



**National Leadership Grants for Museums  
Sample Application MG-30-13-0066-13  
Project Category: Collections Stewardship**

**American Museum of Natural History**

Amount awarded by IMLS:	\$475,463
Amount of cost share:	\$476,397

Attached are the following components excerpted from the original application.

- Abstract
- Narrative
- Schedule of Completion

**Re-coloring Faded Taxidermy:  
Research into the Properties and Applicability of Dye Materials for Conservation Treatment**

**ABSTRACT:**

The American Museum of Natural History (AMNH), in partnership with Yale University's Center for Conservation and Preservation (CCAP) and Peabody Museum, and in collaboration with the Department of Art Conservation at Buffalo State College, requests funding of \$475,462 over three years for a research project to develop best practices for recoloring taxidermy mounts, primarily displayed in museum habitat dioramas. Deterioration and fading of taxidermy is a high-priority problem in museum displays and other types of collections world-wide, with few acceptable ameliorative treatment options, as indicated by a survey AMNH recently circulated among collections care professionals. By advancing the science of taxidermy conservation, this project addresses a conservation challenge of great national and international importance.

The project will build on a ground-breaking pilot study AMNH undertook in its iconic Hall of North American Mammals (NAM) to identify and utilize 'conservation-approved' materials to restore faded fur mounts. As a result of that pilot, specimens that were dramatically faded from exposure to light were successfully restored to their original color, patterns, and sheen with Orasol, a metal complex dye. The proposed research project will test additional dye sources identified as potentially useful and develop treatment protocols and decision-making standards for the use of well-understood, high-quality, affordable materials in the conservation of fur-based specimens and artifacts. The three main avenues of inquiry will be a) to characterize the light-fastness qualities of tested dyes, b) to better understand the deeper interactions between the dyes and the fur substrates in terms of enhancing or protecting from further degradation, and c) to examine the degree of penetration and transfer of the dyes into and from the fibers. A training workshop hosted jointly with the Society for the Preservation of Natural History Collections (SPNHC) at the end of the project period will directly benefit collections care professionals charged with the repair of damaged habitat dioramas, conservators responsible for the treatment of fur-based specimens and artifacts, and contemporary artists incorporating whole or parts of specimens in their art. Furthermore, access to the innovative equipment utilized in this project will benefit the broader New York conservation community.

The project will be directed by Lisa Elkin, AMNH Chief Registrar and Director of Conservation. Judith Levinson, AMNH Director of Conservation, and Paul Whitmore, Director of the Art Conservation Research Center, Center for Conservation and Preservation (CCAP), Yale University, will serve as project co-directors. The project team of seven AMNH and CCAP conservators, conservation scientists and exhibit preparators will be supported by an external advisory committee of widely recognized experts in the fields. IMLS funds will support a full-time project conservator to perform appropriate analytical procedures at both AMNH and CCAP conservation labs, the purchase of equipment and supplies critical to the execution of the work, and travel of external advisors and project team members to regular meetings and conferences.

Project success will be measured through the identification of recoloring materials and development of treatment techniques that can be broadly implemented for use in collections conservation. Project results and best-practice procedures for recoloring faded furs and other recommended treatments for taxidermy will be broadly disseminated, including through the workshop in association with SPNHC, a project blog and website, publications, and conference presentations. The project will greatly advance efforts to preserve the extraordinary educational value of historical taxidermy collections across the nation and around the world.

## INTRODUCTION

The American Museum of Natural History (AMNH), partnering with Yale University's Center for Conservation and Preservation (CCAP) and the Yale Peabody Museum, and in collaboration with the Department of Art Conservation at Buffalo State College, seeks a research grant of \$475,462 over three years to develop best practices for recoloring faded mammal taxidermy mounts displayed primarily in habitat dioramas. The discoloration and fading of taxidermy due to exposure to light and other environmental extremes is widely viewed as a high-priority problem when displaying natural history collections, and successful techniques for its treatment are not yet available. This research gap puts at risk heritage collections of great educational value, especially as many historical specimens represent species that are endangered, if not extinct. Therefore, the development of recoloring methods that do not alter the physical characteristics of specimens and that meet ethical standards of reversibility are of great importance to the conservation field and national and international efforts to preserve historical taxidermy collections. Such research will also foster cross-disciplinary collaborations among conservation specialists with varying forms of expertise, helping to bridge the institutional gap between natural history, art, and history museums and collections.

This innovative research will build upon promising results from a pilot study led by AMNH into the use of metal complex dyes, such as those used in printer inks, to recolor mammalian hair and fur. As a result of that exploratory analysis (see *Appendix 1 AMNH Report: Investigation into Recoloring Materials for Mammal Taxidermy*), specimens that were dramatically faded from exposure to light were restored to more closely replicate their original color, patterns, and sheen (see *Appendix 2 Examples of Damaged and Faded Taxidermy in AMNH Hall of North American Mammals, Before and After Treatment.*) The findings from the study, which AMNH presented at annual meetings of the Society for the Preservation of Natural History Collections (SPNHC) and the American Institute for Conservation (AIC) and published in the International Committee of Museum, Natural History Collections Working Group Newsletter were received with immense interest by practitioners and researchers (Nunan et al, 2012. Sybalsky (1&2) et al, 2012. Also see *Appendix 3 Newsletter and Posters*). Together with results from a national survey among conservation practitioners (see below and *Appendix 4 Survey Findings*), this provides strong evidence of the urgent need for comprehensive research to identify additional dyes and protocols appropriate for recoloring faded fur in the museum context.

For the proposed investigation, AMNH—a leader in applied research on conservation methods, will partner with the CCAP, a world center for innovative interdisciplinary research on the materials and preservation techniques of cultural artifacts, to develop a robust research design for assessing the use of additional dyes and to lead the evaluation of results (see *Appendices 5 CCAP—Background and 10a/b Letters of Support Strobel/CCAP and Briggs/ Yale Peabody Museum*). In addition, the Department of Art Conservation at Buffalo State College will contribute its equipment and expertise in the conservation science of fine art and material culture (see *Appendix 10c Letter of Support Rogge*). An advisory committee of experts in the field will support the project team throughout the course of the project (see Project Work Plan).

The project will culminate in a workshop hosted jointly with SPNHC to train conservation professionals in the use of well-understood, high-quality, affordable materials for the conservation of taxidermy; introduce standards for decision-making about treatment procedures; and present a project website and other resources to support the care and treatment of natural history collections. In addition, the project will provide art museums and conservation research and teachings institutions in the New York metropolitan region with access to urgently needed equipment for the conservation treatment of material culture collections, including training opportunities for their students in the use of this equipment.

The project will significantly advance the science of taxidermy conservation and directly benefit collections care professionals charged with the repair of damaged habitat dioramas, conservators responsible for the treatment of fur-based specimens and artifacts, and contemporary artists incorporating whole or parts of specimens in their art.

## PROJECT JUSTIFICATION

**Background:** For decades, the repair of historical taxidermy mounts has been a challenge for conservators due to a lack of research supporting the use of specific materials or techniques. One particularly vexing problem is the need to recolor the fur of faded mammal specimens, since in some contexts, the appearance of a discolored specimen may be considered scientifically inaccurate and not representative of the species. Recoloring materials of lower quality have been frequently borrowed from the field of traditional taxidermy and applied to museum specimens with less than satisfying results. In other cases, damaged heritage mounts created by early practitioners of the art have been discarded entirely due to a lack of proven recoloring methods. Without concerted evidence-based conservation attention, these collections are at risk of losing their inestimable educational and cultural value.

The proposed research will continue and expand upon a preliminary AMNH investigation into recoloring methods conducted in collaboration with the Department of Art Conservation at Buffalo State College and the Conservation Research Center at Carnegie Mellon University (January 2011–June 2012) in connection with the renovation of the AMNH Hall of North American Mammals (NAM) habitat dioramas. Created over 70 years ago, these historic dioramas were conceived as a means to inspire wonder and appreciation for the natural world, and to encourage visitor’s appreciation of the importance of environmental and wildlife conservation. Together with the many new interpretive techniques used by museums, dioramas provide visitors with an experience of habitats they have never seen, encouraging the type of visitor engagement that is fundamental to informal learning.

Internationally, researchers have consistently documented the effectiveness of dioramas in teaching and learning many aspects of biology (e.g., see Tunnicliffe and Scheerso 2009, Reiss & Tunnicliffe 2011). Some represent local environments that encourage place-based learning about biodiversity, ecology, and the environment and provide an important complement to outdoor activities. Others represent environments that have significantly changed since their construction providing a unique opportunity to discuss topics such as environmental degradation, invasive species, and change over time, all important parts of K–12 curricula. Artists and students make frequent use of these dioramas to study animals up close and practice their drawing skills and as reference for their own works. In depicting a specific location at a specific time, many of the dioramas now represent locations that no longer exist in their pristine condition or animals that are now endangered or extinct. As these sites and animals face increasing risk, the dioramas become more and more valuable as a means of education and advocating for wildlife conservation.

While the AMNH dioramas represent some of the most well-known examples of their kind executed by the artists and scientists who perfected the technique—Carl Akeley, Frank M. Chapman, and James Perry Wilson—other examples of exceptional dioramas exist both nationally and internationally, including some created by these same artists. For example, Carl Akeley took his talents to the Milwaukee Public Museum, Chicago’s Field Museum, and the National Museum of Natural History. The Yale Peabody Museum contains dioramas of North American mammals and of Southern New England, including the famous diorama of the Connecticut shoreline created by J. Perry Wilson. In the US alone, there are dozens of major institutions with historic habitat dioramas (see *Appendix 6*) that will benefit from evidence-based methods of taxidermy recoloring. This research also has the potential to transform how visual artists, especially those working with taxidermy, create and conserve their work (see *Appendix 10s: Letter of Support Coyne*).

**Recoloring—The Conservation Challenge:** A recent AMNH survey, circulated among collections care professionals nationwide, provides a compelling argument for the need for a solution to degraded and faded taxidermy in exhibits such as habitat dioramas. Of the nearly 60 returned questionnaires, approximately 65 percent of respondents indicated that fading and deterioration of fur were among their most pressing challenges in presenting and maintaining this class of material. Of this subgroup, nearly half felt that they do not have sufficient methods in place for addressing these preservation challenges and rely instead on modifications to lighting (see *Appendix 4*).

AMNH's pilot study in the context of the NAM renovation project confirms the urgency to address the treatment of faded fur (see *Appendix 2*). In the AMNH dioramas, exposure to environmental extremes while on display—high light levels, little or no environmental control, and some open exhibits—have caused damages to the taxidermy that can be quite severe: large/wide openings at seams, extensive dust, dirt, and soot accumulations, degradation of fill materials and coatings used in detailing facial features, and extreme discoloration and fading due to lighting conditions. Lighting within a habitat diorama is necessary in setting the scene; particularly in its ability to convey a time of day through the intensity (or lack) of sunlight, allowing the dioramas to depict high noon in the western plains or the lower light of a dense forest. So, ‘modifying’ the lighting could have a negative impact on the overall success of the diorama. In the case of the NAM Hall, exposure to intense light in combination with elevated temperatures for nearly 70 years has caused the zoological specimens to fade to such an extent that many no longer reflect the natural appearance of the living animals, compromising the overall impact and effect of the dioramas.

While the AMNH NAM renovation project focused on developing and implementing solutions to all of these challenges, the research gap on the treatment of faded fur proved to be a particular challenge (*Nunan et al. 2012; Sybalsky, et al. 2012*). AMNH conservators needed to identify an acceptable recoloring material as an alternative to those used in traditional taxidermy. Investigation of the conservation literature on contemporary methods revealed few references for recoloring faded taxidermy mounts and little to no research on long-term stability or impact, with the consequence that exhibition staff and/or taxidermists have been recoloring faded fur using methods and materials that are unacceptable for use by the broader museum field. The following limited options for recoloring faded mounts were either mentioned in the literature or learned through personal communications: 1) Oil paints thinned with trichloroethane spray applied, used historically at AMNH and other institutions (*personal correspondence, Stephen Quinn, AMNH*); 2) Acrylic paints, commonly used by contemporary taxidermists, spray applied (*personal correspondence, Wildlife Preservations*); 3) Commercial hair dye—Clairol—was reported as a successful recoloring technique (*personal correspondence, the Canadian Museum of Nature*) but engendered concern about adverse effects of aqueous treatments on tanned hides; and 4) Procion® fiber-reactive dyes have been reported engendering some concern about effects of acidic or basic dye residues and their long-term impact on the hair/feather material (*Palumbo, 2012*).

**AMNH Research To Date:** In preparation for the NAM restoration project, discussions among project conservators, master taxidermist, diorama historian/artist, and Mammalogy curators highlighted several important requirements for potential recoloring materials: 1) **Minimal Physical Alteration:** The colorant should not alter the physical characteristics of the hair; 2) **Working Properties:** The colorant must allow for constant grooming and removal throughout the process, should not require rinsing and should be carried in a non-water solvent; 3) **Health and Safety:** High toxicity colorant or solvent carriers should be avoided; 4) **Re-treatability:** Exposure to the light levels needed in replicating original habitats will result in fading therefore the colorant must allow for future recoloring as well as cleaning and re-grooming; and 5) **Lightfastness:** The colorant should still fare well upon exposure to ongoing and high light levels.

AMNH Conservators worked closely with the project taxidermist (George Dante) and partnered with outside conservation scientists (Corina Rogge, Buffalo State College and Paul Whitmore, Carnegie Mellon University) to assess a selection of materials against the necessary criteria. It was found that for most of the historic and contemporary options available, the long-term aging properties and/or potential impacts on the specimen are either unacceptable or poorly understood (*see Appendix 1*).

Among the colorants assessed, only Orasol® dyes maintained the qualities of the hair, provided the necessary working properties, and allowed for follow-up re-treatment making this class of colorants the subject of further investigation. Orasol® dyes (1:2 metal complex dyes) are generally approved and used by the conservation community in a variety of capacities (*Inside Installations, 2006; Koob, 2006; Kronthal, 2001; Webb, 2000*). They are assigned moderate to high lightfastness ratings, can be delivered in solvent, and require no rinsing.

Though the manufacturer (BASF) provides lightfastness information for Orasol® dyes, those ratings are based on tests conducted using a binding medium (as in printing ink) on a non-keratin substrate. Additionally, various solvents can be used as the carrier for Orasol® dyes with associated variation in resulting color. It was therefore necessary to accomplish additional lightfastness testing of the dyes in the absence of a binder on a representative substrate. Microfade testing was accomplished and complemented by accelerated light aging (*ASTM D4303 Standard for Lightfastness of Artists Materials Colorants*).

Upon testing, the Orasol® dyes showed great promise for restoring the naturalistic appearance of deteriorated taxidermy specimens: They did not alter the physical properties of the hair, they enhanced color, they provided the necessary working properties for the taxidermist, their lightfastness was confirmed acceptable, they are safe to use with ethanol as the carrier, and the specimens can be re-treated in the future. The treatment protocol that was developed provided an acceptable visual solution within the limitations of the project while meeting most of the key conservation criteria mentioned above.

The dye research in the context of this pilot study has generated numerous new questions and is the starting point for this research proposal to assess 1) the lightfastness of colorants; 2) the influence of colorants on the rate of degradation of the fiber substrate; and 3) the penetration depth and/or transfer behavior of colorants.

### **Intended Project Results:**

The overarching goal of this project is to develop best practices concerning the conservation (specifically recoloring) of aged and faded fur of mammal specimens. The proposed research will serve to broaden the acceptable toolkit of possible materials and application techniques, as well as the methods of analysis used in understanding the interaction between the colorant and its substrate. The NAM pilot study identified one accepted conservation grade material, the 1:2 metal complex Orasol® dye, as a reversible technique to recolor faded furs. Far more research is required, however, to understand the reciprocal interactions between this dye and the degraded fur substrate than was possible during the initial investigation. The proposed project will identify a group of dyes to investigate further. Critical input will be provided by conservators, conservation scientists, exhibit artist/preparators, and taxidermists.

A wider range of dyes identified as potentially appropriate for use on protein fibers will be subjected to parallel testing, along with the Orasol® dyes. Some of these dye classes have been utilized for recoloring in other museums, but cannot be recommended for use without the required testing. The testing will evaluate three broad categories: lightfastness of the dyes, degradation of the fiber substrate, and dye penetration and transfer. Numerous analytical techniques using standard testing protocols will be performed and newer techniques will be investigated, as detailed in the Project Work Plan below (also see *Appendix 7 Research Plan*).

### **Project Benefits:**

This project is of great value to the national and international museum community, as it provides the evidence-based methods urgently needed for the repair of faded taxidermy mounts that are no longer representative of their species. Many of these mounts at museums around the world are of artistic value and/or represent endangered species, making simple replacement of the specimens impossible. Museums visitors will benefit from the restored splendor and educational value of restored taxidermy in habitat dioramas.

Conservators charged with the care and repair of material art collections also stand to benefit greatly from research into damages to organic materials caused by exposure to light and new options for treatment to secure long-term stability. Even the model developed for investigating materials for use on specimen-based collections will advance the newly emerging field of natural science collections conservation. Moreover, art museums and conservation research and teachings institutions in the New York metropolitan region will be able to access the urgently needed equipment AMNH will be able to make available through this grant. In particular, academic and museum scientists have only limited access to environmental aging chambers, which are a widely recognized tool for material testing. Scientists and conservation students at these and other institutions will be able to use the equipment to deepen their understanding of light damage and its potential remedies (see

*Appendices 10l, k, and m Letters of Support, Roemich, Leona, and McGlinchey*). Other stakeholders include contemporary artists who lament the loss of the accurate representation of the natural world through taxidermy and describe the need for its vivid depiction for use in creating their artworks (see *Appendices 10r, s, and t Letter of Support, Milgrom, Coyne, and Dion/Rockman*).

## PROJECT WORK PLAN

**Project Design:** The proposed project will pursue research questions related to potential colorants for discolored taxidermy (relative lightfastness) beyond those tested in the initial inquiry related to the NAM renovation project, such as whether colorants accelerate or retard degradation of the fiber substrate, as well as the assessment of colorants' penetration depth and transfer behavior. Most of the laboratory experiments will require only data collection and interpretation according to standard test protocols or using methods that have been previously established in the completed pilot investigation. The exploration of other methods will require the determination of suitable analytical methods. The project plan proposes to undertake these two activities—straightforward data collection and the more exploratory research into supplemental methods—concurrently, with the final experimental phase focused on using those analytical methods identified as effective.

In addition to expanding knowledge of the Orasol® dye family, the proposed research will provide data concerning additional dye classes, including commercial hair colorants and fiber-reactive dyes. The project will expand research beyond unbleached wool flannel and bison fur substrates to include other hair types representative of mammalian taxidermy. Previous experience at the AMNH has shown that coarse, wiry fibers take dye differently than fine, smooth, or hollow, brittle hairs. Finally, in order to represent the potential impact of different museum lighting solutions on lightfastness and substrate deterioration, the proposed research will be performed in the context of UV-filtered and UV-rich lighting environments, thus mimicking exhibit conditions utilizing UV-rich lamps versus those that contain little or filter out UV.

Initially, each possible colorant will be assessed according to working properties that directly inform its suitability for recoloring faded taxidermy mounts. Colorants that perform poorly in this assessment, or in subsequent testing and analysis, may be excluded from further investigation. Criteria are informed by four of the five requirements for recoloring materials used in the NAM renovation outlined above, and will include:

- **Minimal Physical Alteration.** Does it cause the hairs to mat or adhere in a way that would impede future cleaning or retreatment? Does it alter the fur's texture or sheen in undesirable ways? Does the available color range enable one to achieve naturalistic results?
- **Working Properties/Re-treatability.** Can it be applied by airbrush? Is rinsing required, and if so, can it be achieved safely? What solvent carriers can be used and are they safe for the conservator and the mount? To what extent can the colorant be removed?
- **Health and Safety.** In what solvent is the colorant carried, and is its toxicity limiting?

Once a final group of specific dyes has been identified as 'workable,' each will be applied to the variety of fur substrates and tested for the following:

**1) Lightfastness (susceptibility to fading upon exposure to light):** Because of the high light levels characteristic of some habitat dioramas, the infrequency and cost of restoration efforts, and the imperative to intervene upon objects as minimally as possible any recoloring material must display excellent lightfastness. The proposed project will provide funds to support the purchase of an accelerated aging chamber and spectrophotometer to be used at the AMNH in the quantitative assessment of color change (see *Budget Justification and Appendices 10k and l Letters of Support, Leona and Roemich*). Testing will be conducted at AMNH according to two methods:

- ASTM D4303–10 Standard Test Methods for Lightfastness of Colorants Used in Artists' Materials (*ASTM 2010*) and a customized method informed by the ASTM standard but adapted to better model a UV-filtered lighting environment comparable to the AMNH habitat dioramas. The ASTM standard has been used

successfully to assign lightfastness ratings to Orasol® dyes in research to-date at the AMNH, providing a basis of comparison for future data (Sybalsky et al (1 & 2), 2012) (see *Appendix 1*).

- Testing of artificially aged samples will be complemented by measurement of samples aged in real time using the ISO British Blue Wool Standard. ISO dyes of known lightfastness and test colorants will be exposed in actual diorama light conditions and monitored over an extended period of time using spectrophotometry and visual evaluation.

**2) Substrate Degradation:** Processes increasing degradation not only cause spontaneous damages, but also limit the potential success of future maintenance and treatments. For this reason, colorants that play a role in accelerating substrate degradation may be inappropriate for many applications in taxidermy restoration. The proposed research will examine this question by means of:

- Tensile testing according to ASTM D3822–07, Standard Test Method for Tensile Properties of Single Textile Fibers; and ASTM D76/D76M–11, Standard Specification for Tensile Testing Machines for Textiles, or similar methods. Tensile testing equipment and support is available to the applicant through the Buffalo State College Art Conservation Department (see *Appendix 10c Letter of Support Rogge*).
- Scanning Electron Microscopy (SEM). In order to better visualize the hair surface features and break patterns correlating with the mechanical properties observed, samples will be examined using SEM. This equipment and support is available at the AMNH, where previous work has demonstrated its effectiveness in imaging hairs at the scale necessary to resolve such features (see *Appendix 1*).
- These techniques will be supplemented by additional analytical methods identified during the exploratory research into supplemental methods, to be coordinated through partners and/or fee-for-service providers (See *Schedule of Completion* and *Appendix 7 Research Plan, Further Methods Phase 1*).

**3) Dye-Substrate Interactions, Penetration, and Fixation:** It is useful to understand dye fixation and transfer behavior and to assess the potential for its control when considering the needs of differing display environments for taxidermy. One may require the ability to easily remove dyes for the purpose of reversing treatment or manipulating color. Alternatively, it may be important that dye be well fixed if specimens are on open display and may be handled or cleaned frequently. The proposed research will examine:

- Surface tension, viscosity, surface wettability, and contact angle: The proposed budget supports the purchase of an optical tensiometer used to acquire measurements related to the physical interaction of dye and fiber substrate on single fibers (see *Budget Justification*). These measurements directly represent the material properties controlling application outcomes. This is equipment that is conspicuously absent in the New York metropolitan region and, as with the environmental aging equipment, will be made available to the local art museums and conservation research and teachings institutions through this grant.
- The proposed budget supports the purchase of a crockmeter to assess colorant/substrate systems for resistance to removal by wet or dry rubbing (see *Budget Justification*). Testing will be conducted according the AATCC 8–Crockmeter Method and/or AATCC 116–Rotary Vertical Crockmeter Method, and will inform a ranking of dye-solvent solutions according to degree of transfer from various substrates.
- As above, these techniques will be supplemented by additional analytical methods identified during the exploratory research into supplemental methods phase.

The project director and conservator will monitor the timeline (see *Schedule of Completion*). Any changes to the timeline will require approval of the project team and the external advisory committee (see below).

**Project Resources: Personnel, Time, Budget:** AMNH’s partner for this project is Yale University’s CCAP and the Peabody Museum, with the Department of Art Conservation at Buffalo State College as a collaborator on specific aspects of the project. The direction of this project will be shared between AMNH and CCAP, with AMNH Chief Registrar and Director of Conservation Lisa Elkin serving as Project Director.

The AMNH is a large teaching and research organization with the infrastructure required to ensure effective, efficient, and fiscally responsible management of large research programs funded by federal sources. The

Project Director, Lisa Elkin, has a positive track record of overseeing IMLS-funded projects with successful project results and impact on the conservation community (Elkin, 2013; Elkin, 2011). For the proposed project, Lisa Elkin will provide overall project supervision, Paul Whitmore will provide oversight of the research program, and Judith Levinson will provide oversight of the aging and lightfastness work at AMNH.

Yale's Center for Conservation and Preservation (CCAP) was established in 2012; beginning in March 2013 it will house the Art Conservation and Research Center, previously at Carnegie Mellon University (see *Appendix 5*). The Research Center will continue to be directed by Project co-Director Paul Whitmore, one of the AMNH longstanding collaborators, including on the NAM renovation project. CCAP, through Dr. Whitmore will be in charge of the project's research design and evaluation of results. To foster close working relationships, CCAP will contribute support (40 percent of time over the three year period) for a full-time Project Conservator who will work at both AMNH and CCAP research laboratories under the guidance of Lisa Elkin and Paul Whitmore. CCAP will also provide financial support for the development of a workshop in association with the Society for the Preservation of Natural History Collections (SPNHC) to disseminate results (for details, see section Project Results). In addition, the Yale Peabody Museum will provide expertise on habitat dioramas.

The Department of Art Conservation at Buffalo State College, through its professor of Conservation Science, Dr. Corina Rogge, will continue its successful collaboration with the AMNH. Dr. Rogge has provided continued input concerning the direction of the recoloring investigations, specifically the accelerated aging work and analysis. As member of the External Advisory Committee, Dr. Rogge will play a critical role of oversight as well as provide technical support concerning the tensile testing aspect of the research program.

**A highly qualified team of conservators and conservation scientists at AMNH and Yale University** will manage and perform grant activities:

#### **Project Conservator**

- **Julia Sybalsky** will serve as the Project Conservator, AMNH/Yale (100 percent time commitment) and will report directly to the Project Director, Lisa Elkin. She will carry out analysis at AMNH, Yale and Buffalo State College and will document and present all findings. She will work with project participants in developing the website, the workshop, and content for the blog. Julia has worked at AMNH for nearly three years, most recently on the renovation of the NAM dioramas. She is proficient in the issues taxidermy conservation and is committed to this project (See *Appendix 10i Letter of Commitment Sybalsky*).

#### **AMNH Team**

- **Lisa Elkin**, Chief Registrar and Director of Conservation, AMNH (25 percent time commitment) will serve as Project Director. Ms. Elkin will provide general administrative oversight of the project conservator and will ensure proper oversight concerning all administrative activities. She will manage relationships between AMNH, Yale, Buffalo, and the External Advisory Committee, ensuring clear and close lines of communication and well defined roles. With the project conservator, she will ensure timelines are effective and planning activities are relevant and achievable. She will provide specific oversight for all outreach activities including website/workshop development and blog maintenance.
- **Judith Levinson**, Director of Conservation, AMNH (20 percent time commitment) will serve as project co-director. Ms. Levinson worked closely on all aspects of the NAM project and oversaw the initial lightfastness work, working closely with Dr. Whitmore and Dr. Rogge. She will provide on-site guidance concerning the preparation of samples and the aging and lightfastness analysis at AMNH.
- **Elizabeth Nunan**, Associate Conservator, AMNH, will maintain the project blog and will assist the project conservator with sample preparation and analysis at AMNH. Ms. Nunan was involved in most aspects of the AMNH NAM project (planning, documentation, analysis, and treatment). She was also responsible for maintaining the project blog through the duration of the project and beyond.

#### **Yale team**

- **Paul Whitmore**, Ph.D., Director of the Art Conservation Research Center, Center for Conservation and Preservation, Yale University (beginning March 1, 2013). Dr. Whitmore will serve as project co-director

and will provide oversight of the overall research program and its development, provide support concerning analysis and evaluation of results and foster access to expertise across Yale science departments

- **Aniko Bezur**, Director of Scientific Research, Center for Conservation and Preservation, Yale University will provide guidance in the use of analytical equipment and evaluation of results.
- **Michael Anderson**, Museum Preparator, Yale Peabody Museum will stand as the resident expert on habitat dioramas and will provide guidance concerning the visual impact any treatment must have.

During the length of the project, input from various stakeholders will be sought through several means:

**An external advisory committee** comprised of experts in a range of related fields will be convened following funding notification. The committee will review the research questions to ensure issues critical to working/visual properties and long-term stability are covered. The advisory committee will also ensure that research results and status over the course of the project are continually evaluated to guarantee the best direction of the research and to adapt the timelines, as necessary. Three annual meetings are budgeted to be held at Yale and AMNH respectively (see *Schedule of Completion*). These meetings will provide a forum to present details concerning the program and encourage discussion on the quality of the results; whether the methods of analysis need to be adapted, and whether timelines need to be re-thought. In between meetings, the external reviewers will receive regular updates through email, Google Groups and Skype, as appropriate, so that they can monitor the overall direction of the project, review the testing conducted thus far, and provide input concerning aspects of dye application and interpretation. The following members letters of commitment are attached:

- **Corina Rogge**, Ph.D., Assistant Professor, Conservation Science, Department of Art Conservation, Buffalo State College. Dr. Rogge provides a critical role of oversight concerning the research program and analysis of results. Dr. Rogge will be the point person liaising between the project team and the committee and will have the most regular contact with the project team. (see *Appendix 10c Letter of Support Rogge*).
- **Catherine Hawks**, Conservator, National Museum of Natural History. Ms. Hawks is a renowned natural science conservator and will provide guidance concerning the potential long-term impact of the proposed treatments to specimen based collections (see *Appendix 10e Letter of Support Hawks*).
- **George Dante**, Master Taxidermist. Mr. Dante was the taxidermist on staff for the AMNH NAM project. He will provide insight concerning the suitability of the various dyes for treatment and will assist in disseminating results to the world of professional taxidermists as an effort to improve current methods and practices in this professional community (see *Appendix 10d Letter of Support Dante*).
- **Stephen Quinn**, Diorama Historian and Artist. Mr. Quinn is the authority on habitat dioramas (Quinn, 2006) and the project director of the AMNH NAM renovation. He will provide insights into the methods and materials used in constructing historic taxidermy and how the proposed treatments could be influenced as such (see *Appendix 10g Letter of Support Quinn*).
- **Tim White**, Assistant Director for Collections, Peabody Museum of Natural History. With his extensive leadership role within SPNHC, particularly concerning Best Practices, Mr. White will ensure that the results of the project are up to the standards expected of this field and disseminated to the appropriate audiences—conservators, collection managers, taxidermists, etc. (see *Appendix 10h Letter of Support White*).
- **Jane Pickering**, Executive Director, Harvard Museums of Science and Culture. Ms. Pickering will provide the voice for public programming, education and exhibition. She will guarantee dissemination of the results to these communities and will provide guidance in the planning and development of the workshop and website (see *Appendix 10f Letter of Support Pickering*).

**An interactive project blog on the AMNH website**, such as that developed for the previous recoloring project (see *Appendix 8 Sample AMNH NAM Blog*), will provide updates on the progress of the project for the external advisory committee, as well as other interested museum professionals. The blog will be advertised on list-serves with focus on collections conservation and preservation (NHCoLL, ConsDistList, Taxidermy.net) encouraging related contributors to participate and post questions, concerns, or comments.

## PROJECT RESULTS

**Impact on the Conservation Field:** Resolution of the need for evidence-based recoloring techniques will have an impact on all museums with historic habitat dioramas, museums using taxidermy to present biological information, historic houses with taxidermy mounts, and contemporary artists using taxidermy as reference or as an actual element of their art. Letters from stakeholders within the curatorial, conservation, and visual arts fields make evident the broad desire for preservation of historical museum dioramas. Exhibit curators and preparators are greatly concerned with preserving the educational aspects of the dioramas, their ability to convey a love of the natural world through accurate scientific depiction, and the need to protect the environment from ongoing damage. Conservators describe the need for development of best practices in the preservation of natural science materials, not only in museums, but also in historic houses and other types of displays accessible to the public. Artists cite the importance of the museum's dioramas as inspiration, as important educational tools, in their own intellectual inquiry, and in their ability to convey a sense of wonder of the natural world. (See *Appendix 10 Letters of Support*.)

**Dissemination of Results:** The project co-directors have shown their high level commitment to disseminating results from IMLS funded projects through publications in widely distributed professional journals (Elkin et al., 2013, Elkin et al., 2011, Nunan et al., 2012, and Sybalsky et al., 2012). The Yale CCAP supports the mission of the Institute for the Preservation of Cultural Heritage, which is positioned to disseminate research findings quickly and effectively, further strengthening our outreach goals. Our collaborators at Buffalo will ensure findings are relayed to emerging students in the field of conservation. The proposed project will use a variety of dissemination methods to reach audiences who may benefit from the work and the advisory committee will be involved in ensuring effective communication with audiences at hand.

**A workshop in conjunction with an annual meeting of the Society for the Preservation of Natural History collections (SPNHC)** will present information and demonstrations of the recommended recoloring techniques to the conservation/collections care community (see *Appendix 10j Letter of Support Norris*). The workshop will cover the history and technology of the taxidermy production, the biology of hair and the mechanisms of its deterioration, options for preservation and restoration techniques (with emphasis on health and safety), and ethical considerations and best practices in treating these objects (for example, is recoloring the best option?). We expect to hold the SPNHC workshop in 2016 and to offer it to other professional organizations as well as institutions with habitat dioramas (see *Appendix 9 Draft Workshop Content*).

**The interactive project blog** on the AMNH website (see above) will serve to disseminate project research goals, progress and results on an ongoing basis to audiences including, but not limited to, conservators, collection managers, conservation scientists, and taxidermists. The blog will also act as a place that questions can be posted and responded to by the project team. This blog will continue to be supported beyond the end of the project by AMNH conservation staff as a resource for those dealing with the preservation of taxidermy.

**Publications, presentations, and posters** at conservation and collections preservation conferences at the end of the testing period will serve to present results to relevant audiences. Based on the presentation of the AMNH NAM pilot study presented at annual meetings of the American Institute for Conservation and the Society for the Preservation of Natural History Collections (Nunan et al., 2012. Sybalsky et al. [1&2], 2012. Also see *Appendix 3 Newsletter and Posters*), we expect intense interest in the results of this project. Results from this project will also be shared with other related groups (International Council of Museums, Conservation Committee, Taxidermy groups, Mammal groups). Publications presenting the project results will be submitted to the SPNHC Collections Forum and/or the AIC Journal.

**A website will present best practices** concerning the care of taxidermy, with emphasis on the results of the work at hand (recoloring methods), the workshop content, and a decision-making matrix to help make determinations concerning the appropriateness of any given treatment (see *Budget Justification*). The website will be maintained by AMNH conservation staff.

**Measuring Success:** The success of the project will be indicated through the development of recoloring materials and techniques that can be broadly implemented for use in the area of collections conservation. For recommendations to be made, success will be measured through testing of the long-term stability of the dye materials themselves and through a clearer understanding of the hair/dye interaction. Adoption of these methods by other institutions will be a further measure of success.

The well thought-out research design and methodology—developed with critical input from conservation scientists Paul Whitmore and Corina Rogge to address each avenue of the inquiry (see *Appendix 7 Research Plan*)—will serve as the basis for continual evaluation of direction and results by the project team and external advisory committee. Monthly reviews with the core project team, both at AMNH and CCAP, will ensure that key issues are effectively addressed. Upon completion of the project, the team will revisit the needs survey and request further information from those initial respondents. This will allow for a very clear sense of how our critical audiences view the product(s) of our research, how successfully our results were disseminated, and what, if any needs still exist concerning the recoloring of historic taxidermy.

### References:

- ASTM. 2010. Standard test methods for Lightfastness of Colorants Used in Artists' Materials, D4303-10. Philadelphia: American Society for Testing and Materials.
- Inside Installations, 2006. S.M.A.K. Ghent, Netherlands Institute for Cultural Heritage. "The Aeromodeller 00-PL by Panamarenko." [http://www.inside-installations.org/artworks/detail.php?r\\_id=96&ct=research](http://www.inside-installations.org/artworks/detail.php?r_id=96&ct=research). Accessed 27 December 2012.
- Elkin, L., E. Nunan, D. Fenkart-Froeschl. 2013. The Collections Risk Management Program at the AMNH. *Collections: A Journal for Museum and Archives Professionals*. Vol 9, no. 1 (2013).
- Elkin, L., D. Fenkart-Froeschl, R. Waller, E. Nunan. 2011. A Database Tool for Collections Risk Evaluation and Planning. *ICOM-CC 16<sup>th</sup> Triennial Conference, Lisbon, Portugal, September 2011*.
- Koob, Stephen P. 2006. *Conservation and Care of Glass Objects*. Archetype Publications.
- Kronthal, Lisa. 2001. Conservation of Chinese Shadow Figures: Investigations into their manufacture, storage, and treatment. *Journal of the American Institute for Conservation*. Vol 40, No. 1, Article 1. Pp 1–14.
- Nunan, et al. "In Their True Colors: Developing New Methods for Recoloring Faded Taxidermy," Presentation at the American Institute for Conservation, 40th Annual Meeting, Albuquerque, NM. May 8-11, 2012.
- Reiss, M.J. & Tunnicliffe, S.D. 2011: Dioramas as Depictions of Reality and Opportunities for Learning in Biology. *Curator*; 54 (4) 447-459.
- Palumbo, B. 2012. The restoration of color to avian mounts. *Collection Forum* 26, (1–2). Pp 50–59. Society for the Preservation of Natural History Collections.
- Quinn, Stephen Christopher. *Windows on Nature. The Great Habitat Dioramas of the American Museum of Natural History*. Abrams. 2006.
- Sybalsky (1), et al. "The use of Orasol Dyes for In-Situ Recoloring of Taxidermy Specimens". Poster Presentation at the SPNHC 27<sup>th</sup> Annual Meeting, Yale University, New Haven CT. June 11-16, 2012.
- Sybalsky (2), et al. "Innovation Through Interdisciplinary Exchange: Restoration of the North American Mammal Habitat Dioramas." Presentation at the SPNHC 27<sup>th</sup> Annual Meeting, Yale University, New Haven CT. June 11–16, 2012 and publication ICOM NHC-WG Newsletter. Issue No. 17, Oct 2012.
- Tunnicliffe, S.D. and Scheerso, A. (eds) 2009: The important role of Natural History dioramas in biological learning. *ICOM Natural History Committee Newsletter* 29: 1–40
- Webb, Marianne. 2000. *Lacquer: Technology and Conservation : a Comprehensive Guide to the Technology and Conservation of Asian and European Lacquer*. Butterworth-Heinemann.
- Whitmore, P. M., Bailie, C., and Connors, S. A. 2001. Micro-fading tests to predict the result of exhibition: progress and prospects. In *Tradition and Innovation: Advances in Conservation*, ed. A. Roy and P. Smith, International Institute for Conservation, Melbourne. 200–205.

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