen scientist by participating (Image 4). The lab also has a fairly large screen after the display tables with some information as well. Posters are used in the Astronomy & Astrophysics Research Lab to exhibit some of the research (Image 5). On the back wall there are two large screens with images about astronomy and astrophysics research. Near the front of the glass is a large screen explaining current research in the lab (Image 6). The Lab Head wrote a grant to purchase the screen "to kind of get away from that mystery of what's happening in the lab because I [Lab Head] didn't think it was clear what we're working on."



Image 4: Biodiversity Lab



Image 5: Astronomy & Astrophysics Research Lab

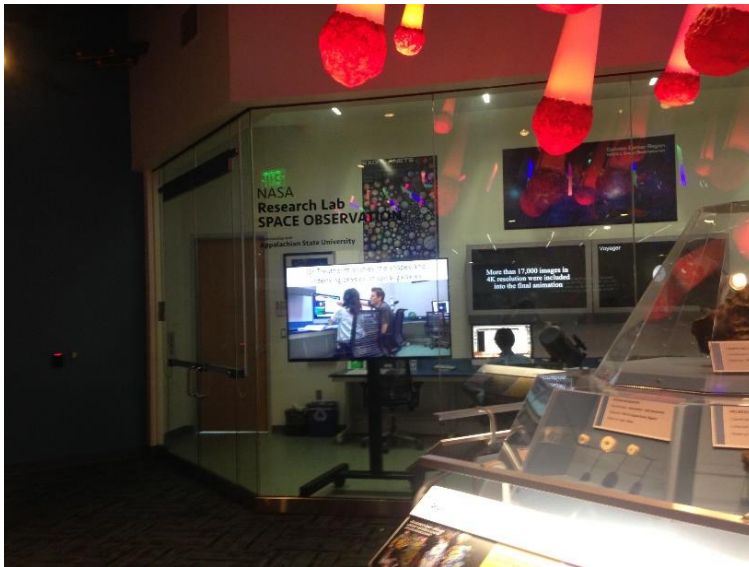


Image 6: Screen directly behind glass wall of Astronomy & Astrophysics Research Lab

Interpreting research. In the Paleontology Research Laboratory, two large fossils in plaster jackets with some interpretive content sit in front of the windows with a slideshow of images of the associated fieldwork. Next to the large fossils is a shelf with smaller fossils in plaster jackets and information about where the fossils were found, the year, and their level of priority (Image 7) The Genomics & Microbiology Research Lab (Image 8) has a display table with items related to the research with text explaining the research, and a whiteboard lists staff working and summaries from published research. There are also posters about genomics and microbiology and a screen with images of staff and text describing their research.



Image 7: Paleontology Research Laboratory



Image 8: Genomics & Microbiology Research Lab

The most recent addition to the visible labs in NRC is the Evolutionary Biology & Behavior Lab, still under development as of my visit (Image 3). The lab plans to put screens, pictures, and explanations about the lab's research program. With the assistance of volunteers they are going to create "a portrait series of [ant] workers and winged females ...sort of like a year book of the ant colony." Meanwhile, the lab is using the Lab Head's research web page and YouTube channel to link with the lab's published research. Other labs in the institution have their own

webpage, blog, and other social media to keep the public updated on their research as well. There is signage directly behind the glass walls saying “Watch scientists at work through the glass walls of this research lab.” The Lab Heads are generally solely responsible for developing content. One Lab Head voiced the need for more support in developing content.

Even with the displays in the visible labs it is not clear if the public realizes they are seeing active research. A visitor study found that “people didn’t always understand that active research was going on in the lab and a lot of time [visitors] thought that we [staff] were just actors pretending to do science.” Visitors think “this is for show because we are on exhibit ... We have just begun to try and do that and that requires more interactive content outside the lab.” Lab Heads mentioned the possibility of having docents outside the labs explaining to the public the work being done in the labs.

Similar to the Paleontology Research Lab at the NRC, the Schlessman Family Laboratory of Earth Sciences has two large fossil specimens in front of the window (Image 9). The large specimens have dinosaur figures near the two fossils to show the type of dinosaur the citizen scientists are removing from the matrix. Behind the two fossils is a white board with information about the fossil such as how old it is, the part of the dinosaur, and where it was found. On the back wall are large drawings of the specimens the volunteer citizen scientists are working on. The parts colored in red are pieces citizen scientists are working on and written on the side are the names of the volunteers preparing the fossil although the distance between the window and the wall makes it difficult to read. Underneath the window on the exhibit side is a sloped panel that explains the fossil preparation and shows images of volunteer citizen scientists in different stages of fossil preparation. The panel is for when a visitor walks up and “someone is working further back in the lab and you [visitor] can’t talk to them [staff] you can sort of look at that” and

interpret what the staff is preparing. Near the front is a screen with footage of staff out in the field.



Image 9: Schlessman Family Laboratory of Earth Sciences

Initially an adjustable camera was connected to the screen to give visitors a close view of the fossil preparation in the back but there were a few technical problems. A significant problem was maintaining the electronics because of dust and sediment created by the preparation work. Additionally, volunteer citizen scientists would sometimes move to work on another area of the fossil, not in the cameras range, they would forget to move the camera, and occasionally the citizen scientist would forget to turn off the camera during breaks or when done for the day. The lab wants to continue finding other methods to engage the public with the work in the lab and they are “still a work in progress.”

Public Interface

Public interaction was often mentioned. The labs at DMNS interact with visitors in the lab or at the window, depending on the lab. Visible labs at the Nature Research Center mostly present their research using the SECU Daily Planet. Other subjects mentioned interacting with visitors outside their lab and through other resources.

During my observations at the NRC, I didn't happen to see the public interaction near or around the visible lab (Figure 1). However, all interviewees at the Nature Research Center discussed using the SECU Daily Planet to present their research (Image 10). Usually a scientist (and sometimes a volunteer) from the lab presents once a week to a public audience. Within that time "visitors can come and talk to scientists" – this includes not only the staff from the lab but other scientists. When the facility first opened the permanent staff were mainly giving talks about the research done in the labs:

"When there were fewer staff I [Lab Head] would probably give one talk every other week and so somebody from my lab would give one talk a week and there were only two of us in the lab. So we each sort of rotated and we do fewer talks in the Daily Planet because we have so many people scheduled. So other scientists [are] giving other talks from the lab; it not only has to be me [Lab Head]."

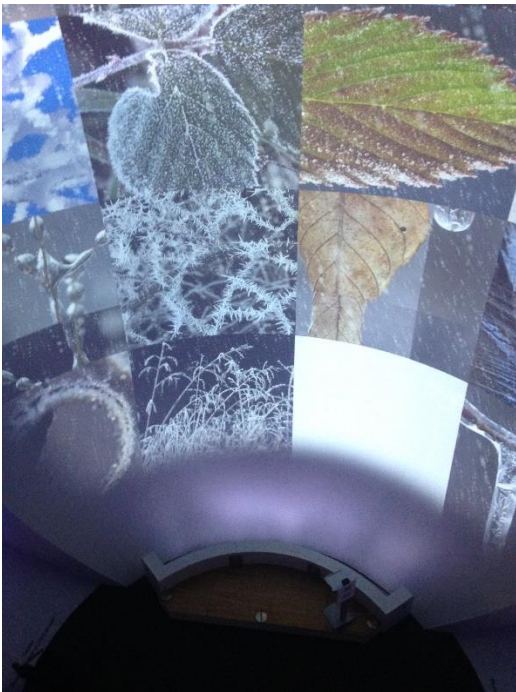


Image 10: SECU Daily Planet.

Additionally, when the Lab Heads or other staff members walk out of the lab, sometimes they will speak to visitors "who look interested or ask a question." The Genomics & Microbiology Research Lab occasionally has volunteers "do a cart program and they basically take a movable

table outside of the lab and take some props from the lab...it's another way to talk about some of the research that goes on behind the glass." Contingent on the props the volunteer can identify the work a staff member is accomplishing. Other labs mentioned other formats for public interaction such as using a microphone for volunteers in the lab to speak with the public while cleaning and preparing specimens.

The Genetics of Taste lab crowdsources visitors through a 30 to 40 minute research study enrollment. While staff is explaining the study, visitors swab their own foreheads and cheeks for their DNA and step on a Tanita, a scale that measures their BMI, creating a baseline of information for the study. Visitors next taste samples and answer questions on an iPad. Once their participation is complete visitors receive a small envelope with their BMI information.

In the fossil preparation lab at DMNS a couple of citizen scientists were observed speaking with visitors at the window during my observation. Citizen scientists would leave the window open, inviting the visitors to speak with them about their work if they were working with the large fossils in front of the window. Some of the subjects mentioned they want to have the window open the entire time the lab is open, but "we [lab] aren't there yet, we have come a long way... We look for volunteers to engage with visitors and encourage the volunteers to leave the window open when they are working in the lab." Keeping the window open as much as possible is a priority because it is part of the *Prehistoric Journey* exhibit.

Chapter 5: Conclusion and Implications

Conclusion

Visible laboratories are “another way for the public to understand research” (Einsiedel, 2004, p.76) and observe research being conducted in museums (Einsiedel, 2004). Recently, the Burke Museum of Natural History and Culture and the University of Nebraska State Museum have announced they are including visible labs in their new or current facilities (Kehl, 2015; UNL Today, 2015). “In one way or another [management] is regarded as an important part of the work and responsibilities of most professional staff and... not just of the director and his or her deputies”(Edison, 2004, p. 133). Yet little is known about the management of these emerging forms of labs.

The purpose of this research was to examine the management and operations of visible labs. Seven visible labs between two institutions were involved in the study. The research included interviews with ten museum professionals who work in or with the visible labs and observation of activities in the visible labs.

Research suggested several trends about the management and operations of the labs. The labs are managed and operated by a combination of scientists, volunteers and additional staff who are hired and trained specifically to work in the labs. Volunteers often assist in the research and sometimes become co-authors in published papers. People within the community can survey and collect information to share with staff as citizen scientists and participate in the studies. Research was the highest observed activity in the visible labs. Research taking place in these labs is selected or designed not only to engage the public, but also to contribute to research in the associated disciplines of the labs with results often published in peer and museum publications. Running a lab is complex and includes balancing research obligations and public

communication. It typically involves collaborations between different departments and may involve lots of logistical variables that the lab manager or curator might not control. Head staff working in or with visible labs are in charge of creating content for visitors to understand the active science behind the glass. Many create displays near the glass wall or window and some train their volunteers to communicate with the public in or near the visible labs. At the same time, staff working in the visible lab must be able to complete their work and sometimes speak with the public while working in the lab.

Although not a focus of these study, there was a suggestion that visitors may not realize they are watching scientists and not actors.

Implications

Further study is needed to fully understand the management and operations of visible labs. Studies should be done with various types of visible labs. A larger sample size and involving other types of visible labs would benefit this topic and illuminate a broader understanding in their function. I hope that this study provides guidance in managing visible labs to institutions who plan to install or have new plans for them in their new buildings. Each lab has a unique role within the institution.

The constraints of the physical space of the visible lab itself restricts some of the work that can be done in the lab. Some visible labs do not have enough space or shelves to hold specimens. Another constraint is the acoustics within the museum that make it difficult to focus when writing in the visible lab. In plans to have a visible lab both space and acoustics of the facility should be taken into consideration. One visitor study found that visitors were not understanding the active research being done in some of the visible labs and believed the staff are actors.

This issue indicates a research study should be done on visitors' perspectives of visible labs. These issues bring to light that it takes more than the staff within the visible lab to create the interface with the public about the active research in the lab. Other visible labs have the assistance of educational and volunteer coordinators in creating content in order for the visitor to understand the active research. Yet others only have the staff within the visible lab to create the public interface. It takes collaboration between different departments within an institution to create a functional visible lab, and to create meaningful experiences not only for visitors but for the staff in the lab.

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Appendix A: List of Visible Labs

Type of Lab: Research		
	Museum	Visible Lab Name
1	California Science Academy	Project Lab
2	Denver Museum of Nature and Science	Genetics of Taste Lab
3	Field Museum	Daniel F. and Ada L. Rice DNA Discovery Center
4	Florida Museum of Natural History	Genomics Lab
5	Florida Museum of Natural History	Microscopy Lab
6	Florida Museum of Natural History	SEM Lab
7	Florida Museum of Natural History	Special Projects Lab
8	North Carolina Museum of Natural Science	Astronomy & Astrophysics Research Lab
9	North Carolina Museum of Natural Science	Genomics & Microbiology Research Lab
10	North Carolina Museum of Natural Science	Biodiversity Lab
11	North Carolina Museum of Natural Science	Evolutionary Biology & Behavior Lab
12	Virginia Museum of Natural History	Archaeology Lab
13		Scanning Electron Microscopy
14	Oregon Museum of Science and Industry	Life Lab
Type of Lab: Fossil		
	Museum	Visible Lab Name
15	Carnegie Museum of Natural History	Paleo Lab
16	Children's Museum of Indianapolis	Paleo Prep Lab
17	Denver Museum of Nature and Science	The Schlessman Family Earth Science Laboratory
18	Field Museum	McDonald's Fossil Preparation Laboratory
19	North Carolina Museum of Natural Science	Paleontology Research Laboratory
20	National Museum of Natural History	FossiLab

21	National History Museum of Los Angeles County	Dino Lab
22	Natural History Museum of Utah	S.J. and Jessie E. Quinners Foundation Paleontology Lab
23	Oregon Museum of Science and Industry	Paleo Lab
24	Page Museum	Fishbowl Lab
25	Paleontological Research Intuition's Museum of the Earth	Prep Lab
26	Perot Museum of Nature and Science	Paleo Lab
27	Rocky Mountain Dinosaur Resource Center	Paleo Lab
28	Tate Geology Museum	Prep Lab
29	Texas Natural Science Center	Paleo Lab
30	The Academy of Natural Sciences of Drexel University	Fossil Prep Lab
31	Virginia Museum of Natural History	Elster Foundation Vertebrate Paleontology Lab
Type of Lab: Conservation		
	Museum	Visible Lab Name
32	Clifford Still Museum	Conservation Studio
33	Commemorative Air Force Airpower Museum	Conservation Lab
34	Field Museum	Regenstein Pacific Conservation Laboratory
35	Grave Creek Mound Archaeological Complex	Conservation Lab at the West Virginia Archaeological Center
36	Hiller Aviation Museum	Restoration Shop
37	International Quilt Study Center and Museum	Conservation Work Room
38	Kimbell Art Museum	Conservation Studio
39	Lake Champlain Maritime Museum	Conservation Laboratory
40	Musical Instrument Museum	Conservation Lab
41	Penn Museum	Artifact Lab
42	Science Museum of Minnesota	Visible Lab
43	Smithsonian American Art Museum	Lunder Conservation Museum
44	Walter Art Museum	Conservation Museum

Appendix B: Interview Guide

Interview Guide

Researcher: Justine Lopez

Email: jlopez23@uw.edu

Thesis Advisor: Kris Morrissey, Museology Graduate Program, University of Washington

Email: Morriss8@uw.edu

Consent Script

I am asking you to participate in a research study that is part of my Master's Thesis work at the University of Washington. The purpose of this research is to describe the processes and practices of visible labs. I am audio recording this interview. If I choose to quote you, I will not use your name but may identify your title and institutions. I will give you the opportunity to review any direct quotations before publication. Your participation is voluntary. Refusal to participate will involve no penalty or loss of benefits, and you may discontinue participation at any time. If you have any questions now or in the future, you may contact me or my adviser using the contact information I have provided above and will leave with you. Do you have any questions? Do you agree to participate in this interview?

Yes No Other

Name of Participant

Date

Location

Interview Questions

My few first few question are designed to discuss the function and management of the visible lab in the [insert name of the museum]

What do you see as the role of the visible lab in the [insert name of museum]?

What does the [insert name of the museum] see or say is the role of the visible lab?

What does the visible lab offer that other types of programs or exhibit do not?

How would you describe the selection and training of the staff?

Is the lab always staffed during its open hours? If it is not, what is done?

Next, I would like ask about management of the collection in the visible lab as it pertains to its function

What criteria is used to decide what collections work takes place in the visible lab?

Are there any formal policies and procedures of how objects are handled in the visible lab?

Interview Guide

Researcher: Justine Lopez

Email: jlopez23@uw.edu

Thesis Advisor: Kris Morrissey, Museology Graduate Program, University of Washington

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Finally, as visible labs are in viewed by the public I would like to ask about what the public see in the lab.

Are there certain aspects of the museums ongoing research or collection management that is not done in the visible lab? If so, why not?

What type of information, if any, is provided to visitors about what they see in the lab?

Anything else you would like to say?

Thank you for participating in this interview.

Appendix C: Coding Rule Break

Q1: What does the management of visible labs look like?	<i>Subcategories</i>	North Carolina Museum of Natural Sciences	Denver Museum of Nature and Science
Role- Role of the lab with in the museum		“Well we have many roles the first primary role is research and this primarily a research space we have a really strong research program.” “It’s really to demystify the mystery of science I think the initial goal was and what the continuing goal is.”	“The lab is dispel about what paleontology is by seeing staff and volunteers work on fossils and lets them know that active research is going on in this museum” “Visitors get one on one conversation with an actual person and not just a video or text.”
Staff- Selection of staff; including permeant staff, volunteers, and interns	<i>Permanent Staff</i>	“So all the lab heads here have joint appointments here with universities. That means half of our salaries is paid by the university and half is paid by the museum.”	“So not just they are a good scientist or a good preparator but they can also work 120 varied volunteers was a really important piece of the hiring.”
	<i>Volunteers and Interns</i>	“Always looking for 2 fundamental things proficiency and a love for science and a love for reaching out to the public”	“They get an interview with our volunteer services staff and then that 20 hour practicum time the preparator work with the potential volunteer that is sort of considered and interview as well.” “Anyone can volunteer the age limit is 18 and up.”
Operational Structure - The staff in charge of the lab; the assistant lab head; then interns and volunteers		“the one full time employee reports directly to me”	“Our curator for Expedition Health and is the geneticist who essentially kind of the 1st entity of starting the Genetics of Taste Lab.”

Training - Practicums, any training involving staff working in the visible labs	<i>Research</i>	“You know people then have to get trained in how to do research so we train them in that aspect just like we would in any academic institution you know use hypothesis driven research you the ways we go about the scientific process.”	“They have to study the script they have familiarize themselves with how to say salimoismaxia, which is the bacteria we're discussing right now and they go through this process and once they have kind of test out between the lab manager and myself they are ready to enroll [participants]”
	<i>Public Communication</i>	“They give talks in the Daily Plant or try to get them involved in that side.”	“So we make to pair together really scientifically accurate experience but also a really engaging experience for our guests and all of the citizens scientists”
	<i>Collection Handling</i>	“So when we bring in volunteers we do a whole training with them on how to handle and care for the specimens until we to put in collections.”	“There is a 20 hour practicum that they must pass. Our staff people are preparator, watch them, give them smaller less intricate less complicated fossils to work on and then they guide them through the process.”
Open Hours - When the visible is operational during the institutions open hours		“Sometime on the weekend me or someone else in lab have to go into the lab and do some experiments but there are a lot of times on the weekends when there are higher visitations and there is nobody working in my lab”	“The lab is always staffed during open hours with the exception of volunteers, [they] do take a mid-day break or a mid-afternoon break.” “Lab will almost always have a citizen scientist and/or lab manager.”
Q2: What work is done in the visible lab?			
Research - Analyzing data; sorting DNA samples; Use of laptops		“My work doesn't really use collections because I do a lot DNA based work” “I won't do work near the window unless it pertains to safety and maybe needing to be in a safe space”	“So the way it works is there is a designated team of staff and volunteers that work in the Genetics of Taste Lab and conduct the research that we are doing.”

Collections - Working with a physical object that will eventually be in the museum's collection		“So we bring them to the lab we cut those jackets open we prepare them out of the rock in this space and then we put them in boxes as well and put numbers on them and basically send them to collections”	“All the fossil preparation that takes place in this building goes through that lab upstairs. Even the things in the oversized lab are worked down to a manageable size so that they can go upstairs to the visible lab.”
Policies and Procedures- guidelines and delegations		“Each project has its own proto calls for sure”	“We follow the best practices of AMMP Association of Materials and Methods in Paleontology.”
Q3: How does the visible lab communicate with the public?			
Visual Interface- Use of display tables; iPads; posters; labels	<i>Use of Technology</i>	“We have some iPads that we run. We can call up different slide shows depending on what's going on in front of the windows. We have 1 screen that faces the windows that has some stuff going on.”	“Space just outside the genetics of taste lab where people can come and watch a 2 minute video about what the study is currently about.”
	<i>Interpretive Research- anything not with technology</i>	“A couple of things that we've done we put signage or important specimens. When we name a new species for example we'll put is up on the glass and put some signage there. So we've done that we're exhibiting specimens in the glass and then what I tried to is because I can't create signage or content on the exhibit floor I've created it digitally so I have established a web site essentially for the lab.	“There is a little bit of signage out front that talks about making jacket and kind of what we're doing.”

Public Interaction- Staff working with in visible labs speaking with visitors in or within the institution.		“So even with the talks we give in the Daily Planet we talk about whatever we want.” “Speak to the public through the microphone system.”	“With people talking at the window and answering questions its. You know sometimes its little kids going what's that? What's that? We'll answer the question and tell them what it is. There is not a set script that we give to the volunteers or people at the window to talk and "oh here is this stuff" it's a free flow of whatever questions the public asks.”
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Appendix D: Observation Guide**Observation Guide**

Researcher: Justine Lopez

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Thesis Advisor: Kris Morrissey, Museology Graduate Program, University of Washington

Email: Morriss8@uw.edu

Directions:

The observations will be done for 2 hours with 15 minutes increments. The observer will scan the visible lab and note activities taking place in the visible labs. Above the observation table the observer will write the name of the institution, name of the visible lab, date of observation and their own name. In the time column the observer will write down the time observation began and the end time. After the description has been written down the observer will check mark one of the four categories described below. The observations sheet is on the next page.

Collection Use (Coll.):

Activities relating to the handling of an object from the museum's collection to be preserved or is being researched in the visible lab

Public Engagement (Pub.):

Activities relating to the interaction with the public such as talking to or acknowledgment of the public in the visible lab.

Museum Work (Muse.):

Activities relating to answering the phone, curator giving instructions, or anything related to the everyday function of the lab that does not involve collection use or public engagement.

Other:

Activities that was not thought about by the researcher that involves the processes and practice of visible labs.

Email: Morriss8@uw.edu

Name of Visible Lab

Observer

[illegible]

Notes: