SPNHC 2012

PROGRAM & ABSTRACTS

Emerging Technology and Innovation in Natural History Collections Management

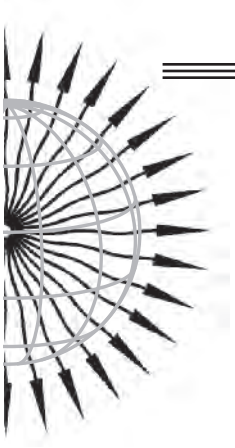
The 27th Annual Meeting of the Society for the Preservation of Natural History Collections

June 11–16, 2012

Yale University • New Haven, Connecticut USA

Yale PEABODY MUSEUM OF NATURAL HISTORY

SPNHC ADVANCING COLLECTIONS CARE



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Welcome to SPNHC 2012

Dear Participants of the SPNHC 2012 Annual Meeting,

It is with great pleasure that I welcome you to New Haven, Connecticut. As you know, Annual Meetings are the perfect opportunity to interact directly with our colleagues; to establish and maintain our professional network; to find out what's new in the field of natural history collection management and conservation, and to highlight and celebrate some of our accomplishments.

Once again, the Local Organizing Committee has worked hard to provide a program with a full schedule of informative, practical and exciting sessions, great workshops, and some fun local activities. The theme, "Emerging Technology and Innovation in Natural History Collections Management," is very timely, as many new technologies are quickly making their way into our professional lives. Please, join me in expressing great appreciation to them for the enormous amount of work they have invested to make this another memorable event. We must remember that these are people that actually volunteer to organize and host an annual meeting. And of course, we must not forget to thank all the individual presenters of oral papers and posters, and those leading workshops; your continued participation is what makes our annual meetings such a valuable element in our professional development.

As in the past, this meeting would not be possible without the significant financial support of our sponsors and vendors; thank you so much for all that you have done and continue to do. Notwithstanding the importance of your financial support, your presence at our annual meetings continues to be a significant added value to our professional networking and development endeavours. The best way for conference participants to show appreciation is to visit the vendors' booths at the tradeshow and find out what they have to offer.

Finally, if this is your first SPNHC conference, I hope you have registered for the special breakfast for newcomers (Wednesday at 7:00 a.m.) and introduce yourself to members of the SPNHC Council; we would like to get to know you better and help you make the most of the first of what we hope will be many meetings.

Enjoy!

Jean-Marc Gagnon, *President,*
Society for the Preservation of Natural History Collections

SPNHC
ADVANCING COLLECTIONS CARE

The Society for the Preservation of Natural History Collections (SPNHC) is a global organization composed of a lively, active, and interdisciplinary community of professionals dedicated to the care of natural science collections. SPNHC members are museum specialists; such as curators, collections managers, conservators, preparators, and database administrators, from more than 20 countries. The Society holds annual meetings and sponsors symposia and workshops to foster the exchange of ideas and information. To learn more about SPNHC or to become a SPNHC member, please visit www.spnhc.org.

SPNHC 2012 Local Organizing Committee

Tim White
Co-Chair

Susan Butts
Co-Chair

Susan Castaldi
Travel & Social Events

Maureen DaRos
Collections Tours

Lynn Jones
Communications

Bonnie Mahmood
Accomodations & Social Events

Sally Pallatto
Website & Logo Design
Merchandise

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Hospitality

Harry Shyket
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Jessica Slawski
West Campus Liaison

Patrick Sweeney
Program

Annette Van Aken
Sponsors & Vendors

Rosemary Volpe
Program Design

Greg Watkins-Colwell
Field Trips

Field Trip Leaders

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Susan Butts
Leo Hickey
Susan Hochgraf
Maureen DaRos
Anton (Twan) Leenders
Lynn Jones
Cope MacClintock
Bill Moorhead
Penny Sharp
Jessica Utrup
Greg Watkins-Colwell
Tim White
Charles Yarish
Kristof Zyskowski

Workshop Leaders

Rachael Perkins Arenstein
David Bloom
Peter Desmet
Marilyn Fox
Theresa Fairbanks Harris
Christine McCarthy
Elizabeth Merritt
Meaghan Monaghan
Nelson Rios
Catherine Sease
Carol Spencer

SPNHC 2012

Welcome from the SPNHC 2012 Local Organizing Committee

Dear SPNHC 2012 Delegates,

On behalf of the SPNHC 2012 Local Organizing Committee, it is our great pleasure to welcome you to the City of New Haven and the campus of Yale University. This is the first time that the Society for the Preservation of Natural History collections has met at Yale University and we are proud to host the Society in 2012. Delegates from 14 countries have made the trip to SPNHC 2012 and we welcome all of you to New Haven.

The theme of this meeting—"Emerging Technology and Innovation in Natural History Collections Management"—reflects the creativity that our museums and collections are facing every day to meet the many challenges and opportunities in the 21st century. For the past year our local committee has developed a program that reflects those challenges and creativity. SPNHC and many other organizations, such as the American Association of Museums, have devoted much energy to develop and disseminate best practices for managing and conserving natural history collections. In the past two years the National Science Foundation of the United States has promoted the Advancing Digitization of Biological Collections program and has challenged the natural history community to build a national resource for study of biodiversity and the history of life. With that as a backdrop, SPNHC is pleased to partner with AIC, the NSF-sponsored IDigBio, the Council for Library and Information Resources, and the Smithsonian Institution National Museum of Natural History on several special sessions, including digitization, cryo- and frozen-tissue collections, archives and special collections, preventive conservation, and storage of museum collections that require innovation and creativity from our museum specialists and several institutions.

This year we have 45 companies, institutions, and organizations sponsoring topical sessions, workshops, and social events. With their support, we have been able to keep the costs of this meeting affordable for broad participation from the natural history and museum communities. In particular, we would like to thank Delta Designs, Ltd., and the Yale Institute for the Preservation of Cultural Heritage for their outstanding support.

Our meeting venue is the Omni Hotel in downtown New Haven, near the New Haven Green. Our keynote address and plenary session will take place in New Haven's historic Shubert Theater. We encourage you to enjoy the city, the Yale campus and the meeting. With our best wishes,

Tim White, *Co-Chair*
Susan Butts, *Co-Chair*
SPNHC 2012 Local Organizing Committee

Welcome from the Yale Peabody Museum of Natural History

Welcome to the Yale Peabody Museum, Yale University and New Haven. My colleagues and I at the Peabody Museum are delighted to be hosting this, the 27th meeting of the Society for the Preservation of Natural History Collections, and we are particularly pleased at the record registration.

As you will see, Yale University continues to be a remarkable steward of its collections, which extend well beyond natural history to the holdings, for example, of its two major art galleries. The Peabody Museum collections of more than 12 million specimens are housed in New Haven and at Yale's West Campus. The Class of 1954 Environmental Science Center, adjacent to the public museum, houses entomology, the herbarium, paleobotany, living and fossil invertebrates, and vertebrate zoology in collection facilities across the corridor from faculty labs, allowing ready access to materials for research and teaching. Yale's West Campus houses some 40% of the Peabody's collections, including our museum archives, historical scientific instruments, and most of our anthropology materials, in newly furbished space. Special collections from most of the Peabody's other museum divisions are also accommodated there. And in the near future West Campus will be the venue of Yale's new Institute for the Preservation of Cultural Heritage, which will incorporate new centers for digitization and conservation that will serve all the University's collections.

We have a full schedule of workshops and sessions treating all the developments that exercise today's stewards of natural history collections. Not surprisingly, a major focus this year is on how we obtain, handle, use and make data available, with sessions on three-dimensional imaging, digitization, georeferencing and data sharing. Conservation is also central, including the newer challenges presented by cryo collections. As ever, our concerns are caring and sharing, developing and delivering new methods of conserving our collections and making the information they embody as widely available as possible. And apart from the attraction of Yale's collections, you will discover that New Haven, with its many fine restaurants and bars, is an ideal venue for a SPNCH meeting—for, as we all know, it is the informal and unscheduled conversations, as much as the conference meetings, that move our agenda along.

Derek E.G. Briggs
Director, Yale Peabody Museum of Natural History

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General Conference Information

REGISTRATION BOOTH

Please visit the Registration Booth before attending any events or talks to check-in and pick up your name badge, conference tote, and tickets for social events. Badges should always be worn in the conference venues and in Yale buildings to identify you as a conference participant. Conference participants with badges have free admission to the Peabody Museum exhibits.

Registration Booth hours and locations are:

Omni 1st floor lobby
Sunday, 6:00 p.m.–8:00 p.m.

Omni 2nd floor lobby
Monday, 8:00 a.m.–4:00 p.m.
Tuesday, 7:00 a.m.–5:00 p.m.
Wednesday, 7:00 a.m.–4:00 p.m.
Thursday, 8:00 a.m.–4:00 p.m.
Friday, 8:00 a.m.–10:00 a.m.

There will be sign-up sheets for Special Interest Groups and Peabody Collection Tours at the Registration Booth. You can also register for any social events, workshops, or field trips that still have openings.

Download the list of attendees and vendors from the SPNHC 2012 website at www.peabody.yale.edu/collections/SPNHC2012/program

INFORMATION FOR PRESENTERS

ORAL PRESENTERS

Your talk MUST be uploaded at the Speaker Ready Room (Omni Crown Room) the day before your talk. If there is no one present in the Speaker Ready Room, please ask for assistance at the Registration Booth. Talks can be in PowerPoint or PDF format. Files should be labeled with the speaker's last name. Oral presentation sessions will take place in the Omni New Haven Ballroom C, Temple Room, and College Room. The keynote speaker and plenary sessions will be held at the Shubert Theater, 247 College Street, (through the courtyard facing the Omni front door).

POSTER PRESENTERS

Posters should be hung on Tuesday 1:00–5:00 p.m. or Wednesday 7:30–8:30 a.m. Poster removal is Thursday 5:00–7:00 p.m. The Poster Session is Wednesday 3:00–4:00 p.m. Please try to be at your poster during the poster session so that you may discuss it with viewers.

TRADE SHOW

This year, the Trade Show features booths of over thirty vendors who have helped to sponsor this conference. Please stop by the Trade Show in Omni Ballroom A/B. The Trade Show will be open from 1:00–5:00 p.m. Wednesday and 8:00 a.m.–3:40 p.m. Thursday. Coffee breaks will be at 10:00 a.m. and 3:00 p.m. Wednesday, 10:00 a.m. and 3:10 p.m. on Thursday, and 10:10 a.m. Friday in the Trade Show. All registrants are invited to attend.

WI-FI ACCESS

Wi-Fi is available to registrants in all areas on the 2nd floor of the Omni hotel. To connect:

—Search for and connect to
the "AVT Wireless Network"
—Open your Internet browser

You will get an AVT splash page asking for username and password (all capital letters with no spaces):

Username—SPNHC2012
Password—SPNHC2012

Check the box with "terms and conditions" and you will be connected in a few seconds.

Wi-Fi is complimentary for Omni guests in the main 1st floor lobby and in all guest rooms.

SOCIAL MEDIA

Our Twitter hashtag is #SPNHC2012.
Look for us Facebook: SPNHC 2012 annual meeting.

ANNUAL BUSINESS MEETING

The Annual Business Meeting will take place on Friday, June 15, at noon in the Omni Ballroom A/B. Lunch will be provided.

SPECIAL INTEREST GROUPS (SIGS)

Special Interest Groups will meet from 1:30–2:30 p.m. Friday, June 15, in various locations throughout the Omni. This year we will have SIGs for STASH: Collaborations in Storage Methods and Practices, Collections Issues: Herbaria, Collections Issues: Cryo and Tissue Collections, Databases,

General Conference Information

Collecting and Shipping—Permits and Regulations, Grants and Funding Opportunities, EMu Community Developments, and Best Practices for Natural History Collections Environments.

Please register (free) for SIGs at the Registration Booth. There is a limit of 20 people per group. Meeting locations are listed on the sign-up sheet.

BEHIND-THE-SCENES PEABODY COLLECTIONS TOURS

You will have the opportunity to tour the Peabody Museum collections in the Class of 1954 Environmental Science Center (ESC), our state-of-the-art collections facilities, and the newly renovated collection facility on the Yale West Campus. We have four simultaneous afternoon collections tours slated from 3:00 – 5:00 p.m. on Friday, June 15:

—*ESC 1:* Molecular Tissue Lab, Ornithology/ Vertebrate Zoology Preparation Lab, Invertebrate Zoology, and Invertebrate Paleontology
—*ESC 2:* Botany, Paleobotany, Center for Earth Observation, and Entomology
—*ESC 3:* Vertebrate Paleontology, Vertebrate Paleontology Preparation Laboratory, and Mineralogy
—*West Campus:* Archives, Vertebrate Zoology and Entomology, Kirtas (high-throughput digitization), and Anthropology

Participants of the ESC tours should walk from the Omni New Haven to the Peabody Museum (25 minutes). For those on the West Campus tour, van transportation will be available between the Omni and West Campus, meeting on the 2nd floor near the Registration Booth.

Please register (free) at the Registration Booth. There is a limit of 20 people per tour.

SOCIAL EVENTS

All social events are ticketed events and require pre-registration. Please check with the Registration Booth to see if additional tickets are available for purchase.

WELCOMING RECEPTION

The Welcoming Reception will be held under the world-famous Zallinger mural *The Age of Reptiles* in the Great Hall of Dinosaurs at the Peabody Museum on Tuesday from 5:30–9:00 p.m. Some transportation is available between the Omni New Haven and the Peabody starting at 5:15 p.m., but the distance is walkable from the Omni (25 minutes) and the residential colleges (20 minutes).

BANQUET

Join us on Thursday for a Down East Clambake at Amarante's Sea Cliff, located in a quiet cove along Connecticut's shore, just minutes from downtown New Haven. Appetizers will be served from 6:00 to 7:00 p.m. with dinner to follow.

The banquet includes:
—Your choice of 1-1/4 pound steamed lobster, beef tenderloin filet, or vegetarian entree, plus barbecued chicken, mussels, corn on the cob, roasted red potatoes, cole slaw, and strawberry shortcake
—Open bar
—D.J. and dancing

Bus transportation will be available to take you from the Omni New Haven, beginning at 5:30 p.m. Return buses will be available beginning at 9:30 p.m., with the final trip at 11:00 p.m. Please bring your banquet ticket for admission.

VENDOR LUNCH

Say hello and thank our conference sponsors and vendors for their support throughout the year and for their support of the SPNHC 2012 conference at the Vendor Lunch. The Vendor Lunch will be held at the Omni Temple Room at noon on Wednesday. Please bring your ticket for admission.

NEW PARTICIPANT BREAKFAST

SPNHC New Participants—please join us for breakfast and meet SPNHC officers, mentors, and other newcomers. Breakfast will be at 7:00 a.m., Wednesday, in the Harbour and Davenport rooms (Omni New Haven, 19th floor) and will finish in time to head to the opening talks. Please bring your ticket for admission.

FIELD TRIPS

Field trips will meet on the second floor of the Omni New Haven, near the Registration Booth. Lunch and bottled water will be provided, but you might like to bring additional water. Grab a lunch and look for the field trip leader holding a sign with your field trip name.

Field trips will leave at:
—Bird-watching 8:00 a.m.

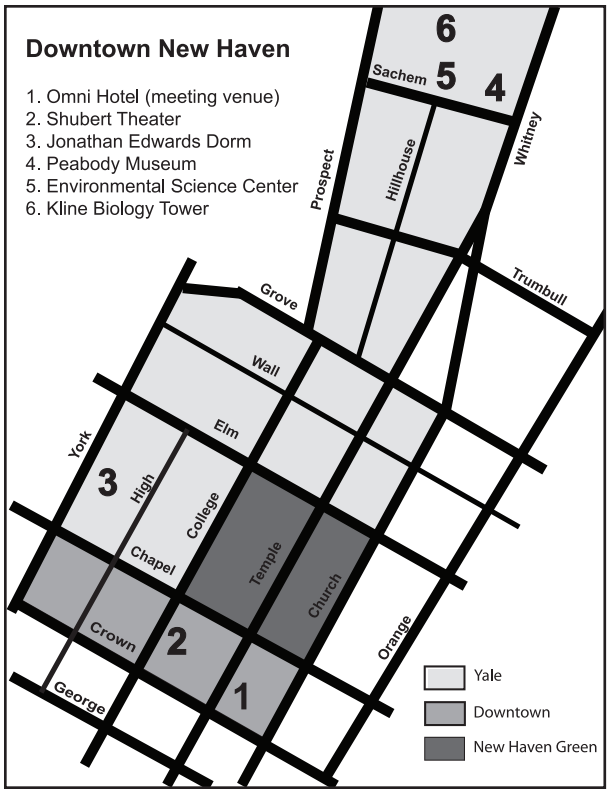
General Conference Information

—Connecticut Geology	8:30 a.m.
—Plant-life of Traprock Ridges	9:00 a.m.
—Marine Algae of Southern New England	9:00 a.m.
—Botany of Northwestern Connecticut	9:00 a.m
—New Haven Walking Tour	9:30 a.m.

WORKSHOPS

The pre-conference workshop, Georeferencing, will be held on Sunday, June 10 (10:00 a.m.–6:00 p.m.) and Monday, June 11 (9:00 a.m.–6:00 p.m.) in the Kline Biology Tower (KBT) CSSSI StatLab Classroom (C27) on Yale Science Hill. It is approximately a 25-minute walk to KBT from the Omni and 20 minutes from the residential colleges. Lunch and breaks will be provided both days.

The post-conference workshop, Forecasting the Future of Natural History Museums and Collections, will be held in the auditorium of the Yale Peabody Museum on Saturday, June 16, from 8:30 a.m.–5:00 p.m. Use the Peabody main entrance. The post-conference workshop, Stabilize This!, will be held in the Class of 1954 Environmental Science Center (ESC) adjacent to the Peabody Museum on Saturday, June 16, from 9:00 a.m.–5:00 p.m. There will be directions to the meeting rooms at the ESC entrances. Lunch and breaks will be provided for both workshops.



SPNHC COMMITTEE MEETINGS

Committee meetings for the SPNHC Council will be held on Monday, June 11, in the Class of 1954 Environmental Science Center. A schedule is included in this program.

GETTING AROUND

Information on transportation for specific events is listed with that event. New Haven is pedestrian-friendly. As with any large urban setting, it is advisable to be aware of your surroundings and walk accompanied after dark.

Walking times between lodging and venues:

Omni New Haven to Peabody	25 minutes
Jonathan Edwards Residential College to Peabody/ESC	20 minutes
Jonathan Edwards residential college to Omni	15 minutes

Taxis are generally available outside the Omni.
Metro Taxi: (203) 777-7777
Quick Taxi: (203) 777-7778
NH Yellow Taxi: (203) 777-7770

PARKING

Parking at the Omni is available for $19/night in the below-ground garage. Parking for the resident colleges is $28. Please note that the resident college parking garage is approximately one mile away, on foot, from campus housing locations. Yale Shuttle service is available. Most of the downtown New Haven streets have metered parking. Parking at the Peabody Museum is available, but very limited.

JONATHAN EDWARDS RESIDENTIAL COLLEGE

Enter Jonathan Edwards Residential College at the main gate at 68 High Street (off street). You will be assisted by Yale Conference Services employees. The Housing Office is open for check-in from 8:30 a.m.–4:30 p.m. If check-in or assistance is needed after hours, please contact the Guest Service Representatives on call at (203) 432-2840.

MAPS

Maps of downtown New Haven, the Yale Campus (inside back cover), and the 2nd floor of the Omni Hotel, are in this program.

Keynote Speaker

PHOTO BEN STECHSCHULTE

FROM THE PAGE TO THE PIXEL: SCIENCE WRITING GOES ONLINE

CARL ZIMMER

The Internet has profoundly transformed communication about science. Traditional venues, such as museums and printed magazines, have now been joined by blogs, Facebook, Twitter, Google Plus, and a dizzying menagerie of other media. Carl's talk will discuss his experiments—successful and otherwise—in making the transition to science online.

The New York Times Book Review *calls award-winning popular science writer, speaker and blogger Carl Zimmer "as fine a science essayist as we have." Zimmer graduated magna cum laude from Yale University and from 1994 to 1998 was a senior editor at Discover, where he remains a contributing editor and writes a monthly column. The author of 12 books about science, Zimmer has written hundreds of articles for the* New York Times *and magazines including* National Geographic, Time, Scientific American, Science *and* Popular Science. *Zimmer's work has been anthologized in both* The Best American Science Writing *series and* The Best American Science and Nature Writing *series. Since 2008 he has been a lecturer in Yale's Environmental Studies Program, where he teaches science writing. He is a two-time winner of the American Association for the Advancement of Science Journalism Award and has received the National Academies Communication Award. In 2011 he was elected to the board of directors of the Council for the Advancement of Science Writing.*

Plenary Session

THE DIGITAL CONTENT LIFECYCLE AND NATURAL HISTORY COLLECTIONS: NEW RESPONSIBILITIES AND OPPORTUNITIES

There has been an increasing focus on digitizing objects housed in natural history collections, and recent funding initiatives will lead to the acquisition of digital assets on a massive scale. The acquisition of these assets presents many new challenges related to the management and accessibility of these items. It also provides an opportunity to make collections accessible in new and interesting ways. This session will feature presentations on the digital content lifecycle from leaders in the field.

IMPLEMENTATION MAY BE PROBLEMATIC

KENNETH HAMMA

Consultant

Yale Center for British Art, Yale University, P.O. Box 208280, New Haven CT 06520-8280 USA

We all have managed aspects of transitioning collections and collection management into a digital mode. The longer we've been at it, the more we have worked not just with systems and digital assets but also with institutional change. The "digital content lifecycle" has evolved to describe and summarize the scope of our every-day back-end management. In addition it helps us conceptualize an overview that may vary from one institution to another but is fundamental in planning processes, policy and funding.

It has been my experience, however, that, even with the understanding we share today, successful long-term implementation with all the desired outcomes cannot be assumed. While models like the

Continued

digital content lifecycle are stable and predictable, many elements we manage are not.

Kenneth Hamma is currently working as an independent consultant for planning and organizational change at the intersection of information technology and cultural heritage collections. Among current clients are the Andrew W. Mellon Foundation, the Yale Center for British Art, the Museums of New Mexico and Yale's Office of Digital Assets and Infrastructure. He was Executive Director for Digital Policy and Initiatives at the J. Paul Getty Trust until 2008. From 1996 to 2004 he was Assistant Director and from 1987 to 1996 Associate Curator of Antiquities at the Getty Museum. He has served as a member of the Steering Committee of the Coalition for Networked Information (CNI), a member of the RLG Programs Council of OCLC, and a member of the At Large Advisory Committee of the Internet Corporation for Assigned Names and Numbers (ICANN).

COLLABORATIVE DIGITAL RESEARCH

DOMINIC OLDMAN

Deputy Head of Information Systems
British Museum, Great Russell Street, WC1B 3DG, United Kingdom

For many scholars the Internet and the World Wide Web promise a revolution that always seems to be just about to happen. The web can be highly immersive but also disruptive, operating as a continually moving environment. It is fuelled year on year by new technology, greater bandwidth and processing power, and by multimedia visualisations with the potential to radically change the way that we work and present knowledge to a global audience. Despite this potential many academic organisations lack the infrastructure, skills and culture to engage with the Internet effectively, leaving it to others to provide Internet services covering the arts and history that often suffer from issues of quality and quantity. This presentation looks at some of the challenges for researchers using the Internet and how it is changing the way that we collaborate. It will look at some of the initiatives aimed at releasing knowledge previously held in data silos, and some of the tools and technologies that might support the work of digital researchers in the future.

Dominic Oldman is the British Museum's Information Systems Development Manager and the Principal Investigator of ResearchSpace, an Andrew Mellon Foundation-funded project developing a collaborative online environment for humanities research projects using semantic web data technology. He has been involved in museum curatorial computing for many years and managed the implementation of the British Museum's Collection Online system, recently extended for computer reuse. He is currently chair of the new Bloomsbury Digital Humanities Group.

DIGITAL PRESERVATION —A DIFFERENT ANIMAL IN SURPRISING WAYS

PAUL COURANT

University of Michigan Librarian and Dean of Libraries
Library Administration, University of Michigan, 818 Hatcher Graduate Library South, Ann Arbor, MI 48109-1205 USA

As the scholarly and cultural records are increasingly produced in digital form, legal, technical, institutional and economic preservation frameworks that worked well in a world where only physical objects matter are under stress and at risk of failure. Put simply, the ability of research and cultural her-

itage institutions, including libraries and museums, to provide access to valuable and interesting objects of study depended on those objects being well-preserved and cared for. In the digital world, the connection between access and preservation is no longer automatic. This is especially true for texts and images, but will become increasingly true in other domains, as we are better and better able to encode complicated information in digital form and as we develop tools that require digital information as the starting place for our work.

The crux of the organizational and economic problem is that preservation for its own sake is difficult to produce and sustain, so we need to develop institutions and incentives that will assure preservation in the interest of future access, or we risk the loss of elements of the scholarly record and associated objects of study. Bits rot, formats change, storage and distribution of digital information can be and often will be outsourced. Born-digital information is especially at risk, but so too are digitized copies of texts, objects and events, as well as scholarly work that is done using those objects.

In my segment of the plenary session, I will amplify these themes, review the current landscape of cultural heritage organizations supporting access to digital information and present an economic framework for addressing the questions all decision-makers face as they consider digital preservation, following from work that is discussed in the Blue Ribbon Task Force on Sustainable Digital Preservation and Access, of which I was a member.

Paul N. Courant is Arthur F. Thurnau Professor, Harold T. Shapiro Collegiate Professor of Public Policy, Professor of Economics, Professor of Information, and Faculty Associate in the Institute for Social Research at the University of Michigan. Courant has authored half a dozen books and over seventy papers covering a broad range of topics in economics and public policy, including tax policy, local economic development, gender differences in pay, housing, radon and public health, relationships between economic growth and environmental policy, and university budgeting systems. More recently, he has been studying the economics of universities, the economics of libraries and archives, and the changes in the system of scholarly communication that derive from new information technologies. From 2007-2010, Courant was a member of the Blue Ribbon Task Force on Sustainable Digital Preservation and Access.

The 2012 Carolyn Rose Award

For outstanding commitment to natural history collections care and management

Catharine Hawks

In recognition of her significant contributions to conservation and collection management worldwide through her tireless service as a conservator, author, editor, and educator, the Council of the Society for the Preservation of Natural History Collections has voted to present the 2012 Carolyn Rose Award to Catharine (Cathy) Hawks.

It is easy to see that Cathy was a natural to receive this honor when one reads some of the accolades in the support letters that were written on her behalf.

"Twenty-six years after first meeting Cathy, I am more in awe than ever of her professional knowledge and leadership abilities, and her amazing generosity of spirit. I would not have had the career that I have had without Cathy's mentoring."

"She is one of the most considerate, ethical, and devoted people that I know in our field."

"To me, the real test of dedication is the unacknowledged time and effort that a person spends on something that they believe in. And Cathy is an extraordinary example of genuine dedication."

"Cathy was a protégé of, collaborator with, and close friend to Carolyn L. Rose. I know that Carolyn, in looking down at us making this award to Cathy, would be very proud of and happy for her, as we all can be."

The 2012 President's Award

For activities which have furthered the objectives of the Society through outstanding committee work, prolonged officer roles, or promotion of activities of the Society

Russell D. (Tim) White

In recognition of his extensive contributions to SPNHC since its earliest days, the Council of the Society for the Preservation of Natural History Collections has voted to present the 2012 President's Award to Russell D. (Tim) White.

Tim is fiercely devoted to SPNHC. Period. A look at his CV shows that, in addition to his tenure as President, he has served on eight committees and four local committees, and has received four Special Service Awards. When one of his colleagues asked him recently about his future SPNHC activities, he noted "I'm just going to keep doing stuff until someone tells me to stop."

In the words of his supporters:

"Through his strong leadership and unshakable dedication [as President], he helped to guide the Society on a path towards broad influence and acknowledged professionalism beyond natural history"; indeed, he fostered "the elevation of SPNHC into a truly professional and world class society."

"I have no hesitation in saying that Tim is one of the pillars of the SPNHC Community…[,] epitomizes what the Society stand for and strives to promote collections care and the profession in its widest sense."

"The unwavering commitment and devotion that Tim continues to show in his efforts and interactions on behalf of the Society are awe-inspiring."

The 2012 Special Service Award

Recognition for a single extraordinary effort that directly and positively affects the success of SPNHC activities or events

Lisa Kronthal Elkin

In recognition of her significant contribution to SPNHC arising from her chairmanship of the Publicity and Outreach Sessional Committee, the Council of the Society for the Preservation of Natural History Collections has voted to present a Special Services Award to Lisa Kronthal Elkin.

In the words of her supporters:

Lisa "managed the committee's work in an extremely professional manner" and she clearly was "the driving force behind P&O."

"P&O ended up tackling some of the biggest questions that face any professional society"; via their recommendations, the Society now has a new logo, promotional materials, conference exhibit booth, and, as many of you have likely seen, a new website.

"Most importantly, the recommendations of the P&O Committee led to two major new initiatives of the Society, focused on professional mentorship and best practices." These initiatives have helped define the future of the Society.

Program at a Glance

Sunday, June 10

Registration
6:00 p.m. – 8:00 p.m.
1st Floor Lobby, Omni Hotel

Georeferencing Workshop
Day 1 • 10:00 a.m. – 6:00 p.m.
Kline Biology Tower
CSSSI Stat Lab Classroom, C27
Presented by the University of California–Berkeley
and Tulane University

Monday, June 11

Registration
8:00 a.m. – 4:00 p.m.
2nd Floor Lobby, Omni Hotel

Georeferencing Workshop
Day 2 • 9:00 a.m. – 6:00 p.m.
Kline Biology Tower
CSSSI Stat Lab Classroom, C27
Presented by the University of California–Berkeley
and Tulane University

8:30 a.m	**Committee Meetings** Class of 1954 Environmental Science Center
12:30 p.m.	Lunch (on your own)
1:15 p.m.	**Committee Meetings** Class of 1954 Environmental Science Center
4:45 p.m.	
6:00 p.m.	**1st Council Meeting** (dinner included) Class of 1954 Environmental Science Center
10:00 p.m.	

Program at a Glance

Tuesday, June 12

Registration
7:00 a.m. – 5:00 p.m.
2nd Floor Lobby, Omni Hotel

Vendor Set Up
1:00 – 6:00 p.m.
Ballroom A/B, Omni Hotel

Poster Set Up
1:00 – 5:00 p.m.
Ballroom D, Omni Hotel

FIELD TRIPS
Depart from 2nd Floor Lobby, Omni Hotel

<table>
<tr><td>8:00 a.m.</td><td rowspan="8">Bird-watching</td><td></td><td></td><td></td></tr>
<tr><td>8:30 a.m.</td><td rowspan="9">Connecticut Geology</td><td></td><td></td></tr>
<tr><td>9:00 a.m.</td><td rowspan="6">Consortium of Northeastern Herbaria Co-sponsored Botany Trips

Plant-life of Traprock Ridge
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<tr><td>9:30 a.m.</td><td rowspan="5">Walking Tour of New Haven and Yale Collections</td></tr>
<tr><td>10:00 a.m.</td></tr>
<tr><td></td></tr>
<tr><td>3:00 p.m.</td></tr>
<tr><td>3:30 p.m.</td></tr>
<tr><td>4:00 p.m.</td><td></td><td></td><td></td></tr>
<tr><td>4:30 p.m.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5:30 p.m.</td><td colspan="4">Welcoming Reception
Yale Peabody Museum Great Hall of Dinosaurs</td></tr>
<tr><td>9:00 p.m.</td><td></td><td></td><td></td><td></td></tr>
</table>

Program at a Glance

Wednesday, June 13

Registration
7:00 a.m. – 4:00 p.m. • 2nd Floor Lobby, Omni Hotel

New Participant Breakfast
7:00 – 8:30 a.m.
Harbour and Davenport Rooms, 19th Floor, Omni Hotel
(ticketed event)

Poster Set Up
7:30 – 8:30 a.m.
Ballroom D, Omni Hotel

Trade Show
1:00 – 5:00 p.m.
Ballroom A/B, Omni Hotel

<table>
<tr><td>START</td><td colspan="3">SHUBERT THEATER</td></tr>
<tr><td>8:30 a.m.</td><td colspan="3">Opening Session
Welcome and Keynote Speaker</td></tr>
<tr><td>10:00 a.m.</td><td colspan="3">Break</td></tr>
<tr><td>10:30 a.m.</td><td colspan="3">Plenary Session</td></tr>
<tr><td>12:00 p.m.</td><td colspan="3">Lunch (on your own)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>START</td><td colspan="3">OMNI HOTEL</td></tr>
<tr><td>12:00 p.m.</td><td colspan="3">Vendor Lunch – TEMPLE ROOM (ticketed event)</td></tr>
<tr><td></td><td>BALLROOM C</td><td>BALLROOM D</td><td>COLLEGE ROOM</td></tr>
<tr><td>1:30 p.m.</td><td>Oral Session
Collections Digitization & Mobilization 1</td><td></td><td>Oral Session
General Session 1</td></tr>
<tr><td>3:00 p.m.</td><td></td><td>AIC & SPNHC Poster Sessions
(refreshments provided)</td><td></td></tr>
<tr><td>4:00 p.m.</td><td>Oral Session
Collections Digitization & Mobilization 1 (cont'd)</td><td></td><td rowspan="2">Oral Session
General Session 1
(cont'd)</td></tr>
<tr><td>5:00 p.m.</td><td></td><td></td></tr>
<tr><td>5:30 p.m.</td><td rowspan="3">Consortium of Northeastern Herbaria Business Meeting</td><td></td><td></td></tr>
<tr><td>6:00 p.m.</td><td></td><td rowspan="2">SALIX Workshop</td></tr>
<tr><td>7:00 p.m.</td><td></td></tr>
<tr><td>7:30 p.m.</td><td></td><td></td><td></td></tr>
</table>

Program at a Glance

Thursday, June 14

Registration
8:00 a.m. – 4:00 p.m.
2nd Floor Lobby, Omni Hotel

Trade Show
8:00 a.m. – 3:40 p.m.
Ballroom A/B, Omni Hotel

Vendor Breakdown
3:40 – 7:00 p.m.
Ballroom A/B, Omni Hotel

Poster Removal
5:00 – 7:00 p.m.
Ballroom D, Omni Hotel

START TIME	BALLROOM C	TEMPLE ROOM	COLLEGE ROOM
8:30 a.m.	Oral Session **General Session 2**	Oral Session **Technology in Outreach & Education**	Oral Session **Collections Digitization & Mobilization 2**
10:00 a.m.	Break – BALLROOM A/B		
10:30 a.m.	Oral Session **General Session 2** (cont'd)	Oral Session **Preventive Conservation**	Oral Session **Collections Digitization & Mobilization 2** (cont'd)
12:00 p.m.	Lunch (on your own)		
1:30 p.m.	**DemoCamp**	Oral Session **Preventive Conservation** (cont'd)	Oral Session **Archives & Special Collections**
3:10 p.m.			
3:15 p.m	Break – BALLROOM A/B		
3:40 p.m.	**DemoCamp** (cont'd)	Oral Session **Preventive Conservation** (cont'd)	Oral Session **Archives & Special Collections** (cont'd)
5:00 p.m.			
6:00 p.m.	**SPNHC Banquet at Amarante's Sea Cliff** (ticketed event) Shuttle transportation from the Omni Hotel begins at 5:30 p.m. Return trips run from 9:30 – 11:00 p.m.		
11:00 p.m.			

Program at a Glance

Friday, June 15

Registration
8:00 – 10:00 a.m.
2nd Floor Lobby, Omni Hotel

<table>
<tr><th>START TIME</th><th>BALLROOM C</th><th>TEMPLE ROOM</th><th>COLLEGE ROOM</th></tr>
<tr><td>8:30 a.m.</td><td rowspan="2">Oral Session
Collaborations</td><td>Oral Session
Cryo Collections</td><td>Oral Session
Three Dimensional Imaging</td></tr>
<tr><td>10:10 a.m.</td><td colspan="2" rowspan="2">Break – BALLROOM A/B</td></tr>
<tr><td>10:15 a.m.</td><td>Break – BALLROOM A/B</td></tr>
<tr><td>10:40 a.m.</td><td>Oral Session
Collaborations
(cont'd)</td><td>Oral Session
Cryo Collections
(cont'd)</td><td>Oral Session
Three Dimensional Imaging (cont'd)</td></tr>
<tr><td>12:00 p.m.</td><td colspan="3">Annual Business Meeting (lunch included) – BALLROOM A/B</td></tr>
<tr><td>1:30 p.m.</td><td colspan="3">Special Interest Groups
(Omni)</td></tr>
<tr><td>2:30 p.m.</td><td></td><td></td><td></td></tr>
</table>

Peabody Museum Collections Tours
3:00 – 5:00 p.m.
Yale Science Hill or West Campus

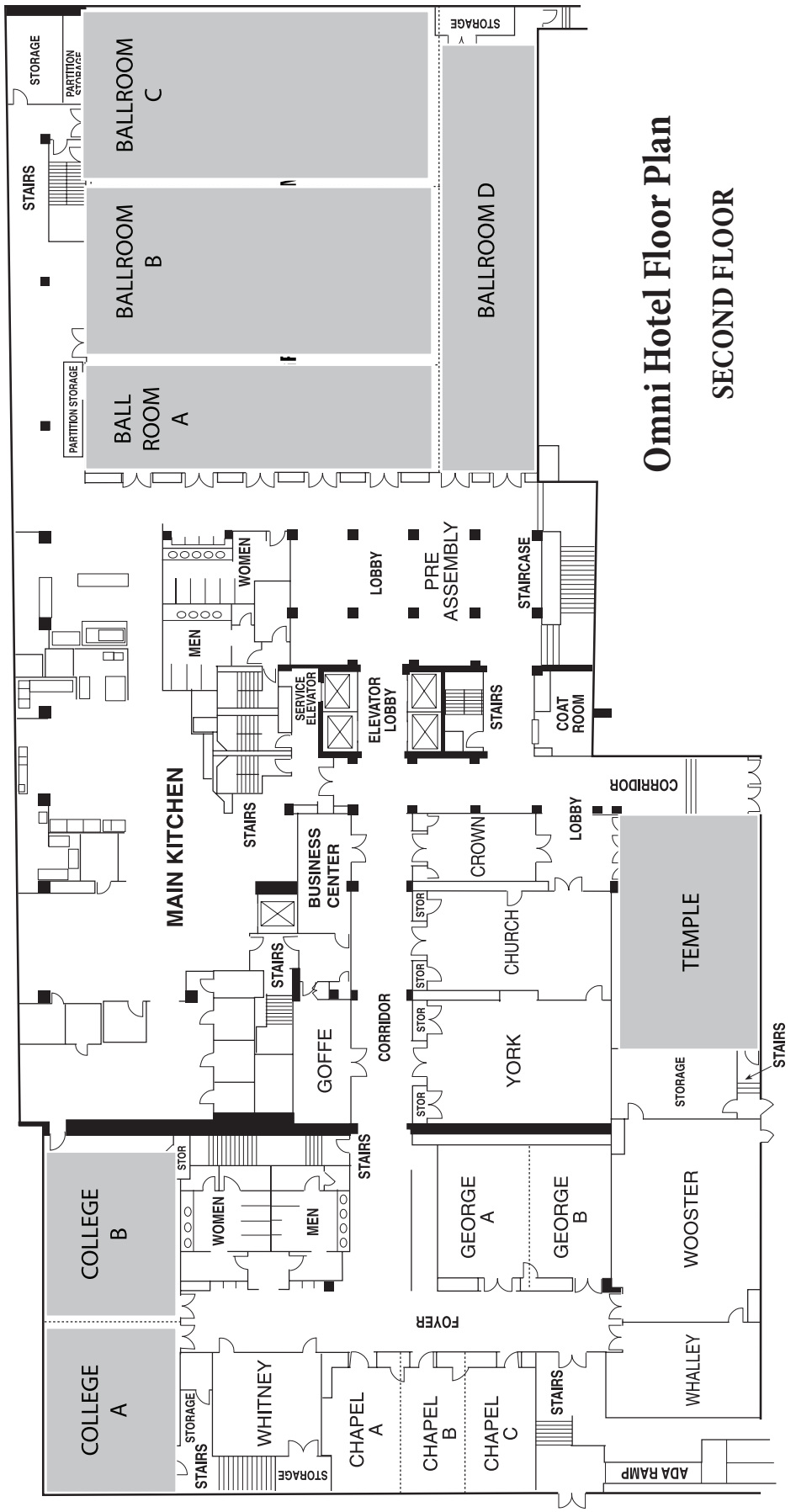
2nd Council Meeting
5:30 – 9:00 p.m.
Class of 1954 Environmental Science Center, Room 110

Saturday, June 16

FULL DAY WORKSHOPS

Forecasting the Future of Natural History Museums and Collections
8:30 a.m. – 5:00 p.m.
Yale Peabody Museum Auditorium

Stabilize This!
9:00 a.m. – 5:00 p.m.
Class of 1954 Environmental Science Center, Room 110


Omni Hotel Floor Plan
SECOND FLOOR
BALLROOM C
BALLROOM B
BALLROOM D
BALL ROOM A
STORAGE
PARTITION STORAGE
STAIRS
WOMEN
MEN
LOBBY
PRE ASSEMBLY
STAIRCASE
SERVICE ELEVATOR
ELEVATOR LOBBY
COAT ROOM
MAIN KITCHEN
BUSINESS CENTER
CROWN
CHURCH
YORK
GOFFE
CORRIDOR
TEMPLE
COLLEGE B
COLLEGE A
GEORGE A
GEORGE B
WOOSTER
WHITNEY
CHAPEL A
CHAPEL B
CHAPEL C
FOYER
WHALLEY
ADA RAMP

Detailed Program • Sunday, June 10

START	1ST FLOOR LOBBY, Omni Hotel	KLINE BIOLOGY TOWER CSSSI Stat Lab Classroom, C27
10:00 a.m		**Georeferencing Workshop• DAY 1** Presented by the University of California–Berkeley and Tulane University
6:00 p.m.	**Registration**	
8:00 p.m.		

Detailed Program • Monday, June 11

Registration • 8:00 a.m. – 4:00 p.m. • 2ND FLOOR LOBBY, OMNI HOTEL

START	CLASS OF 1954 ENVIRONMENTAL SCIENCE CENTER			KLINE BIOLOGY TOWER
	ESC 110	ESC 240	ESC 210	CSSSI Stat Lab Classroom, C27
8:30 a.m.	**Committee Meeting: Web**		**Committee Meeting: Mentorship**	
9:00 a.m.				**Georeferencing Workshop• DAY 2** Presented by the University of California–Berkeley and Tulane University
9:45 a.m.	Break			
10:00 a.m.	**Committee Meeting: Best Practices**	**Committee Meeting: Professional Development**	**Committee Meeting: Legislation & Regulations**	
11:15 a.m.	**Committee Meeting: Long-range Planning**	**Committee Meeting: Documentation**	**Committee Meeting: Publications**	
12:30 p.m.	Lunch (on your own)			
1:15 p.m.	**Committee Meeting: Membership**	**Committee Meeting: Conference**	**Committee Meeting: Conservation**	
2:30 p.m.	Break			
2:45 p.m.	**Plenary Session: Long-range Planning** (includes all committee chairs, council)			
4:45 p.m.				
6:00 p.m.	**Council Meeting** (dinner included)			
10:00 p.m.				

Detailed Program • Tuesday, June 12

Registration • 7:00 a.m. – 5:00 p.m. • 2ND FLOOR LOBBY, OMNI HOTEL
Poster Set Up • 1:00 – 5:00 p.m. • BALLROOM D, OMNI HOTEL
Vendor Set Up • 1:00 – 6:00 p.m. • BALLROOM A/B, OMNI HOTEL

<table>
<tr><th colspan="5">FIELD TRIPS</th></tr>
<tr><td>START</td><td colspan="4">DEPART FROM REGISTRATION BOOTH, OMNI HOTEL, 2ND FLOOR LOBBY</td></tr>
<tr><td>8:00 a.m.</td><td rowspan="9">Bird-watching</td><td></td><td></td><td></td></tr>
<tr><td>8:30 a.m.</td><td rowspan="10">Connecticut Geology</td><td></td><td></td></tr>
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</table>

Detailed Program • Wednesday, June 13 • Morning

Registration • 7:00 a.m. – 4:00 p.m. • 2ND FLOOR LOBBY, OMNI HOTEL

Trade Show • 1:00 – 5:00 p.m. • BALLROOM A/B, OMNI HOTEL

<table>
<tr><td rowspan="2">START</td><td rowspan="2">SHUBERT THEATER</td><td colspan="2">OMNI HOTEL</td></tr>
<tr><td>BALLROOM D</td><td>HARBOUR & DAVENPORT ROOMS, 19TH FLOOR</td></tr>
<tr><td>7:00</td><td></td><td></td><td rowspan="2">New Participant Breakfast
(ticketed event)</td></tr>
<tr><td>7:30</td><td></td><td>Poster Set Up</td></tr>
<tr><td>8:30</td><td>OPENING SESSION
WELCOMING REMARKS

Tim White
Co-chair, SPNHC 2012
Jean-Marc Gagnon
President, SPNHC
Derek Briggs
Director, Yale Peabody Museum
Peter Salovey
Provost, Yale University</td><td></td><td></td></tr>
<tr><td>9:00</td><td>KEYNOTE ADDRESS
Moderator: Susan Butts

From the Page to the Pixel:
Science Writing Goes Online
Carl Zimmer</td><td></td><td></td></tr>
<tr><td>10:00</td><td colspan="3">Break – BALLROOM A/B, OMNI HOTEL</td></tr>
<tr><td></td><td>PLENARY SESSION
Moderator: Meg Bellinger</td><td></td><td></td></tr>
<tr><td>10:30</td><td>Implementation
May Be Problematic
Kenneth Hamma</td><td></td><td></td></tr>
<tr><td>11:00</td><td>Collaborative
Digital Research
Dominic Oldman</td><td></td><td></td></tr>
<tr><td>11:30</td><td>Digital Preservation
—A Different Animal
in Surprising Ways
Paul N. Courant</td><td></td><td></td></tr>
<tr><td rowspan="2">12:00 p.m.</td><td colspan="3">Lunch (on your own)</td></tr>
<tr><td colspan="3">Vendor Lunch – TEMPLE ROOM (ticketed event)</td></tr>
</table>

Detailed Program • Wednesday, June 13 • Afternoon

START	BALLROOM C	START	COLLEGE ROOM
	COLLECTIONS DIGITIZATION & MOBILIZATION 1 Moderator: Patrick Sweeney		**GENERAL SESSION 1** Moderator: Catherine Sease
1:30	**Common and effective digitization practices in biological and paleontological collections** Nelson & Paul	1:30	**The physicochemical characteristics and conservation of fossil resins (amber)** Nascimbene, Bisulca, Elkin, Grimaldi
1:50	**Digitizing North American lichen and bryophyte specimens** Thiers, Gries, Nash, Gilbert	1:45	**Constructive decision-making for destructive sampling: An example for isotopic geochemistry** Clementz, Holroyd
2:10	**Plants, herbivores, and parasitoids: A model system for the study of tri-trophic associations** Tulig, Naczi, Rabeler, Magill, Schuh	2:00	**Documenting and communicating about toxins in collections** DeMouthe
		2:15	**Hazard identification and exposure assessment of conservation occupational work tasks associated with anthropological collection objects** Makos
2:30	**Large volume digitization: How to spend 18 million dollars** van der Mije	2:30	**A ticking time bomb: Acid-caused decay of mammal skins** Quaisser, Giere, Willborn, Bartsch
2:50		2:45	**Towards best practice in mounting and conservation of botanical specimens** Yesilyurt, Collins, Santana
3:00	**Poster Sessions** – BALLROOM D	3:00	**Poster Sessions** – BALLROOM D
4:00	**Building a service centre for outsourcing large-scale digitisation** Saarenmaa, Tegelberg, Pajari, Mononen, Hyvönen, Shah, Haapala	4:00	**Developing methods for the use of pulped paper in archival fossil repair** Vital
4:20	**A names-based cyberinfrastructure—What can names management offer to collection management** Patterson	4:15	**Protecting collections and integrated pest management challenges: A twelve-year perspective** Hites, Revelez
4:40	**Digital representations: An approach to best practice for data sharing** Giere	4:30	**New approaches to combat an old infestation: Webbing clothes moths at the Natural History Museum, a case study** Mendez, Ryder, Smith
		4:45	**Innovation through interdisciplinary exchange: Restoration of the North American mammal habitat dioramas** Sybalsky, Palumbo, Nunan, Levinson, Elkin
5:00		5:00	**Rising to a challenge: Embedding museum conservation with natural history at the National Museum Wales** Buttler, Carter, Purewal
		5:15	**ConservationSpace** McCarthy
5:30	**Consortium of Northeastern Herbaria Business Meeting**	6:00	**SALIX Workshop**
7:30		7:30	

Detailed Program • Thursday, June 14 • Morning

Registration • 8:00 a.m. – 4:00 p.m. • 2ND FLOOR LOBBY, OMNI HOTEL
Trade Show • 8:00 a.m. – 3:40 p.m. • BALLROOM A/B, OMNI HOTEL • **Vendor Breakdown** • 3:40 – 7:00 p.m.
Poster Removal • 5:00 – 7:00 p.m. • BALLROOM D, OMNI HOTEL
SPNHC Banquet at Amarante's Sea Cliff • 6:00 – 11:00 p.m. (ticketed event)
Shuttle transportation from the Omni Hotel begins 5:30 p.m. • Return trips 9:30 – 11:00 p.m.

START	TEMPLE ROOM
	TECHNOLOGY IN OUTREACH & EDUCATION Moderator: Bill Watson
8:30	**Building a 21st century natural history museum** Watson
8:45	**21st century learning in natural history settings:** **Perspectives from conference attendees** Babcock, Chandler, Dasari, Flannery, Norris, Pickering, Sullivan
9:00	**Networking nature: Building cybercabinets of digital curiosities** Sargent
9:15	**Innovative educational and collection management tools** **for natural history museums** Mavrogianni, Marianos, Gkinis, Maroudas, Tsilivigkos
9:30	**Riding the World Wide Web to fame and fortune** Mayer, Grant
9:45	**iCBUG: The Peabody's collections in nature's classroom** Piel, Gall, Pickering, Shyket, Sweeney
10:00	Break – BALLROOM A/B
	PREVENTIVE CONSERVATION Moderators: Cathy Hawks and Lisa Elkin **Co-sponsored by the American Institute for Conservation of Historic and Artistic Works**
10:30	**Introduction**
10:40	**Resources for preventive conservation and collections care** Fifield, Arenstein, Gleeson
11:00	**Cultural property risk analysis:** **A report on the state of the art as revealed at the 2011 International Symposium** Waller
11:20	**Protecting collections: Tools to engage climate dialogues with conservators,** **engineers, collection managers and facilities managers** Grzywacz
11:40	**Research on energy savings opportunities: System shutdowns and cultural institutions** Linden, Reilly, Herzog
12:00 pm	Lunch (on your own)

Detailed Program • Thursday, June 14 • Morning

START	BALLROOM C	COLLEGE ROOM
	GENERAL SESSION 2 Moderator: Greg Watkins-Colwell	**COLLECTIONS DIGITIZATION & MOBILIZATION 2** Moderator: Susan Butts
8:30	**Larger collection yet smaller location: Moving the ichthyological and herpetological alcohol collections of NCB Naturalis** de Ruiter	**Maximizing data generation workflow: Two case studies from the New York Botanical Garden** Asencio, Gottschalk
8:45	**From *Acris* to *Xenopus*: Recuration of amphibians at Yale Peabody Museum** Smith, Watkins-Colwell, Skelly	**A shift in strategy for digitizing a large herbarium: Implications for managing the collection** Tarnowsky
9:00	**Developing a new national museum of natural history at Tel Aviv University** Furth	**Meeting the demands of rapid digitization —Imaging and archiving plant specimens** Bevans
9:15	**Herbarium in a public library's history room** Flannery	**Streamlining herbarium specimen digitization using optical character recognition** Gottschalk, Kirchgessner, Watson
9:30	**The Barneby Legume Catalogue: An integration of specimen data and published text** Santos Lorenzo, Tulig	**GIGAmacro technology for high-resolution digitization of specimens** Cooper, Cooper
9:45	**RCIS developments at NMNH** Brown, M.; Orrell, T.	**Advances in the computational photography tools: Reflectance Transformation Imaging (RTI) and Algorithmic Rendering (AR)** Schroer, Mudge
10:00	Break – BALLROOM A/B	
10:30	**One name, one fungal species: Implications for the herbarium and the database to the rescue** Dominick, Rossman	**Museum protocols serving as a standard for workflows and a support document for activities: A case study** Alonso-Perez, Ford
10:45	**The rewards of having counted** Brouillet	**Maintaining a mineral collection in an evolving geosciences department: Progress toward preservation** Holl, Hollister, Duffy
11:00	**Creating collection relevance: A museum's guide to values assessment** Work	**Conservation and digitization of Compendium Index of North American Mesozoic and Cenozoic Type Fossil Plants at the Peabody Museum** Hu, Hickey
11:15	**Developing a flexible collections competency system for Europe** Huxley, Maldar	**Using specimen collections databases to highlight significance of animal pollinators: a case study from East Africa** Otieno, Muchai, Oyieke
11:30	**Federal interest in scientific collections: A status report on two interagency working groups** Schindel, Miller, Bartuska, Jones	**Using herbarium databases to deduce plant associations** Landrum, Lafferty, Baker
11:45	**Managing a collection of students** Watkins-Colwell	**Sam Mitchel Herbarium of Fungi: A case study in the future of collection information in a digital world** Toner
12:00 pm	Lunch (on your own)	

Detailed Program • Thursday, June 14 • Afternoon

Registration • 8:00 a.m. – 4:00 p.m. • 2ND FLOOR LOBBY, OMNI HOTEL
Trade Show • 8:00 a.m. – 3:40 p.m. • BALLROOM A/B, OMNI HOTEL • **Vendor Breakdown** • 3:40 – 7:00 p.m.
Poster Removal • 5:00 – 7:00 p.m. • BALLROOM D, OMNI HOTEL
SPNHC Banquet at Amarante's Sea Cliff • 6:00 – 11:00 p.m.
Shuttle transportation from the Omni Hotel begins 5:30 p.m. • Return trips 9:30 – 11:00 p.m.

START	COLLEGE ROOM
	ARCHIVES & SPECIAL COLLECTIONS Moderator: Rusty Russell **Co-sponsored by the Council for Library & Information Resources**
1:30	**21st century approaches to 17th century collections: Aspects of access to, conservation and security of the early botanical collections of the Natural History Museum, London** Huxley
1:45	**Creating serendipity: How collaboration and a shared database can lead to eureka moments** Utrup
2:00	**Catherine Parr Traill and Adam White: Challenges met and discoveries made while conserving their historical botanical scrapbooks** Metsger, Cowan, Dickinson
2:15	**The American Museum of Natural History Archive Project** Mathé, Lee, Morgan
2:30	**Integrating paleobiological and archival informatics in the cataloging of the University of California Museum of Paleontology archives** Holroyd, Marshall
2:45	**Archives at the Yale Peabody Museum of Natural History: The anatomy of a university natural history museum and the evolution of science in America** Drew
3:00	**What Henderson saw: Extracting observations from century-old field notebook** Thomer, Vaidya, Guralnick, Bloom, Russell
3:15	Break – BALLROOM A/B
3:40	**The ecosystem of the archive: Scholarly and public interaction with natural history collections** Stinson
3:55	**The Field Book Registry: Bringing consistency and cohesion to distributed collections** Sheffield, Russell
4:10	**Discussion**
4:25	**Discussion**
4:40	**Discussion**
5:00 p.m.	

Detailed Program • Thursday, June 14 • Afternoon

START	BALLROOM C	TEMPLE ROOM
	DEMOCAMP Moderator: Amanda Neill	**PREVENTIVE CONSERVATION** Moderators: Cathy Hawks and Lisa Elkin **Co-sponsored by the American Institute for Conservation of Historic and Artistic Works**
1:30	**GIGAmacro: Creating gigapixel photographs of macro and micro specimens** Cooper, Cooper	**Microenvironments: Their future use and potential in the control of deterioration mechanisms in organic and inorganic materials** Collins
1:50	**Reflectance Transformation Imaging (RTI) for empirical documentation of natural history collections** Schroer, Mudge	**Effectiveness of entomological collection storage cabinets in buffering environmental fluctuations in historic museum buildings** Szczepanowska, Hawks, DePriest, Furth, Gentili-Poole, Bell, Shockley, Mecklenburg
2:10	**High-throughput 3-D pinned insect data capture** Sieracki, Favret	**Illumination and preservation of museum exhibitions: Tempering the beast with new technology** Weintraub
2:30	**EGEMS electronic geological management system: Preserving geological materials and information for our future** Timm	**The use of microfading to manage the risk of light-fading during display** Ford, Smith
2:50	**Georeferencing natural history collections data: The GEOLocate Project** Rios, Bart	**Defensible collections: Designing a safe exhibit space** Hirsh, Harris
3:10	Break – BALLROOM A/B	
3:40	**Connecting expert knowledge to specimens: remote annotation of data in a Filtered Push network** Morris, Macklin, Dou, Hanken, Kelly, Lowery, Ludaescher, McPhillips, Morris	**Application of preventive conservation to solve the coming crisis in collections management** Simmons
4:00	**Collaborative digitization workflows with Specify** Bentley	Panel
4:20	**Natural selection: Finding specimens in a natural history collection** van der Mije	Panel
4:40	**The Apiary Project—A framework and workflow for extraction and parsing of herbarium specimen data** Best, Neill, Moen	Panel
5:00		

Detailed Program • Friday, June 15 • Morning

Registration • 8:00 – 10:00 a.m. • 2ND FLOOR LOBBY, OMNI HOTEL

START	BALLROOM C
	COLLABORATIONS Moderator: David Schindel
8:30	**Doing it digitally: A 25-year Peabody perspective** Gall
8:45	**Shared digital infrastructure—An institutional approach** King
9:00	**Consortium of Northeastern Herbaria: A regional, data-sharing collaboration** Sweeney
9:15	**Opening access to works in the public domain at Yale University** Fournier
9:30	**The PBI Miconieae project:** **A complete web-based monograph of the tribe Miconieae (Melastomataceae)** Watson, Tiernan, Michelangeli, Tulig
9:45	**An overview of the Global Plants Initiative** Mozzicato, Tulig
10:00	**BiSciCol—A community effort and toolkit to link-up,** **tag and track biological collections data more effectively** Stucky, Ziemba, Deck, Guralnick, Beaman, Cellinese
10:15	Break – BALLROOM A/B
10:40	**Integrated Digitized Biocollections (iDigBio)** **cloud-based cyberinfrastructure** Fortes, Figueiredo, Matsunaga, Thompson, Collins, Xu
10:55	**Canadensys—How we built a national biodiversity data network** Desmet, Bruneau
11:10	**Biodiversity Information Serving Our Nation (BISON):** **The national resource for discovery, linkage and re-use of organismal occurrence data** Simpson, Martín, Masaki, Guala
11:25	**CollectionSpace: Museums, higher education** **and community source collaboration** Forbes, Spinazze
11:40	**Integrating biodiversity distribution knowledge:** **Toward a global map of life** Jetz, Guralnick
12:00 pm	Lunch (on your own)

Detailed Program • Friday, June 15 • Morning

START	TEMPLE ROOM	COLLEGE ROOM
	CRYO COLLECTIONS Moderator: Breda Zimkus	**THREE DIMENSIONAL IMAGING** Moderator: Holly Rushmeier
8:30	**THE Big Chill: A framework for the conversion of the Museum of Vertebrate Zoology genetic resources collection from ultra-cold to liquid nitrogen storage** Trápaga, Spencer, Cicero, McGuire	**3D and hyperspectral scanning at the Yale Graphics Laboratory** Rushmeier
8:50	**The Molecular Collections Facility at the Natural History Museum, London** Huxley, Mackenzie-Dodds	**3D imaging of the structural and geometrical properties of avian nests** Lill, Zyskowski, Bertrand, Shattuck, Prum, O'Hern
9:10	**The Smithsonian's pan-institutional frozen collections** Huddleston, Mullins	**Evolutionary morphing** Amenta, Wiley, Ghosh, Delson, Tallen, Harcourt-Smith, Frost, Rohlf
9:30	**The Global Genome Initiative: Building the genomic collection from across the Tree of Life** Coddington, Butler, Barker	**From organismal- to millimeter-scale: Methodologies for studying patterns in color and direction of the reflectance from avian organisms** Harvey, Bostwick
9:50	**Survey of genetic resource collections associated with natural history collections** Zimkus, Ford	
10:10	Break – BALLROOM A/B	
10:40	**Analysis of national and international biorepository standardization** Demchok, Cho, Lockhart, Moore, Vaught	**Using terrestrial laser scanning to construct 3D imagery and models of a Eubrontes trackway at Dinosaur State Park, Rocky Hill, Connecticut** Hyatt, Rosiene
11:00	**DNA barcoding for collection management and QA/QC: USNM birds case study** Schindel, Trizna, Graves, Milensky	**Digitizing the Thera frescoes: Practical 3D acquisition methods for museum conservation** Toler-Franklin
11:20	**Herbarium collections and DNA barcode reference libriaries: Complementary benefits and hidden dangers** Kuzmina	**3D imaging at the Yale University Art Gallery** ffrench
11:40		
12:00 pm	Annual Business Meeting (lunch included) – BALLROOM A/B	

Detailed Program • Friday, June 15 • Afternoon

Registration • 8:00 – 10:00 a.m. • 2ND FLOOR LOBBY, OMNI HOTEL

START	OMNI HOTEL	YALE SCIENCE HILL / WEST CAMPUS	CLASS OF 1954 ENVIRONMENTAL SCIENCE CENTER
1:30	**Special Interest Groups** STASH: Collaborations in Storage Methods and Practices Collections Issues: Herbaria Collections Issues: Cryo and Tissue Collections Databases, Collecting and Shipping —Permits and Regulations Grants and Funding Opportunities EMu Community Developments Best Practices for Natural History Collections Environments		
2:30			
3:00		**Peabody Museum Collections Tours**	
5:00			
5:30			**2nd Council Meeting**
9:00			

Detailed Program • Saturday, June 16

START	FULL DAY WORKSHOPS	
	YALE PEABODY MUSEUM AUDITORIUM	CLASS OF 1954 ENVIRONMENTAL SCIENCE CENTER ROOM 110
8:30 a.m	**Forecasting the Future of Natural History Museums and Collections**	
9:00 a.m.		**Stabilize This!**
5:00 p.m.		

Oral and Poster Presentation Abstracts

In the case of oral presentations with more than one author, presenter names are underlined.
DemoCamp abstracts are provided in a separate section following the Poster and Oral Presentation abstracts.

POSTER

Detecting arsenic in vertebrate specimens at the Michigan State University Museum using a handheld X-ray fluorescence (XRF) analyzer

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The X-ray fluorescence (XRF) analyzer is a useful tool for detecting and quantifying arsenic and other pesticide components in museum specimens. Accurate analytical data are provided rapidly and without damaging the specimen being tested. In 2012, arsenic detection tests were conducted on 1,077 vertebrate specimens at the Michigan State University Museum, using a Niton XLt 700 handheld XRF analyzer. Tested specimens included bird and mammal study skins, and taxidermy-mounted fishes, reptiles, birds, and mammals; collecting dates ranged from 1863 to 2006.

According to Niton, the XLt 700 will accurately detect arsenic up to a depth of 3.18 mm, with a lower level for arsenic detection of 10 parts per million (ppm) when no lead is present; arsenic data are automatically corrected for lead interference. Over a 13-day period, 2,046 samples were collected, with each specimen sampled from 1 to 5 times. Within-specimen samples represent different anatomical and structural features (e.g., beak, face, horn, seam, base). Of the 1,077 specimens tested, all but 3 showed detectable arsenic. There was little consistency across sampling locations within a specimen; arsenic was detected at all types of testing locations, including on the base of many of the taxidermy mounts. Surprisingly, horns, antlers, and hooves of taxidermy-mounted mammals often gave positive readings. Arsenic concentrations were above 100 ppm in 67% of the samples collected and above 100,000 ppm in 3% of the samples. Analysis of data over multi-decade spans indicated a declining trend in specimen arsenic content.

Data from the XRF analyzer, including element readings, spectra, and images of sampling locations are being incorporated into the Museum's specimen records. The MSU Environmental Health and Safety office is working with Museum staff to refine specimen-handing procedures and labeling protocols and develop a training program for staff and regular users of these collections.

POSTER

Developing digital resources for the University of Iowa Paleontology Repository Amoco Conodont Collection

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In 1998, the Amoco Production Company merged with BP and distributed their paleontology collections among several institutions: University of Iowa (conodonts); University of Kansas (foraminifera); Texas A&M University (modern pollen, microfossils); University of Oklahoma (megafossils); and University of California at Berkeley (foraminifera). In 2006, the University of Iowa Paleontology Repository received National Science Foundation funding to digitize the Amoco Conodont Collection. This collection consists of cavity slides of picked material from approximately 1,400 localities worldwide. The specimens were accompanied by a relational database in Microsoft Access containing three tables: locality, stratigraphy, and specimens; over 29,000 records in total. The collection was prioritized for digitization because of the potential loss of data with changes in software and hardware. Initially, data were reformatted and prepared for bulk transfer into the Specify Biodiversity Software 5.2.3 collection database. However, while slides were being numbered and checked against the database, discrepancies in the data were discovered. Over 5,000 slides were listed but not present in the collection and approximately 5,000 slides were present but not listed in the database. Full stratigraphic data were not included in the database, but had to be gleaned from printed locality files. Batch upload to Specify and individual record entry both had advantages and drawbacks. To realize the potential of the collection and its associated documentation, a website is being developed to provide access to the specimen data, locality files, and species reference collection. Public interest features are being developed, including interviews with former Amoco paleontologists about collecting and processing procedures. The potential for collabo-

ration with institutions holding other Amoco collections is being investigated.

POSTER

Engaging students in hands-on and project-based learning—Using specimen preparation as an educational tool in the MVZ Undergraduate Program

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Any zoological researcher or institution that has long-term projects and research goals should be concerned with the creation of a scientific legacy and with training the next generation of scientists. In a recent New York Times article "Why Science Majors Change Their Minds," the problem of retention of science majors in top institutions was emphasized. Although project-based learning has been found to be more effective than lectures in engaging students and in teaching them the scientific method, few institutions have found ways to implement it on broader scales. Project-based learning that directly involves students in research takes time and resources, and thus many institutions struggle to find ways to increase the number of students involved without compromising the quality of data collection and analysis. If we find more ways to engage students in science, it will benefit our long-term goals as zoologists as well as science in general. In response to this challenge, the Museum of Vertebrate Zoology (MVZ) has created a tiered system of learning, with introductory museum courses that allow for entry-level students with no previous knowledge of zoology to learn the basics of vertebrate anatomy and evolution, specimen preparation, and gathering quality data in a supportive hands-on learning environment. From there, the MVZ undergraduate students can pursue molecular or specimen-based lab work, fieldwork, and eventually, their own independent research projects. The MVZ Undergraduate Program has over 120 students involved each semester, with a high rate of student retention. In 2008, it won the UC Berkeley Education Initiatives Award. This poster will present the MVZ approach to undergraduate education, specifically highlighting our specimen preparation lab that benefits the students, the museum, and the broader University. Our program also increases undergraduate awareness about the scientific method and possible career paths in organismal biology and museum science.

ORAL

Museum protocols serving as a standard for workflows and a support document for activities: A case study

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Workflow protocols have long been a staple of industry and have recently become a topic for museum activities. Museums have, in fact, been doing baseline workflows in their general protocols and procedures. In the busy museum setting, unfortunately, protocols are frequently viewed as a time-consuming step that is not really necessary. As museum activities fall under more scrutiny from various sources, however, well-developed protocols serve to streamline, facilitate, and support the activities within a museum collection.

We will present a case study on the authority of protocols to run efficiently and to support a standard inventory of a valuable collection at the Harvard Mineralogical Museum (HMM), which because of its economic value involved higher administrative interest in the process. The collection, consisting of 1054 objects, was physically inventoried, photographed, and updated in the museum database in a total of 48 hours by a team of four people.

The protocol for this successful project consisted of four sections (introduction, methodology, procedure, and glossary) and described the general workflow of the assessment in a manner useful for collection experts and administrators. In addition, daily memo reports and an addendum were appended to document the process and minor adjustments in the protocol during the inventory.

Within a museum, any collection activity can benefit from a well-developed protocol by anticipating the forthcoming problems through defining an optimal workflow, allowing museum staff to work consistently according to a previewed plan, and providing the means for activity results to stand alone during subsequent evaluation. With respect to broader goals, protocols also serve as tools to achieve best practice standards, establish robust baseline indicators, and document an historical record of museum activities.

ORAL

Evolutionary morphing

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Primate evolution is a highlight in many natural history museums. Paleontologists model the gradual cranial changes between species as an interpolation between their shapes. By capturing three-dimensional cranial surfaces with a laser range scanner, and then interpolating the digitized surfaces, we can reify this model. We show the 3D shape change across a tree of Old World Monkeys, producing 3D cranial shapes for the hypothetical ancestor nodes. Comparing fossils to these hypothetical ancestors is interesting. We show some examples of fossil reconstructions, including computer symmetrizations of flattened crania, and the morphological hypotheses about how the fossils should be placed into the tree.

POSTER

Connecting the dots: Wireless data nodes and environmental planning

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Most museums are challenged by their environmental systems. To get an idea of what the conditions are we collect the data, from a wide range of tools, everything from humidity cards to hygrothermographs to data loggers. The data accumulates into piles of paper which are hard to integrate and interpret. HVAC failures sometimes are not caught until the data is downloaded, sometimes weeks later.

In 2010 the Carnegie Museum of Natural History (CMNH) was awarded an IMLS-CPS grant to conduct an environmental survey of the museum's buildings and collections. The project is a collaboration between CMNH Conservation and the Facilities, Planning and Operations Department, to develop a comprehensive and effective environmental monitoring system to better understand environmental risk factors threatening the preservation of collections and the landmark museum building. The accurate monitoring system will allow us to move forward with improving environmental management systems and with integrated planning to improve mechanical systems, we can then accurately assess preservation environments for collections and the landmark building. With these data sets and working closely with consultants from Landmark Facilities Group, we will be able to apply methods to achieve environmental standards as set by conservation research, reducing risk factors to collections.

We are half-way through the process. This poster illustrates both the challenges we have faced in setting up a wireless system in an old landmark building and the successes we are already seeing in identifying and reporting, and improvement of data collections and management.

POSTER

Re-housing archaeological textiles during the National Museum of the American Indian collections move

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[3]National Museum of the American Indian, Cultural Resources Center, 4220 Silver Hill Rd., Suitland, MD 20746 USA

The NMAI's archaeological textile collection was stored in plastic bags and layered in small wooden drawers at the old storage facility in the Bronx, NY. A directive of the Museum is to have the collection be easily accessible and visible for both Native Communities and scholars. The original re-housing proposal was to place each textile fragment into a portfolio that could be flipped to view both sides. This option was not approved because it would have taken too much staff time during the move of 800,000 museum objects to the new Cultural Resources Center in Suitland, MD. The alternative was to leave the textiles in their plastic bags or find a more time efficient solution. A method was developed using folded Tyvek "trays" with tied corners attached to acid-free support boards. These trays can be opened and flattened so that textiles could be turned over using a secondary support board. Several trays can be fitted into archival boxes and stored on shelves. The textiles can be viewed when box lids are removed. Many trays can be made in the time it takes to make one portfolio.

ORAL

Maximizing data generation workflow: Two case studies from the New York Botanical Garden

Asencio, D.S.; Gottschalk, S.D.

The William and Lynda Steere Herbarium, The New York Botanical Garden, 2900 Southern Blvd., Bronx, NY 10458 USA

The workflow of large-scale cataloguing projects can greatly benefit from accessing data from various sources. These include, but are not limited to, duplicate specimen data from other institutions, data from nearby specimen collections, and field book information. Among these, we have found the use of field books to be a highly-effective method of harvesting data for both the Brazilian Amazon and Caribbean Digitization Projects. Projeto Flora, a project led by the New York Botanical Garden (NYBG) in the late 1970s until the mid-1980s, has enabled the acquisition of highly accurate Amazonian Brazil collection data from field books. Similarly, NYBG archives house field books for Caribbean collectors going back to Nathaniel Lord Britton, the Garden's founder.

These represent an estimated 75 percent of Caribbean collectors with collections in the Steere Herbarium. Although care is needed when matching old specimen labels with old field book data, we have found that in some cases different field book information can actually augment less informative specimen labels. We have also found this method to be more efficient than entering data from the labels directly. A total of 53,920 Amazonian specimen collection events were created using field books. An average of 641 collection records were created each day using this method, though productivity has been as high as 1,557 records created in a single day. Similar rates have been observed for the Caribbean Project, which is ongoing.

ORAL

21st century learning in natural history settings: Perspectives from conference attendees

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In February 2012, the National Museum of Natural History hosted the 21st Century Learning in Natural History Settings Conference. This conference was one component of the project funded by the National Science Foundation with the same title. The purpose of the project is to develop, initiate, and disseminate a collaborative and sustained learning research agenda to inform how natural history museums can best use their resources, including collections, to support audiences in the 21st century.

The conference included 100 participants from institutions across the US and three international organizations. Attendees represented a variety of natural history settings, including natural history museums, zoological parks, nature centers, and science centers. The composition of attendees themselves represented various aspects of each institution, including educators, scientists, administrators, and learning researchers.

Participants engaged in several pre-conference activities to begin the dialogue. These included an online chat, internal institutional discussions, and development of a virtual poster. The conference itself included whole-group discussions, various working groups, multiple opportunities for networking, a conference Wiki, and several keynote speakers.

The four-day conference resulted in the development of a Call to Action and a Learning Research Agenda. Both outcomes are meant to guide and transform how natural history museums connect with our audiences, utilizing our unique assets in progressive and innovative ways. Several SPNHC members attended the conference and will share their perspectives, ideas, and action items inspired by the workshops.

ORAL

Meeting the demands of rapid digitization—Imaging and archiving plant specimens

Bevans, M.

The William and Linda Steere Herbarium, The New York Botanical Garden, 2900 Southern Blvd., Bronx, NY 10458 USA

The current demand for biological collections has led to an increased demand for images of plant specimens while the proliferation of digital media has led to increased expectations for the use of images. The New York Botanical Garden Herbarium has been digitally photographing its plant specimen collection since 1998. Advances in digital photography have allowed us to produce larger, higher quality images at a greater rate of speed than ever before. This presentation will cover the methods used to ensure consistent image quality during production and post-production as well as the challenges we face maintaining and modernizing our rapidly expanding digital archive. Topics discussed include selection of photography equipment and image capture, archive strategies and file formats, and preparing images for access and optical character recognition.

POSTER

Vertebrates in the cloud (VertNet.org): Are we there yet?

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[4]University of Kansas Biodiversity Institute, University of Kansas, 1345 Jayhawk Blvd., Lawrence, KS 66045-7593 USA

The NSF-funded VertNet project brings together FishNet2, MaNIS, HerpNET, and ORNIS into a single cloud-based platform for querying, visualizing, and annotating distributed vertebrate biodiversity data. VertNet will combine the four vertebrate data networks into a single portal, making it easier for researchers to aggregate and synthesize data across all vertebrates. VertNet will provide five new and improved features, including: 1) sustainable solutions (no local servers and fewer IT

problems); 2) improved performance and reliability (faster searching, better visualization, more mapping features); 3) ease of discoverability (creating a thesaurus of synonyms for taxonomy and geography); 4) data improvement (enabling annotations from users, potential crowd-sourcing); and 5) better integrations with other projects (including Arctos and Specify, Map of Life, Encyclopedia of Life, AmphibiaWeb, iNaturalist). Development of VertNet APIs (Application Programming Interfaces) will be available to any online project for searching and visualizing VertNet data. For example, the Map of Life project will use VertNet APIs to display data points for species distribution maps while VertNet will display species range maps generated by Map of Life. In addition to infrastructure development, VertNet has been very active in outreach. Since January 2011, we have given six georeferencing workshops (in South Africa, Alabama, California, and North Carolina) that have trained 129 people from 13 countries. A Biodiversity Informatics Training Workshop held in June 2012 at Boulder, Colorado, trained an additional 25 students from 9 countries. We will work with institutions from existing networks over the next 6 months to put their data in the cloud, and the new prototype VertNet portal will be functional within the year.

POSTER

Digitising the bird egg card index of the Natural History Museum, London

Brooks, L.

Natural History Museum, Cromwell Rd., London SW7 5BD, United Kingdom

The 153 drawer card index is the only complete record of the collection of birds' eggs held by the museum and has been identified as a security and preservation priority. The scope of the task was to undertake a feasibility study for the creation of a digital equivalent of the resource and to determine a suitable workflow.

A trial drawer was digitised using a combination of flatbed and automatic document fed (ADF) scanners. Cards were divided into two groups: simple annotated index cards, or envelopes containing miscellaneous extra materials. Standard cards were imaged 25 at a time using the ADF, non-standard cards and their contents were imaged individually using the flatbed. To ensure cards could be easily traced from their digital surrogates, cards were numbered and this number was used to name the corresponding image files. The registration number (if present) and scientific name(s) on the card were recorded from the scanned images in an Access database. For registered specimens, this data and the corresponding images will be imported into the museum's collection management software and will be accessible via a web browser.

The trial drawer contained 681 cards and produced 739 images. This was made up of 507 'standard' cards producing 509 images and 174 'non-standard' cards producing 230 images. Preparing the cards for imaging took 4 hours. Standard cards were scanned at a rate of 25 per minute, non-standard at a rate of 1 per minute. Total imaging time was 3 hours 50 minutes. 1 hour was needed to post-process the images. Databasing the cards at a rate of 2 minutes per card took a total of 22 hours 42 minutes. Thus the total time taken to digitise one drawer was 31 hours 51 minutes.

It was possible to create a basic but expandable and functional digital surrogate of the bird egg card index using the available resources. Using the established methodology, digitising the entire card index of approximately 110,000 cards would take around three years of work.

ORAL

The rewards of having counted

Brouillet, Luc

Marie-Victorin Herbarium, Biodiversity Centre of the Université de Montréal, 4101 Sherbrooke E, Montreal QC, H1X 2B2 Canada

Planning prior to moving a collection implies knowledge of the identity and number of items it preserves. Natural history collections do not always have such metadata, as was the case for the Marie-Victorin Herbarium (MT). We also wanted to change the classification system from Dalla Torre & Harms to APGIII. Therefore, moving to the new facility required that the specimens be counted with enough detail to be able to assign genera to APG families and to provide expansion room. Specimens were counted by 36 Friends of the Montreal Botanical Garden in 2010 and the results compiled in a spreadsheet by genus and geography. Each genus then was assigned to a family by the curator. Afterwards, the contents were given a destination in the new cases, taking into account the number of specimens per family and a decompression factor. The contents of each tablet was labeled according to its destination, which ensured a smooth moving later on. All that counting, however, turned out to have its own reward: we now have metadata for the herbarium (http://data.canadensys.net/ipt/resource.do?r=mt-inventory), which everyone can consult. Thus, a researcher interested in a group could download the file and determine whether the herbarium has material of interest before borrowing. Another benefit is that we can now characterize the collection, both geographically and taxonomically. We now know how many specimens we have with some accuracy, and which families are missing from the collection to plan acquisitions. We have a list of all genera present in the herbarium, of great help with digitization. Integrated into the management system, the genus data can help users locate material in the collection. Although it re-

quired a lot of time, counting the herbarium specimens has provided us with new tools to manage the collection and to make it better known.

ORAL

Rising to a challenge: Embedding museum conservation with natural history at the National Museum Wales

Buttler, B.; Carter, J.; Purewal, V.

National Museum Wales, Cathays Park, Cardiff CF15 8LF, United Kingdom

The National Museum Wales (NMW) is a multidisciplinary museum with collections of art, archaeology, social history, industry and natural history. It has long been recognised that art and archaeological objects need specialised conditions and conservation expertise to survive, but until relatively recently natural history specimens had not been given the same level of care. This was the situation at the NMW until the late 1980s when an extensive review of conservation at the museum was undertaken. This resulted in the establishment of a Conservation Unit to tackle the backlog of conservation, initially for a period of 5 years (1988–1993). A Head of Conservation was established and new posts created in areas lacking conservation cover. This included natural history and for the first time dedicated conservators were employed in the Departments of Botany, Geology and Zoology. However the challenge had only just begun. These new posts were contract, low grade and poorly paid, and at this time the concept of museum conservation practise within natural history was only just being developed. The new conservators appointed had training and experience in their subject but not in conservation. However guidance from fellow conservators in other disciplines, from subject specialist bodies such as SPNHC and other associated groups helped to cement a framework that could be built upon. Gradually the importance of natural history conservators has become accepted and embedded with the NMW, and has become recognised more professionally. This talk explores the last 20-plus years and the changes that have occurred, and looks to the future in a fluid political and financial landscape.

ORAL

Constructive decision-making for destructive sampling: An example for isotopic geochemistry

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[3]Museum of Paleontology, 1101 Valley Life Sciences Building, University of California–Berkeley, Berkeley, CA 94720 USA

Destructive analyses of natural history specimens represent an increasing percentage of collections use. The diverse range of methods and research questions present significant challenges for collections professionals to evaluate such user requests, and it is often unclear to researchers what constitutes a reasonable request. Based on our experiences as both requestors of specimens and approvers of destructive analyses, we are developing a set of best practices and a decision-making guide for stable isotopic analyses of vertebrate specimens.

Key elements of best practices for requestors include: 1) explicit hypotheses to be tested and an experimental design that accounts for the fact that samples may be limited and are irreplaceable; 2) clear elucidation and justification of the relationship between the hypotheses and sample selection; 3) sample selection based on a sound understanding of the biology of the organisms and how the biomaterials are formed; 4) a plan to minimize and mitigate damage (e.g., through replication of specimens); 5) a data management plan to document each stage of sampling and lab protocols used in sample processing; and 6) provision for reporting of results both to host institution and through publication. Provider institutions should give information on preparations and possible chemical alteration of specimens, when possible.

We hope that the existence of explicit guidelines informed by the scientific literature can help researchers better communicate with collections professionals, which, in turn, will save them time and effort in their project development. Further, we hope it can provide museum decision makers with information that can aid the evaluation process and the development of proactive collections policies. These guidelines can also serve as a template for other types of destructive analyses, and we strongly encourage other collections professionals to partner with researchers to develop similar guidelines for different areas of research.

ORAL

The Global Genome Initiative: Building the genomic collection from across the Tree of Life

Coddington, J.; Butler, C.; Barker, K.

Office of the Associate Director for Research and Collections, National Museum of Natural History, Smithsonian Institution, P.O. Box 37012, MRC 105, Rm. E-529, Washington, DC 20013-7012 USA

The Earth's non-human genomes hold great potential for research, discovery and innovation; yielding solutions to medical, environmental, energy, security and agricultural problems. These solutions are not guaranteed. The potential for these discoveries is not only threatened by habitat and species loss, but by lack of collaboration between the world's biodiversity biorepositories and research organizations. The Global Genome Initiative (GGI) aims to preserve the genomic diversity of life on

earth for future research and discovery by laying a solid foundation for non-human genomic research. Steps toward this vision will be guided by four collaborative activities: Global Genome Biodiversity Network, Biodiversity Research and Collecting, Bioinformatics and Biotechnology, and Engagement. Preservation of genomic diversity starts with collaborative collecting and collection management efforts, including appropriate access and benefits sharing (ABS). Online access to these resources for genomic research, including genomic samples, vouchers, molecular analysis, publications, and images requires a federated information infrastructure. Members of the Global Genome Biodiversity Network are working collaboratively to address issues associated with genomic sample preservation and access on global scales.

ORAL

Microenvironments: Their future use and potential in the control of deterioration mechanisms in organic and inorganic materials

Collins, C.J.

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Passive and active microenvironments have been used extensively in museums to fine tune or control environmental conditions around specimens. Passive control enables conservation staff to sustainably manage specific environments around either individual or groups of specimens, without requiring the use of mechanical systems and their subsequent maintenance and energy requirements. Micro-environmental control has largely been primitive control of relative humidity (RH) to keep levels below a set RH figure. Their use grew as conservation science's understanding of deterioration mechanisms, such as pyrite oxidation increased and conservators became aware of the links between relative humidity, oxidation rates and hydration states of minerals. The development of more efficient forms of silica gel, such as Artsorb® and Prosorb® and the use of saturated salts to condition these relative humidity buffers to a wide range of specific relative humidities has improved conservation staffs ability to manage humidity sensitive specimens and to slow down rates of deterioration. More recent developments in the use of reduced oxygen (ROE) and anoxic environments has further enhanced our ability to control a wide range of oxidation and humidity based problems, in organic and inorganic materials.

This paper reviews the current and future use of microenvironments. In particular, it will look at developments in the use of microenvironments in collections and the field to better conserve samples and their associated data sets for research and education.

ORAL

GIGAmacro technology for high-resolution digitization of specimens

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Questions: How can specimens be documented with enough photographic detail to enable online collaborative exploration and sharing of specimens worldwide?

Methods: GIGAmacro is a new technology designed to create, explore, annotate, and share gigapixel photographs with ease. It includes robotics hardware, photography equipment, linear axis engineering, and software. These tools allow automation of the process of taking images, "focus stacking" to increase the depth of field, and "stitching" to create high resolution photographs, ideal for digital preservation of objects.

Resulting Gigapixel Photographs can be explored online, compared to each other using the Comparative Viewer, viewed in time-lapse format, and shared with the public and researchers online. This new approach to photographing and studying subjects can be applied to research, curriculum, interactive exhibits, or print format.

Findings: GIGAmacro is currently in use at Carnegie Museum of Natural History (entomology and paleontology), the USDA Bee Research laboratory, The Scottish Ten Conservation Group (to image ancient calfskin documents), Carnegie Mellon University, Gigapan, and the Northern Virginia Community College (geology). We will share details of this work and how researchers are using the technology to explore uncharted territory.

Implications: To have gigapixel images of delicate, rare, or degenerating objects is a way to preserve them for researchers and exhibitors alike, for scientific study worldwide, and for use in education and exhibitions. Through our early collaborations we quickly realized that the technology is valuable not only for documentation, but also to enable new research and studies that were previously not possible. We look forward to sharing the technology with members of SPNHC and welcome input on how it can be used to further research and preservation goals.

POSTER

Odd lots: Storage supports for special situations

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In 1998, following the completion of three permanent exhibit halls and the emptying of numerous storage cabinets, the then-Section of Anthropology at Carnegie Museum of Natural History began re-organizing and decompressing its storage. Cabinets were emptied, cleaned,

and new storage supports made for thousands of objects. Many lessons were learned, and new support types devised. When Gretchen Anderson, late of the Science Museum of Minnesota, came on board, she introduced several new ideas and materials.

The problem of odd-shaped objects, or those with special needs, had to be addressed for proper storage. The poster explores some of the solutions developed for a variety of things, both ethnographic and archaeological, from the collections of the Center for World Cultures, CMNH. Included are ancient glass, archaeological pottery, ethnographic money, and dolls and figurines.

Different mount forms and materials are illustrated, including ring mounts, cavity mounts, specialized boxes, and stackable supports. A number are based on Science Museum of Minnesota methodology; others are home-grown.

ORAL

Analysis of national and international biorepository standardization

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Human biospecimens are critical in accelerating the development of molecular-based diagnostics and therapeutics for personalized medicine. The sensitivity of analysis platforms requires high quality biospecimens obtained using standard operating procedures (SOPs). The publication of best practices (BP) guidelines is an attempt to unify biorepository policies and procedures, which serve as a foundation for SOPs. A comparative analysis of biorepository BP guidelines was performed from six national and international organizations including the National Cancer Institute (NCI). Most organizations' BPs address the same areas of standardization with a comprehensive breakdown of specific recommendations. Five of the six organizations studied provide guidelines for biorepository operations and management, biosafety, biospecimen informatics, quality management systems, and access to biospecimen data. Only two of the six organizations published BP guidelines for biospecimen collection, storage, retrieval and dissemination. In a separate study of 200 biorepositories, only 15% of them had publicly available SOPs. Of the published SOPs describing blood collection, DNA/RNA extraction, and liquid nitrogen snap freezing, each institution prescribed different procedures for each process. Furthermore most SOPs lacked evidence-based references. In conclusion both national and international biorepositories lacked inter-institute standardization. Collaborative efforts from national and international biorepositories are needed to harmonize BPs and SOPs in order to consistently provide standardized high quality biospecimens to the research community.

ORAL

Documenting and communicating about toxins in collections

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Museum collections contain toxins in a number of forms. Some specimens are intrinsically toxic, while others have been treated with poisonous materials for preservation or protection against pests.

The integrity of collections and safety of all users can easily be managed in a few simple steps. Documentation of poisons, regardless of their origins, should be part of any collection record. This can include notes or alerts in the catalog or database, and codes or warnings on labels, drawers, cabinets and rooms. Color codes or distinctive symbols can be used to provide a visual alert.

Toxic commercial products that have been used in a collection should be documented with MSDS sheets that are available to all users. Testing should be part of normal collection management protocols, and in some cases should be on a regular schedule.

Access to toxic specimens should be restricted. Access and handling protocols should be posted and enforced as part of a collections management policy. Collection users, including staff, visitors, borrowers, and students, should be notified of all potential health risks and trained in appropriate handling methods for each type of specimen containing toxins. Records of this training should be kept to insure that everyone participates and is kept up to date.

ORAL

Canadensys—How we built a national biodiversity data network

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Canadensys (www.canadensys.net) was established to coordinate efforts to unlock the rich biodiversity information found in Canadian biological collections. Headquartered at the Université de Montréal Biodiversity Centre, the network comprises 11 universities and five botanical gardens, and unites 35 researchers and 30 collections (herbaria, botanical gardens, entomological and mycological collections). Canadensys collectively holds over 13 million specimens, of which approximately 20% are now digitized. The data are published through its own web portal (data.canadensys.net/ipt) and that of the Global Biodiversity Information Facility (GBIF).

Canadensys is innovating the publication of biodiversity data in several ways: collection managers can publish their data through the world's first fully customized and hosted GBIF Integrated Publishing Toolkit (IPT) and benefit from dedicated support, including help with Darwin Core mapping and metadata review. Canadensys is also actively contributing to biodiversity standards and open source software tools, and encourages its participants to dedicate their data to the public domain under the Creative Commons Zero waiver, enabling wide use of the data.

ORAL

One name, one fungal species: Implications for the herbarium and the database to the rescue

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Article 59 of the International Code of Botanical Nomenclature has long allowed an exception for fungi to the rule that only one scientific name can be applied to one species. This accommodated the pleomorphic states of fungi, e.g. those species with very different morphologies in their sexual and asexual (imperfect) states. This resulted in the use of two or more scientific names for one species of a fungus. In the herbarium, the sexual and asexual states of a species have been filed separately; also, researchers often request specimens that represent one, or the other, of these two states. At the most recent International Botanical Congress, it was voted overwhelmingly to move to the use of one scientific name for fungi. As of 1 January 2013, one scientific name for fungi will be required. We give a brief overview of this new requirement and how it will be carried out. We then discuss how this may affect fungal herbaria and also describe the solution the U.S. National Fungus Collections has arrived at using its extensive nomenclatural database.

ORAL

Archives at the Yale Peabody Museum of Natural History: The anatomy of a university natural history museum and the evolution of science in America

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The Peabody Museum of Natural History has received a grant from the Council for Library and Information Resources (CLIR) and the A.W. Mellon Foundation to electronically catalog the archives and special collections of the Museum and the 11 curatorial divisions. The cataloging of these archive collections has offered an opportunity to add important value and understanding of Museum's history and development of its traditional natural history collections. The planning and implementation of the project has offered challenges unique to cataloging archive collections. The divisional archives were assessed for content and condition and a plan was developed for the archival handling and storage of the collections. The Museum's existing collections management system, KE EMu was evaluated for the cataloging of the archives and procedures were adopted for the use of encoded archival description (EAD) standards in organizing the data. The adoption of EAD standards has led to the standardization of archive cataloging practices across the Museum's division. The digital records of previously cataloged archives were evaluated, standardized and migrated to conform to the new standards. As the archives are cataloged they will be available through Yale's finding aid database to a wide range of researchers and historians.

ORAL

3D imaging at the Yale University Art Gallery

ffrench, John

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We know more about our collections now than we ever have before. Twenty-first century documentation tools empower us to act as collection stewards seeking insight and discovery through novel tools and methods. The Yale University Art Gallery is exploring a variety of methods for three-dimensional capture using a variety of 3D technologies for collection study. Ranging from Quick Time VR to Reflectance Transformation Imaging, the technologies being utilized range in complexity and require varied skill sets. In addition to highlighting the software systems being used, discussions will be presented regarding workflow, staffing and file support.

ORAL

Resources for preventive conservation and collections care

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[2]A.M. Art Conservation, 1 Rectory Lane, Scarsdale, NY 10583 USA

[3]Emerging Conservation Professionals Network of the American Institute for Conservation, 4236 Campus Ave., San Diego, CA 92103 USA

Environmental monitoring, maintenance of collections spaces, integrated pest management, risk assessment, disaster planning, and collection policies and procedures, are some of the methodologies that foster preservation of cultural heritage and are a part of responsible stewardship. Collections care professionals, especially those working with natural science specimens, know the everyday practices of preventive conservation contribute to greater overall collections

preservation and prevent damage that requires time consuming and expensive interventive treatment. Preventive care projects almost always benefit an interdisciplinary approach with input from conservators and the full range of staff who work with collections in other capacities. The goal of this presentation is to further the knowledge of preventive care resources developed for other disciplines that may be of use to the natural history community, and create better cross-discipline collaboration in the realm of preventive conservation. The presentation will highlight resources for developing an institutional preventive conservation program, organizing the resources by topic: registration and documentation, emergency preparedness, integrated pest management, storage support creation, environmental management and sustainability and more. The American Institute for Conservation's new Collections Care Network will also be introduced.

ORAL

Herbarium in a public library's history room

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Herbaria are found in a number of different venues, from natural history museums to botanic gardens to educational institutions. Libraries are less likely locations for plant specimen collections. However, there is a small, but well-maintained collection housed at the Wilton Library in Wilton, Connecticut. It is in the library's History Room which is staffed on a part-time basis by the Wilton Historical Society. The foundation of the collection, which numbers over 1,000 sheets, was the donation of 200 sheets by Anna Carpenter (1833-1933) who spent the last 42 years of her life in Wilton. She presented the rest of her collection to the Connecticut Botanical Society herbarium which is housed at the Yale University Herbarium.

In 1960s the Wilton Garden Club began its herbarium project which resulted in several hundred sheets being added to the collection at the Wilton Library with the Carpenter sheets maintained as a separate collection. This project culminated with digitization of the information on all the specimens, and publication of Ferns and Flowering Plants of Wilton in 1992. Along with maps, plant illustrations, and essays, the book includes a checklist of all the native and naturalized vascular plants growing in Wilton outside of cultivation. It draws on the Wilton Library Herbarium collection and several others.

Admittedly, the Wilton Library Herbarium is small, but it's an important ecological document giving evidence of what was growing in the area both during the late 19th to early 20th centuries and during the late 20th century. Carpenter gave part of her collection to the library because she wanted it to be accessible to Wilton residents and so it remains. Well maintained in acid-free folders and boxes, it is an exemplar of a small local collection that is prized for its accessibility to students and all who are interested in plants.

ORAL

CollectionSpace: Museums, higher education and community source collaboration

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CollectionSpace (www.collectionspace.org) is an open-source, flexible, web-based software application for the description, management, and dissemination of museum collections information that serves a broad range of museum types and sizes. The application can be scaled and configured to suit the needs of a single institution or a group of institutions, but is designed to encourage the use of field-wide and domain-specific standards.

Led by Museum of the Moving Image with the University of California, Berkeley, Information Services and Technology Division, and University of Cambridge, Centre for Applied Research in Educational Technologies, CollectionSpace is a collaborative effort driven by museum and higher education professionals and is guided by the community source software development ethos that puts the community at the forefront of defining functional requirements as well as development priorities. CollectionSpace is in the midst of a strategic planning process that will result in a business model and plan that will inform how the effort moves away from being a project and into becoming an organization during 2012; as well as a pilot for offering CollectionSpace as a Service to better understand how services and support around a hosted solution could be efficiently designed and delivered.

Additional development resources are provided by OCAD University, The Fluid Project. Our dedicated early adopter community includes: Museum of the Moving Image; Phoebe A. Hearst Museum of Anthropology, The University and Jepson Herbaria, and History of Art Visual Resources Collection all on the campus of University of California, Berkeley; Statens Museum for Kunst (National Gallery of Denmark), and Walker Art Center. CollectionSpace is made possible by the visionary support of The Andrew W. Mellon Foundation.

ORAL

The use of microfading to manage the risk of light-fading during display

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Microfading is an accelerated light-fading test method in which a sub-millimetre spot of very intense visible light is focused on an object and the resultant (visually undetectable) colour change tracked in real time using reflectance spectroscopy. The method is rapid, non-destructive but most importantly specific to the object tested, because for a colourant the rate and nature of photochemical reactions depend substantially on particular circumstances including prior exposure and its physical and chemical environment.

The National Museum of Australia adopted the technique in 2008 because the existing lighting guidelines—which for want of reliable lightfastness data were necessarily generalised and conservative—seriously restricted public access to important artefacts and incurred unsustainably high light-driven object replacement costs over the lifetime of the Museum's core "permanent" exhibitions. At the same time the most fugitive colourants were probably overexposed because the "acceptable change" criteria relied on averaged rates from published data (where available).

As a hedge against uncertainties in the quantitative relationship between exhibition and test light intensities (reciprocity failure), and to reduce the amount of microfade testing required, the Museum also developed a lighting framework in which objects assessed as highly significant—and therefore more likely to be in regular demand for exhibition over time—are treated differently from those unlikely to be in such demand and which are consequently allowed more exposure when they are displayed.

The combination of lightfastness testing and a structured significance evaluation of hundreds of objects, including materials commonly found in natural history collections, has proved to be a highly cost effective means of more confidently identifying and directing resources towards protecting the most vulnerable and most important items, while improving public access, allowing more flexible lighting arrangements and saving on exhibition costs for collection as a whole.

ORAL

Integrated Digitized Biocollections (iDigBio) Cloud-Based Cyberinfrastructure

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Integrated Digitized Biocollections (iDigBio) has been funded as part of the NSF Advancing Digitization of Biological Collections (ADBC) program with the mission to organize all the information contained in vouchered biological and paleontological collections across the USA. iDigBio is developing a national resource that supports the vision of ADBC including building and deploying a customized cloud-based cyberinfrastructure for collections among other activities. The iDigBio cyberinfrastructure architecture is forward-looking and adaptable, taking advantage of (a) virtual appliances to ease the dissemination of existing tools, community standards and best practices, (b) cloud computing and storage services to aggregate and process data including not only textual information, but also media files from digitization projects, and (c) web technologies and standards to broaden data exchange and dissemination. Virtual appliances are ideal to package tools that facilitate the digitization workflows taking place at Thematic Collections Network (TCNs), which involve data capture, georeferencing, optical character recognition, data validation, and quality control, and most important of all, sharing of data with the national resource. The cloud computing and storage services based on distributed object and database stores are designed to be scalable and reliable in order to support the data management and information processing required by the estimated one billion biological specimens. iDigBio relies on standards, proven solutions and software reuse whenever possible, with programmatic and graphical user interfaces to interact with different stakeholders (data producers, data consumers, domain service providers, infrastructure providers and other aggregators).

ORAL

Opening access to works in the public domain at Yale University

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In May 2011, Yale announced a groundbreaking new policy on open access to digital representations of works in the public domain. In the spirit of the University's mission to advance, disseminate and preserve knowledge, the goal of Yale's Open Access Policy is to make high quality digital images of Yale's vast cultural heritage collections in the public domain openly and freely available in order to facilitate their use in scholarship, education and inspiration all over the world. Yale's policy represents a departure from preceding efforts in that no license is required for, nor any limitations imposed upon, the use of digital images of works in the public domain. The policy is also notable for its breadth across the University's cultural heritage collections, from its library to its art and natural history collections.

This talk will examine how Yale arrived at the current policy, including the institutional climate and cross-campus collaboration that gave rise to the policy, as well as the challenges of implementing the policy across collections in the University in the policy's inaugural year, from interpreting and communicating the

policy internally and externally to developing shared digital infrastructure to support the policy from the technical perspective.

POSTER

Supporting old bones, storage jackets for oversize dinosaur bones

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Fossil bone can and does break under its own weight without external support. Proper storage of paleontological specimens is as important to their long-term usefulness as is good preparation. One aspect of proper storage is adequate support for fossil bones, which, although they appear strong, lack the internal strength of living bone. This support can include specimens stored within specimen trays, as well as those large or fragile specimens that require more elaborate bedding jackets. For smaller specimens within trays polyethylene foam cut to fit the bone is adequate support. However storage support for large bones, some weighing several hundred pounds, require custom-made support jackets of materials able to withstand the stress of such weight. These are usually plaster and fiberglass with additional supports of metal pipe and wood, lined with polyethylene foam.

The Yale Peabody Museum Vertebrate Paleontology Preparation Lab has made over two hundred support jackets for the large Jurassic dinosaurs collected under O. C. Marsh in the 1870s. This presentation will discuss the design and creation of these jackets, and why this design and these materials were chosen.

ORAL

Developing a new national museum of natural history at Tel Aviv University

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An introduction to the new Steinhardt National Museum of Natural History based at Tel Aviv University (Israel). It will detail an eight month detail from the Smithsonian Institution to Tel Aviv University to assist in the development of this new museum. Some details are provided about a collections management course taught, the entomological collections as well as generalities about all the other collections and the plans and progress of this first natural history museum in the Middle East.

ORAL

Doing it digitally: A 25-year Peabody perspective

Gall, Lawrence

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Since the late 1980s, the Peabody Museum of Natural History has employed computing technologies broadly to help it organize, manage and catalogue its various assets. This talk traces the arc and evolution of the museum's digital activities from inception to the present, from both pragmatic and theoretical vantage points. The overarching theme will be how Peabody has addressed issues of scale, with focus given to topics such as: sharing software and systems across multiple curatorial disciplines, tackling different classes of natural history material (e.g., specimens and archives) harmonizing natural history content with content from other domains (e.g., libraries and galleries), and the integration of Peabody with its institutional peers in campus-wide digital initiatives at Yale University.

POSTER

Dr. Robert F. Thorne's botanical collections at Rancho Santa Ana Botanic Garden: A legacy of fieldwork to be processed

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In 2009 the National Science Foundation awarded a grant to fund the Rancho Santa Ana Botanic Garden (RSA) to process an extensive backlog of 10,000 unprocessed botanical specimens from the collection's of Dr. Robert Folger Thorne (Curator Emeritus). These specimens were temporarily housed at an off-site storage facility awaiting processing. Until plant specimens are identified, labeled, mounted and accessioned, they are not available for study and thus cannot contribute to our knowledge of plant diversity. Field notes were relocated and catalogued, labels were transcribed, duplicates sorted and sent to appropriate institutions and specimens were mounted for inclusion to the collection. Thorne's botanical interests and publication record are broad and diverse; he collected globally, thus making his collections extremely important to the botanical community. At RSA-POM we faced many challenges with a backlog this large. Space inside our collection needed to be designated for specimens "to be processed" and notebooks needed to be matched to the hundreds of bundles. Our greatest challenge was dealing with the specimens for which we could not identify notebooks with collection information and finding volunteers interested in mounting fragile plant material.

ORAL

Digital representations: An approach to best practice for data sharing

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Since digitization of collection material, be it archival files, library volumes or museum specimens, has become an invaluable tool over the past years, and since digitization is used in various contexts, both in research and collection management, issues regarding the proper use of digital representations need to be addressed. Simple applications of digitization include digital images of 2D originals such as backup copies of collection catalogues or micrographs of histological sections. These can be produced using standard equipment from flatbed scanners to digital SLR cameras or more advanced technology with specialized scanners for library applications or book scanning robots for high throughput of scanned objects. For other applications, high resolution 3D data is produced using advanced technologies that either record surface structures or internal properties, based on optics, X-ray or magnetic resonance, respectively. All of these techniques have in common, that they produce a digital representation of some of the properties of a physical object, be it a fully searchable file of a first edition or a volume rendering file of a lizard trapped in amber. For rare and fragile objects, the digital representation may be the only object for study, since the original is not available for research due to preservation concerns. However, the link between the object and its digital representation must be maintained, so that an agreement between the user and the museum should be in place that clarifies this issue. This presentation illustrates the need for such an agreement and provides existing examples from various museums.

POSTER

From the American Museum of Natural History with love: Packing fossil specimens for shipment

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Loans from one institution to another are a fundamental aspect of the research process, but whenever specimens are sent out on loan or are returned from loan there is the risk of damage occurring during transit. The damage may range from a minor break, which can be easily repaired by an experienced preparator or conservator, to a complete loss of the specimen in the most extreme cases.

Through our experience with shipping and receiving vertebrate fossils and the feedback received by us from recipients of our packing efforts, we have developed a set of guidelines that we follow whenever we pack vertebrate fossil specimens in the Division of Paleontology, AMNH.

In this poster, we present a few simple packing methods following these guidelines that can be applied to a variety of vertebrate fossil specimens to prevent damage during transport. These methods rely on two key principles: isolating the individual specimens or parts of specimens from each other and preventing movement of the specimens in the package during transport. Also important is ensuring that there is adequate space between the contents and exterior surfaces of the shipping container in the event of a puncture or tear in the outer surface.

This poster is meant to serve as a visual guide to packing fossils of three main size categories: small (8 cm × 6 cm × 4 cm), medium (26 cm × 22 cm × 5 cm), and large (anything larger in dimension than medium). Small specimens will generally fit into a plastic box and medium ones into a cardboard tray, while large specimens require a clamshell or larger cardboard box. We present the general methods that we use to pack specimens in each size class and these methods can be modified to accommodate the needs of the individual specimen.

ORAL

Streamlining herbarium specimen digitization using optical character recognition

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The advancement of optical character recognition (OCR) technology to include batch processing of files has modified the workflow for cataloging specimens at The New York Botanical Garden (NYBG). We have found that OCR, though not perfect, can be helpful in streamlining the cataloging workflow by making the specimen labels digitally searchable from the start. Labels grouped by collector and locality can then be cataloged more effectively. The workflow currently implemented at NYBG begins with an exhaustive curation of the plant family and geographic region of interest, followed by rapid cataloguing and barcoding of every specimen. Each catalogue record contains only a unique barcode number and the currently accepted taxonomic name under which the specimen is filed in the herbarium. The specimens are then digitally photographed using a 21 megapixel camera and named with the barcode number. The image files are cropped using the photo editing software Adobe Photoshop Lightroom, converted to grayscale to reduce file size, and uploaded in large batches to be read by ABBYY Fine Reader. Using a Powershell script we extract the

data from the text files generated by ABBYY and populate rows in Microsoft Excel, checking at the same time for the accuracy of the OCR'd barcode. We can then identify sets of similar labels based on the OCR text and parse these data into the appropriate fields when we import to our database. More consistent text recognition on older labels can often be achieved by using ABBYY's pattern training process.

ORAL

Protecting collections: Tools to engage climate dialogues with conservators, engineers, collection managers and acilities managers

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We are reminded daily of global climate change and the high cost of energy. Within the conservation field we struggle to maintain the perceived optimum set points of 70°F and 50% RH. How do we determine what the climatic set points and the appropriate range; is it ± 2%, ±5% or ± 10%? Who decides? There are many stakeholders in the preservation of cultural heritage: conservators, scientists, curators, museum directors, building owners, trustees, engineers, facilities managers, and architects. One of the greatest challenges of any team is effective communication. For collections preservation this is complicated by the diverse backgrounds and professional vocabularies of the members. Because there is an inherent fear of failure, we demand very strict control, which is expensive. As energy costs soar, we all must work together more and accept compromise without sacrificing preservation of collections. This presentation will identify resources available through the American Society for Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) and the International Facility Management Association (IFMA) to museum professionals to engage engineers and facilities managers in discussion of set points, sustainability and energy conservation.

ORAL

From organismal- to millimeter-scale: Methodologies for studying patterns in color and direction of the reflectance from avian organisms

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Avian organisms have evolved plumage of astounding beauty and diversity, including brilliant color and dramatic pattern. Plumage is fundamental to how birds interact with their world; the signaling function of plumage plays a role in an organism's social interaction and is a determining factor in a organism's overall visual identity. The organization of modified plumage structure over the surface of the bird produces dramatic variation in appearance both within and between species. Previous case studies have established the vast morphological modifications of individual, specialized feathers, their placement on the body, and the millimeter-scale topography generated by the shape and orientation of feather sub-structures. We study plumage morphology and reflectance to explain its potential function in avian behavior, its development and evolution. We propose that a change in the form and orientation of a feather, and in turn its substructures, changes its interaction with light and thus alters appearance. We began our investigations by asking: for every specific component of the modified structure, is there a corresponding signal function and can we identify and measure the signal? In this talk we will discuss two systems of non-destructive tools and techniques we have developed to study and measure plumage morphology and its reflectance from the organismal- to millimeter-scale; the first captures images with high spatial and high spectral resolution and corresponding organismal-scale geometries, while the second obtains high spatial and high directional resolution and millimeter-scale geometries. We will show how plumage morphology at different structural scales influences change in the spectral and directional components of the reflectance over the surface of the organism. We will also suggest the research and archival potential of the large digital data sets acquired in the course of our studies.

POSTER

A tale of two systems: Synergy in managing risks to people and to collections

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The two systems of managing health and safety and of managing preservation of cultural property have many parallels. When managed from a proactive perspective, they can be considered goal-directed systems. In the first case, the goal is to maintain health and avoid accidents to people. In the second case, the goal is to avoid damage and loss to cultural property. Both goals are clear, widely accepted, and even inarguably noble and worthy. As a simple example, wearing appropriate

gloves while handling objects protects the wearer as well as the collection object/specimen from contamination. There are many such examples of complete correspondence of purpose between the health and safety and preservation systems. In these cases both systems will naturally be mutually supportive.

However, not all potential intersections of the two systems align automatically. For instance, an old collection of pharmaceuticals can pose many risks. From a health and safety perspective, disposal seems the obvious solution. From a curatorial perspective, keeping contents intact for future analysis may be important. The exercise of developing a creative solution that protects both people and collections can lead to improved understanding among all parties.

Most institutions that care for cultural property conduct regularly scheduled health and safety inspections of all work areas. Few institutions have a similar routine comprehensive inspection for collection preservation issues. The management of risks to collections could benefit from including a collection care specialist in the team conducting a health and safety inspection. That specialist would be tasked to look for and document situations that pose, or exacerbate, risks to collections. Combining the two inspections encourages synergies that can lead to effective risk management and resource allocation by custodians of our collected heritage.

ORAL

Defensible collections: Designing a safe exhibit space

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A startling number of conservators tell stories about mistreatment of collection material by the public. Is an exhibit successful if attendance effectively damages delicate material? By the way, what makes a teenager throw a French fry onto a *Diplodocus*? And why would a mother attempt to salvage a souvenir from an artifact for an eager toddler?

This oral presentation provides a broad overview of the risk to exhibited collection material imposed by the visitor, starting with evidence of passive damage cited in published studies and moving towards observations of vandalic behavior at larger institutions. Patterns of damage to collections correspond to specific characteristics of the exhibit spaces themselves, suggesting a causal relationship: space design contributes to the way visitors interact with collection material. The presentation will draw on corrective ideas from outside the museum world, looking towards design moves that make civic spaces, stadiums and schools safe and livable. The implication is that effective galleries that accommodate the needs of both exhibit designers and collections managers should consider human behavior and employ multiple, iterative techniques for ensuring the collection's safety.

ORAL

Protecting collections and integrated pest management challenges: A twelve-year perspective

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In 2000, the Sam Noble Oklahoma Museum of Natural History opened its doors. This new state-of-the-art, 190,000 sq. ft. facility was completed to house more than seven million objects with the commitment of maintaining the highest standards and would offer the best care and preservation of its collections. The development of a building-wide integrated pest management (IPM) program was initiated through recommendations from a grant-funded assessment performed by an outside consultant. These recommendations were put into action and modifications continue to be made to keep the collections protected through the use of best practices.

Twelve years of pest management data have been collected and analyzed. Much was revealed, including 1) a succession of pests based on diet or object material, 2) seasonal pest trends resulting in an atypical cycle for pest activity in the winter months, and 3) the modification of IPM strategies. To continue the commitment toward the highest standards in best practices, a second building-wide assessment will be conducted in May 2012 and results will be presented. It is hopeful that other collections and museums may use this information to help define and explore IPM challenges in the establishment and maintenance of a new facility.

POSTER

Have camera, will travel: Interdivisional application of digital imaging best practices

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Best practices, by design, are flexible and must be adaptable to museum-wide concerns. With this in mind, Yale Peabody Museum's digital imaging best practices were developed to apply broadly to a variety of imaging projects. At the Yale West Campus, the Peabody Museum's Vertebrate Zoology Division established a protocol for a digital imaging project in the osteology collection. After weeks of trial and error, a smoothly operating workflow was in place. On short notice and under a tight

schedule, equipment and expertise from this ongoing effort were pressed into service for a unique project in the nearby Anthropology Division. Supported by museum staff from both divisions, a range of on-location problems were solved, existing imaging methods were adapted and were applied. This is an overview of the osteology imaging project and the application of the same concept to the Anthropology project, from decision-making and set-up through successful implementation.

ORAL

Maintaining a mineral collection in an evolving geosciences department: Progress toward preservation

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Princeton University Geosciences is nearing the final stages of the renovation and preservation of an historic mineral collection. Like many other university departments, Princeton faces future constraints on funding and space. We intend to downsize through donations and long-term loans while preserving the educational, scientific, and historic value, and improving accessibility. Digitization of catalog information and reorganization will result in a minimal need for curation and upkeep after the conclusion of the project, increasing the likelihood the collection will be maintained in the future.

We have a significant advantage over our predecessors who constructed the collection in that we have access to powerful modern electronic databases and catalogues. Two and a half years into the project, information (localities descriptions, donors, etc.) in our main catalogue has been entirely digitized, and we are scanning images of original catalogue cards and photographing select specimens. The bulk of the collection was assembled about a century ago, when geological collections played a central role in university. For such a collection to be viable today, access to it must be greatly expanded, both internally and externally. Our main catalogue is now online in searchable form, and we continue to supplement it. Digital information about the collection will be freely available to facilitate loans for specific purposes or donations.

Upon successful completion of the project, we hope that the collection at Princeton will serve as a model for the preservation of an increasingly uncommon historic university mineral collection using widely available modern tools. Earth sciences departments should be encouraged, when possible, to invest the time to preserve their unique collections. Accessibility as part of a larger, virtual "meta-collection" can help justify their preservation.

ORAL

Integrating paleobiological and archival informatics in the cataloging of the University of California Museum of Paleontology archives

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The University of California Museum of Paleontology, like most natural history museums, is a repository for significant collections of archives that represent both scientific activities of the museum as well as the intellectual lives of the scientists who have contributed to these collections. These frequently relate in direct ways to the museum's collections and are themselves objects of research interest. However, these collections are rarely cataloged in ways that make them accessible to researchers or that make explicit the connections between archival objects and documents and related natural history objects.

With support from the Council on Library and Information Resources Hidden Collections program funded through the Mellon Foundation, we are now re-housing and conserving our archives and developing online finding aids for the thousands of field notes, personal papers, maps, photographic media, and artwork that span the 1880s to the present. Using Archon open-source software, we are creating records that can be output in MARC format for compatibility with standard archival document portals. In addition to creating conventional finding aids, we have integrated the archival database with existing specimen and digital photographic databases to capitalize upon our informatics infrastructures to enhance accessibility and generate new, added-value online content. We are finding it particularly valuable having experienced graduate students who know the relevant taxa and field areas enter and check data.By establishing reciprocal links between the archival finding aids from our collections databases, we can let researchers know that more data are available, generate maps that show the geographic extent of specific archives or their relationships to discipline-specific content, e.g., geologic or taxonomic categories, that are not typically incorporated in finding aids. In doing so, we hope to best serve both our primary research community and the broader community who were previously unaware of our archival holdings.

POSTER

Considerations for compact storage of the collection at a large natural history institution: A case study at the Royal Tyrrell Museum of Palaeontology

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When available museum storage space is static and museum collection grow so does the propensity and pressure to move from a stationary stacked cabinet and racking system to a compact storage system. The lure of significant increases in storage capacity (moving to a 60% footprint) without the need to expand the storage perimeter is appealing, but are there drawbacks? At the Royal Tyrrell Museum of Palaeontology (RTMP) capacity is approaching 95%. A study is ongoing to determine the feasibility of retrofitting the collections area with compact storage for both the specimen cabinets and the oversized racking and several conclusions are becoming evident.

The consideration of costs beyond the purchase of a compact storage system is important and will be highly variable. At the RTMP Large portions of the fossil collection will need to be temporarily re-housed in a separate location, leading to space and labour costs; moving the collection puts the specimens in jeopardy of damage so specialized packing materials will be required. If retrofitting the existing furniture, the stability, dimensions and weight capacity will need to be considered, potentially requiring new furniture. Retrofitting oversized storage racking and cabinets adds an additional height which may put the furniture exceedingly close to the overhead sprinkler system, lights and ceiling which means that the overall height of specimen cabinets and racking will need to be reduced to accommodate the new carriages, diminishing the increase in capacity provided by the compactor system.

While compact storage increases capacity it can limit accessibility depending on collection use and access requirements. At times there is upward of five researchers simultaneously working in different aisles in the collection. Compact storage will limit that access and will put more of a strain on the collections team to ensure all researchers' needs are met. These aspects need to be considered as a whole before attempting the large undertaking of switching over to compact storage.

ORAL

Conservation and digitization of Compendium Index of North American Mesozoic and Cenozoic Type Fossil Plants at the Peabody Museum

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The Compendium Index of North American Mesozoic and Cenozoic Type Fossil Plants is a collection of approximately 12,000 8x10 inch cards, in which each card contains illustrations and description of an individual occurrence of a fossil plant species. The Compendium Index (CI) presently covers fossil floras from North America, including Greenland. The CI was begun in 1937 by Erling Dorf, paleobotanist in the Department of Geology at Princeton University. In 1984 the CI was transferred to the Division of Botany (then including paleobotany) at Peabody Museum of Natural History where it has been substantially updated and reorganized. It now covers 248 references extending from 1866 to 2010. The CI is a unique and invaluable resource for fossil plant identification that has no counterpart anywhere else in the world. However, use of the CI has been limited because it exists as a single card collection at one location. In addition, many of the cards had begun to show signs of deterioration and wear. Therefore, the present Division of Paleobotany started a project to conserve and digitize this collection three years ago. Because several attempts to secure funding for this project proved unsuccessful, much of this work was carried on by volunteers, supplemented by Peabody Museum resources on an as available basis. When the work was finished in the spring of 2012, over 3300 cards had been repaired using archival-quality materials. Simultaneously with the conservation work, volunteers and part-time student workers digitized, compiled, and edited all of the cards in the Compendium Index. The electronic version of the CI in a searchable database was published in April of 2012. This project not only serves as an example of the conservation and digitization of a physical card collection, but also shows the importance of volunteers in the current economic and funding contexts.

ORAL

The Smithsonian's pan-institutional frozen collections

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Smithsonian museums, research centers and individual researchers have been collecting genetic resources on an ad hoc basis for decades. In 2005, the National Museum of Natural History (NMNH) began designing a new facility for cryopreserved collections. The goal was to bring NMNH genetic resource collections into one facility for improved management purposes. This facility opened for use in September 2011 and faced several

challenges: equipment reliability, informatics, access control and cultural change. First, our mechanical freezers experienced problems, mainly due to inadequate power supply. Second, we've purchased inventory control software, but have difficulty linking it with our museum catalog database. Third, to prevent problems with inventory control, we must limit physical access to our genetic resource collections even as we ensure intellectual access. Fourth, we continue to address resistance to change from ad hoc "personal" tissue collection to a museum standard collection.

The Smithsonian Institution as a whole took an interest in frozen collections while the Biorepository was being built. In 2006, the Pan-Smithsonian Cryo-Initiative (PSCI) began as a project between NMNH, National Zoological Park, Smithsonian Environmental Research Center, and Smithsonian Tropical Research Institute to address similar issues across units with cryopreserved materials. A baseline assessment evaluated the status of the frozen collections. This survey highlighted needed improvements in each unit's collection management. Currently, PSCI is streamlining frozen collections management into a pan-Institutional process with standardized database. This collaborative collections management approach requires balancing Institutional needs with unit operations, such as incorporating individual unit metadata into a shared schema. Our collaborative initiative advantage is the ability to leverage resources for efficiency. We will describe the data management project underway at PSCI and address the considerations to Institutional integration of cryo-collections management.

Together, we present challenges and solutions to building a modern biorepository with intra-Institutional collections and data management considerations.

ORAL

21st century approaches to 17th century collections: Aspects of access to, conservation and security of the early botanical collections of the Natural History Museum, London

Huxley, R.

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Early botanical collections pose a variety of challenges to access, security and conservation. The Natural History Museum houses its "treasures" in a purpose-built room in its new Darwin Centre building. The collections comprise the 265 bound volumes of plant specimens of Sir Hans Sloane (1660–1753). along with bound and single sheet collections from other significant early collectors. There is also a collection of 12,000 small boxes of seeds, fruits and curios known as Sloane's "Vegetable substances" collection. The herbarium collections contain Linnaean types and represent many of the first collections made in newly opening up parts of the expanding world. They have great scientific, historical and also potential monetary value creating particularly challenging issues of security and conservation. Swipe cards limit access but challenges remain and trials with RFID tags and other technologies aim to reduce the risk of unauthorised removal. The demand for access is increasing due to their value as records of past environments and their role as a focus for a number of historical research projects. Although stabilization and repair to the collection reduces risks of mechanical damage there is a drive to reduce handling through digitization including specialised digital access to the sealed boxes of the "Vegetable Substances" through CT scanning for example. The collections are in great demand for the general public offer and also "VIP" tours and functions adding additional risks to be managed. In addition, the self-guided tour of the Darwin Centre allows visitors to look through windows into the collection space and view selected objects and interpretation of their significance.

ORAL

The Molecular Collections Facility at the Natural History Museum, London

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The Natural History Museum, London has opened a centralised storage facility to accommodate its expanding and dispersed collections of DNA and tissues for molecular studies offering advantages of scale and consistency of best practice. A molecular collections policy requires that all "molecular collections" no longer actively being used by a research project be archived in the facility and that all transactions are ethical, legal and in line with the requirements of CBD's Access and Benefit Sharing policies.

Storage methods are currently a mixed economy of freezers, liquid nitrogen (LN2) vessels and ambient temperature systems with a mid to long term aim to reduce this to ambient and LN2; a strategy driven by cost-efficiency, robustness in emergency situations and future access to molecules beyond DNA. The equipment provides the opportunity for research on these storage technologies and in particular in how the many methods available can ensure optimum storage appropriate to the material and its future use.

Data management is crucial and an integrated dual-system has been developed from the KE EMu collections management system used by the NHM and the specialist biorepository inventory management system *FreezerPro*® The system ensures compatibility and efficient communication with existing and new global molecular databases such as GenBank.

State-of-the–art equipment will ensure that all materials stored and loaned/gifted to users are the highest

purity possible, including high molecular weight "genome ready" products.

The facility is targeting collections from external collaborators and working in partnerships to develop "distributed" networked collections worldwide.

It is becoming increasingly possible to evaluate damage to DNA extracted from museum specimens, repair it and store the material and the facility offers the opportunity to pioneer these methods.

ORAL

Developing a flexible collections competency system for Europe

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The requirements of European natural history museums to manage, care for and use their collections are almost identical but there is a heterogeneous approach to the delivery of best practice. This is exacerbated by variations in staff structures and responsibilities. Competency frameworks offer a defined structure for the development of job specifications and encourage a consistent approach to the delivery of quality collections care and interpretation Using the framework developed by the Natural History Museum, London as a starting point this project will develop a common set of competencies that can be arrayed to match staff roles in a wide variety of size and structure of museums. For example the competencies required by a staff member in a small to medium-sized museum with responsibilities for management of collections but also their display and educational use will draw from the same core set as a specialised collections manager in a large institution. These building blocks will be in clear language and readily translated into local languages. Phase 1 of the project funded by the EU SYNTHESYS project will identify existing frameworks and compile a set of standardised core competencies that can be selected and arrayed to suit the needs of museums of varying size, focus, culture and governance. Phases 2 and 3 will translate these and link them to a series of new and existing learning tools to assist staff and trainers in customising training to meet their competency needs with the overall aim of increasing mobility of collections personnel across Europe.

ORAL

Using terrestrial laser scanning to construct 3D imagery and models of a *Eubrontes* trackway at Dinosaur State Park, Rocky Hill, Connecticut

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Dinosaur State Park (DSP) in Rocky Hill Connecticut hosts an impressive collection of ≈600 *Eubrontes* trace fossils, related dioramas, and associated displays within a domed visitor center that commonly attracts ≈50,000 patrons annually. This study reports on preliminary efforts to map, image, and model the main trackway at DSP using terrestrial laser scanning (TLS), low-level pole photography, and 3D printing technologies. We used a Trimble VX spatial station TLS to collect ≈ 380,000 survey points. The VX is a versatile line-of-sight instrument capable of conventional total station data collection, robotized and wireless pen-controlled surveying, and relatively low speed (15 points per second) scanning. Data were collected from 4 scanning stations that used unique markings on surrounding dioramas as resection points to re-enter the same survey space. The resultant point cloud was, segmented, decimated, and slightly smoothed to generate a 3D mesh of the trackway. High resolution spatially registered images collected with the VX were used to texture the mesh. A significant challenge at DSP is that side-lighting of the trackway, which enhances in-person viewing, confounds the quality of VX imagery. To compensate a series of overlapping, low-level (8 m), and nearly vertical pole photographs were collected using 50 mm and 35 mm focal length DSLR camera. These images were enhanced in Photoshop and projected onto the 3D mesh based on VX calculated camera positions and angles. The resulting retextured model, much improved, was used to create high quality orthorectified image maps of the trackway. In addition to 3D imagery, we are experimenting with rapid prototyping (3D printing) to build physical models for educational and promotional purposes. The latter has included building FDA-approved rubber models to cast chocolate dinosaur tracks, an unanticipated and curious outcome that illustrates the range of opportunities that can arise when working with 3D data sets.

POSTER

Salvage and restoration activity for the bird specimens destroyed by tsunami in the Tohoku Earthquake, Japan

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In Japan, the local museums make great contributions to the conservation and education of biology by collecting specimens of natural history. Some of the local museums in the Tohoku district suffered catastrophic damage through the tsunami caused by Tohoku Earthquake, March 11, 2011. The Rikuzentakata City Museum established in 1959, which is the oldest public museum in the Tohoku district, had been housing more than 150,000 important collections for study and education. The tsunami took these collections into the muddy saltwater and spoiled them. Then many organizations that include universities, museums, institutes and board of education cooperate for salvation and restoration of damaged specimens and artifacts. Concerning more than 500 damaged specimens, Yamashina institute for Ornithology and Okayama University of science are mainly in charge of identification for bird species and restoration of skins and stuffed birds. However, we had not experienced at all to restore the bird specimens damaged by the tsunami. So we observed conditions and devised suitable methods for restoration. Most of the salvaged specimens were stuffed birds, therefore it was necessary to wash and take into pieces. Stuffed birds have complicated structure. Moreover, it is indispensable to apply the knowledge of taxidermy for restoring these damaged birds. We introduce the situation of damaged specimens by the tsunami and the methods of restoration in this work.

ORAL

Integrating biodiversity distribution knowledge: Toward a global map of life

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Global knowledge about the spatial distribution of species is orders of magnitude coarser in grain than other geographically structured environmental datasets such as topography or land cover. Museum-based records represent a critical source of species geographic distribution knowledge, but on their own are limited in utility due to inherent sampling biases. Yet such knowledge is critical in deciphering ecological and evolutionary processes and in managing global change risks. I am laying out a conceptual and cyber-infrastructure framework for refining species distributional knowledge that is novel in its ability to mobilize and integrate diverse forms of data such that collective strengths of different data types overcome individual weaknesses. The ultimate aim is an online, publically accessible, quality-vetted "Map of Life," that for every known species on Earth transparently integrates and optimally visualizes available distributional knowledge, while promoting user feedback and facilitating dynamic biodiversity syntheses and change assessments. A demo version of this tool is now online. I will illustrate and discuss the potential of "Map of Life" as a collaborative research platform and the different possible uses of the by the museum and biodiversity science community.

POSTER

Training in natural history conservation: An intern's perspective

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Natural History Conservation as a specialism is still relatively rare in the UK and tends to be overlooked in the standard syllabus in many conservation courses. As such on completion of a master's degree in the Conservation of Historic Objects, I undertook an internship in Natural History Conservation the focus of which was the conservation of taxidermy. Over the course of the year in-house training was provided as well as external short-term courses. The internship has been fundamental in the development of my conservation specialism and has served to highlight the available technologies which can enhance the preservation of zoological specimens such as X-radiography, endoscopy and X-ray fluorescence. The availability of such technologies can be utilised by the conservator to make more informative decisions regarding treatment plans and determine health and safety concerns.

POSTER

The University of Colorado Museum's Fossils in the Classroom Project

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The aim of the Fossils in the Classroom Project is to engage elementary students and teachers in communities across Colorado in the study of the ancient prehistory of Colorado through hands-on experiences with fossil animals and plants that once lived in the state, and to get students turned on to science through paleontology. In 2009, the Colorado Department of Education adopted new state academic standards that, for the first time, specifically included the study of fossil organisms. Unfortunately, there were very few resources available to address this new standard, and teaching resources were limited.

The goals for the Fossils in the Classroom project directly addressed the new Colorado State Curriculum Standard related to fossils for 4th grade students

through the following. Our team (with the assistance of CU undergraduates and graduate students) built 25 kits containing real and cast fossils, tools, and five detailed lesson plans with associated student exercises and teaching instructions, which were then distributed to five to school districts across the state, reaching more than 1,300 students. Lesson topics ranged from how fossils form to interpreting climate change, vertebrate tooth anatomy and diet, and fossil footprints and trackways. Our project targeted districts with a high proportion of students on free and reduced school lunch programs, as data indicates that these schools have lower rates of science literacy. On-site training provided to teachers on how best to use the kits in their classrooms was a critical step in getting teachers to actually use the materials and exercises as intended with their students. Lastly, a poster featuring sites of paleontological interest plotted on a geologic map of Colorado is being distributed to 4th grade classrooms throughout the state in a broad scale effort to increase science literacy and promote paleontology in the classroom.

ORAL

Shared digital infrastructure —An institutional approach

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The Yale Digital Commons (YDC) is a campus-wide collaboration to develop shared infrastructure for the creation, management and dissemination of the expansive digital asset collections at Yale. This talk will show how Yale's Office of Digital Assets and Infrastructure has used a programmatic approach to collaboration to define and build a robust digital content infrastructure. It will provide an architectural view of the system as a platform and review the core digital services—Mass Storage, Digital Asset Management, Cross Collection Discovery, Content Delivery, Persistent Linking and Preservation.

POSTER

The bird collection and the management at the Yamashina Institute for Ornithology: Overview

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The Yamashina Institute for Ornithology (YIO) maintains approximately 69,000 bird specimens including skins, spread wings, skeletons, fluid-preserved, eggs and nests. The YIO collection is the largest ornithological collection in Japan, and one of the largest in East Asia. The collection consists of specimens that Dr. Yoshimaro Yamashina and other leading Japanese ornithologists collected, purchased, or exchanged with the other organizations. The oldest specimen was collected in the 1700s, whereas some other specimens were collected in the 1800s, the dawn of ornithology in Japan. The YIO collection includes extinct and rare species in addition to approximately 200 type specimens, which are all academically valuable. We keep on collecting specimens since 1932 when the Institute was founded.

We routinely register donated bird carcasses. Because bird carcasses provide not only the material for preserved stuffed specimens but also tissue we can take from it, we began collecting muscle and liver tissue samples for molecular biological studies in the 1990s. The specimens and tissue samples are used for DNA barcoding. Along these efforts, we began building an electronic collection database in 2001. In developing a database, we took digital photographs of both specimens and their associated labels, and then entered the information in to the database by reading data from the digitized labels. We disclosed the database in 2009 and made its English version available in 2011. Currently, you can see most of the over 60,000 specimens and their labels in the collection online (http://decochan.net/). We will also report on the registration system for specimens and materials adopted at YIO.

ORAL

Herbarium collections and DNA barcode reference libriaries: Complementary benefits and hidden dangers

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DNA barcoding was proposed as a way of using genetic markers for the rapid and efficient identification of living organisms. Despite earlier skepticism of the utility of DNA barcoding for plants, recent results provide clear evidence that DNA barcode reference libraries based on consensus of several chloroplast markers alone (*rbc*L, *mat*K, *psb*A-*trn*H), or in combination with ribosomal DNA region (ITS) can be used for rapid identification of specimens, at least to generic level, which is especially important in the species rich floras. The exhaustive collections of sequences from local floras based on correct identifications can significantly increase resolution power of the plant barcodes applied to incompletely identified material. Herbaria play an important role in long-term accumulation of specimen records for plant species, especially for rare species and those from unique locations at their range limits. The possibility to use herbarium collections can significantly improve the representation of the reference barcode library, and help to accomplish projects in shorter term, and at greater cost-efficiency. Additionally, the cross-reference with the

herbarium vouchers annotated by experts allows increasing quality of the reference sequence database. As a feedback, beneficial to the collections, wide screening and analysis of the DNA barcodes help in indication of errors and proper annotation of the herbarium specimens. We demonstrate a cost-efficient algorithm to create an exhaustive sequencing reference library (Churchill, Manitoba) based on 40% herbarium material (WIN, MMMN), and using it as a sensitive tool to improve quality of the herbarium collections. Using summary of the collaborative DNA barcoding projects of the Canadian Centre for DNA Barcoding (University of Guelph, Guelph, Canada) with the researchers acquiring the herbarium material from Costa Rica, Peru, Australia, Nederland, Finland, etc.(2009–2012) we show that the herbarium samples can generate from 80% to 20% successful barcodes depending on the sampling approach and material preservation. A critical success factor is close coordination between the participants of the project representing collections and molecular laboratory and cross-reference between a herbarium specimen and molecular data.

POSTER

Reality check: Our experience integrating invertebrate paleontology and paleobotany collection databases

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Digitization is intended to capture electronically the data about collections, help preserve the information, enhance informational integrity, and improve access to the collections. In science museums, the need to share specimen data across collections or disciplines, within and beyond a single institution, is paramount. Identifying and building toward explicit common goals are the keys to navigating challenges and resolving conflicts while constructing an integrated, cross-disciplinary database.

As part of a recently completed NSF grant, we were involved in integrating the databases of the paleobotany collection with the invertebrate paleontology collection to provide a single point-of-access collection database. However, we realized that even within the paleobotany department's collection we had an "integrated" database. As the paleobotany collection contains not only plant fossils, pollen, and spores, but also other microfossils (predominantly ostracods). Therefore, we needed our database to handle the requirements of recordkeeping for both plants and animals with the added dimensions that the information-rich and integrative field of paleontology contains. Some similarities in database field needs exist (e.g., stratigraphic age assignments), but we also learned some of the needed fields, and even the ways we treated fields, were not the same. Many of these disparities arose due to differences in plants versus animals. We found challenges like: differences in formatting/naming according to the botanical and zoological codes; the taxonomic categorization challenges of fossil plant part names and trace fossils; and the differing dimensional and categorical fields. We found that parsing of the data allowed setbacks to be overcome, although some challenges remain to be solved.

ORAL

Using herbarium databases to deduce plant associations

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Specimen databases provide an enormous source of data on organism distributions. We have been able to use the ca. 485,000 Arizona herbarium specimen records in the SEINet database to investigate plant associations in that state using two strategies. Strategy 1 uses the Associated Species field that lists the additional species observed by the collector when collecting a specimen. For instance, if species X is commonly found in the Associated Species field of species Y, then we suspect that X and Y belong to a similar vegetation type and have similar ecological requirements. Strategy 2 uses georeferenced specimens. If species X and Y often grow close to each other (e.g., within 0.005 degrees of latitude and longitude), then it is possible that they have similar ecological requirements and constitute members of a vegetation type. The results of these investigations are what we call "proximity charts" that link species to each other in networks based on their relative frequency of association based on strategies 1 and 2. We have mainly used the more common woody species for this research because they are frequently mentioned as "associated species" and because they are commonly collected. The "proximity charts" clearly show how vegetation changes in species composition from high to low elevations and how particular groups of species tend to have multiple links within a group. The charts can be used to confirm concepts of vegetation type (e.g., chaparral, mixed conifer forest), or can be used to demonstrate how vegetation changes gradually as a continuum over the landscape. Once a chart has been made, any additional species (e.g., a rare or endangered species) can be added to discover where it falls on the continuum of vegetation.

POSTER

Stabilizing special collections for high-density storage at the Library of Congress

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Most libraries, archives and museums find themselves dealing with growing collections and decreasing available storage space. As many facilities plan for off-site or alternative storage solutions for their special collections, they will need to improvise new approaches to housing collections for transport and long term storage. This poster addresses strategies employed by the Library of Congress to ensure the long-term preservation of special collection materials being moved to a high-density off-site storage. This poster will be of interest to archivists, preservation specialists and other collection specialists responsible for the long-term storage of special collections such as architectural records, posters, photographs, 3-dimensional objects, textiles, globes, relief maps, etc. It will also be of interest to anyone responsible for preparing collections for a move.

ORAL

3D imaging of the structural and geometrical properties of avian nests

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To engineers and biologists, avian nests are a remarkable engineering and evolutionary feat. Stick nests represent naturally occurring stable packings of long rods, and it is of fundamental and technological interest to understand why avian nests are so stable and strong. We have employed two imaging methods to uncover the mechanical and structural properties of avian nests. The first method is nondestructive x-ray computer-aided tomography scans that allow complete 3D reconstructions of the nests, which allow us to calculate the number of contact points, the angles between sticks, and the overall design of the stick nest. The second method has involved deconstructing sample birds' nests by hand and measuring the properties of the individual sticks such as the arc length, center of mass, degree of branching, and aspect ratio. In this presentation, I will give an overview of our progress in this research project as well as discuss the complications associated with 3D imaging of avian nests.

ORAL

Research on energy savings opportunities: System shutdowns and cultural institutions

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This paper will introduce the methodologies and early results of investigations into a promising method to achieve significant reductions in energy use in cultural institutions without compromising the preservation quality of collections environments through a carefully monitored and risk-managed shutdown of air handling units during unoccupied hours. Research shows that environmental conditions (temperature and relative humidity) are the most significant factors that impact the lifespan of cultural materials held by institutions. Mechanical systems in cultural environments are therefore frequently designed to run continuously in order to maintain the desired environmental conditions, often resulting in a high cost both monetarily and in energy consumption. Altering these conditions through changes in HVAC operating schedules is a risk many institutions are hesitant to take.

The specific research question investigated in this project is whether energy usage can be significantly reduced by carefully monitored and risk-managed shutdown of Air Handling Units (AHUs) during unoccupied hours in selected spaces without compromising the quality of the preservation environment. In addition, this research involves several subsidiary questions:
—What are candidate collections spaces for shutdowns and what are the best ways to identify them?
—What tools are needed to measure energy use and the effects of changes on the conditions of collections?
—What procedures and processes for collaboration among facilities and library/preservation staff are required?

In addition to methodology and early results, the paper will also discuss lessons learned to this point in the research process, unexpected findings, and the potential impact in cost-savings of these practices.

This three-year experiment is federally funded in the United States by the Institute for Museum and Library Services, and conducted by the Image Permanence Institute (IPI) at the Rochester Institute of Technology and their partner Peter Herzog, principal of Herzog/Wheeler & Associates, a Minnesota-based energy consulting firm.

POSTER

Fragile creatures: Reboxing Blaschka jellyfish

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In 2008, there was an opportunity to exhibit some of the Natural History Museum's (NHM) Blaschka marine invertebrate glass model collection at and the National Glass Centre, UK and Tring Museum. It was the first time they had travelled to and been displayed at external venues since 1881. Although more famously known for the making the glass flowers exhibited at the Harvard Museum of Natural History, the father and son partnership of Leopold (1822–1895) and Rudolf (1857–1939) Blaschka also made numerous marine invertebrate glass models. Some of the first models they made were sea anemones in the early 1860's and the NHM, London purchased their first set around 1865. This collection currently holds over 185 Blaschka glass models consisting of anemones, sea slugs, jellyfish, octopus, squid, protozoans and corals representing their entire model making career. The models were made in a variety ways with many formed over wire skeletons (known as armatures) with the glass fused together or glued. Therefore the process for making bepoke boxes out of Correx sheets with Plastazote linings for the jellyfish in particular and sourcing correct travel cases was an important part of this collection's care prior to exhibition display.

In the past these models were of scientific importance in teaching but as trends change their significance as works of art are also being highlighted. Each glass model is a unique blend of art, science and craftsmanship looking more life-like than real specimens whose natural colours may fade when stored in jars of preservation fluid over time. Recently the style and the materials used for the jellyfish models boxed storage back in 2008 has been reassessed and new procedures for creating storage for them is evolving.

POSTER

Planning an ApplePie network based on Filtered Push technology to connect botanical collections

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We introduce ApplePie, an instance of a Filtered Push network configured for botanical collections. ApplePie is based on the AppleCore guidance for the use of DarwinCore in herbaria. ApplePie has two primary functions. First, increasing digitization efficiency through rapid discovery of potentially duplicate specimens and delivery of consensus records. Secondly, fostering the accumulation and communication of botanical knowledge through digital annotation; brokering, for the first time, two-way flow of information from aggregators to the sources of the primary object records (herbaria). ApplePie will consist of a set of Filtered Push clients and network nodes. Each node represents an access point ApplePie providing client access to network functions such as messaging services to distribute annotations. The network will contain a knowledge store providing a history of annotations and a cache of data harvested from network participants. Of special relevance to botanical collections, analytical capabilities will be provided for the detection and clustering of potential botanical duplicates, and provision of consensus data will increase data capture efficiency for network members. A web interface will also allow authorized users to view annotations. Several clients will be connected to this network, including Morphbank, Symbiota, and a set of Specify6 collection databases. Annotations collected from Morphbank and Symbiota will be delivered to an annotation processing interface linked to Specify6 collection databases or the web interface to the network, where data curators can review and filter them. Specify6 databases, through implementation of software that maps annotations expressing AppleCore-compliant DarwinCore assertions onto Specify's schema, will be able to directly ingest annotations accepted by the data curator. We will describe the core components involved in ApplePie, including the central technology for many of the activities of the network, the annotation, and how the technologies are configured into a functioning network. Supported by NSF DBI-0960535.

ORAL

Hazard identification and exposure assessment of conservation occupational work tasks associated with anthropological collection objects

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The National Museum of Natural History Department of Anthropology prepared 389 objects for loan to the Anchorage Museum at Rasmuson Center, Anchorage, Alaska, to be used for research and exhibition in collaboration with native tribal groups and other researchers. Instrumental analysis results and archival records indicated many objects may contain potentially hazardous substances such as arsenic, mercury, lead, and organic chemical residues. Sources may be from inherent construction

materials (glass beads, pigments, dyes), past pesticide and preservative applications acquired during collection and storage, and/or chemicals used in conservation treatment and preventive care. In keeping with Smithsonian Institution Safety Policy, the Department sought both to minimize potential health and safety risks to its staff and to provide hazard information data to the loan recipients. A comprehensive occupational exposure assessment was conducted between 2007 and 2010, utilizing industrial hygiene personal sampling methods to determine inhalation, dermal and biological dose. Worker inhalation exposures to mercury particulate and vapor, and arsenic and lead particulate, were significantly below current U.S. occupational exposure limits. Results of biological monitoring samples were within clinically normal ranges for these metals, not exceeding respective Biological Exposure Indices. Risks were minimized through use of Department-established safe work practices, including aeration of cases prior to accessing; local exhaust ventilation, use of personal protective equipment and High-Efficiency Particulate Air (HEPA)-filtered vacuum cleaners during work tasks and routine surface cleaning, staff training and hazard communication.

POSTER

Planning an effective workflow for digital photography of collections

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Capturing high quality photographs of collections is becoming easier and more affordable thanks to the growing accessibility of digital photography equipment. However, the prospect of starting an imaging project from scratch can be overwhelming and subject to a haphazard start. Adopting a workflow based on the following key steps will help to ease the process and create optimal practices for utilizing photographs of collections:

1. Prioritize parts of a collection to be photographed.
2. Create a work area with dedicated space and equipment for shooting.
3. Standardize photographic procedures and equipment settings.
4. Edit settings such as exposure, color correction, and cropping of each image file, if necessary.
5. Add important collections information to the metadata of each image, including copyright.
6. Save and store high resolution and downsized files for each image. Be aware of file sizes and formats in regards to storage space and future use.
7. Put images to use both within your institution and publicly.

Each step of an imaging workflow has multiple options, accommodating a range of needs and means with little compromise to quality. Well thought-out decisions will achieve an efficient working procedure while ensuring the consistency and usefulness of specimen images. Digital images of collections not only have archival advantages, but also are an easy and sustainable way to reach out to researchers and the public. It is well worth the effort to put together a digital imaging project to protect and also share collections.

ORAL

Virtualization and the democratization of natural history

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The Idaho Museum of Natural History has been developing the virtualization infrastructure to democratize science by placing complete natural history collections on-line using newly enhanced techniques in virtualization and hyperplastic database development. This project began with the multi-year NSF funded Virtual Zooarchaeology of the Arctic Project (VZAP), that has successfully virtualized every bone from 160 arctic mammals, birds, and fish in 2D and 3D formats, in a searchable and flexible database system. This is not simply online imaging, but rather, these virtual collections are accurate to 0.001 mm, can be measured and analyzed on screen with 0.01 mm accuracy, and have created the opportunity for scientists around the world to conduct research from wherever they happen to be located. Far beyond the virtual museum, the virtual scientific repository is the foundation for a truly open-access natural history science that has implications for all object-based collections use. The database structure, 3D and 2D imaging techniques, and on-screen measurement and analysis tools will be demonstrated and reviewed, and our translation of these techniques to all areas of natural history including anthropological collections and herbaria, will be presented as a model for the future of education and scientific outreach for natural history repositories.

ORAL

The American Museum of Natural History Archive Project

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Faced with the enormity of the task of identifying and managing its vast archival collections, the American Museum of Natural History Library solicited support from the Council for Library and Information Resource's Hidden Collections program to create minimal level records for its manuscripts, department records, photographic print and photographic slide collections. About the same time, AMNH Natural Science Conservation and the Library applied to IMLS for funding for a risk assessment project for the libraries and archives in the Science Departments, the first phase of which was to identify and catalog these archives, held outside the Library. Both projects were funded. At the beginning of 2010, two project archivists were hired to supervise scores of student interns to work in teams gathering data to create catalog records and repurpose it to allow for online discovery of the resources. While the Library began working with spreadsheets to review and enhance existing data for approximately 1,400 collections, the Science Department archives were in various states of arrangement and description with no existing documentation. With the same methodology that the Library had developed for the CLIR project, using teams to create records by collecting data on spreadsheets, it became possible to have the archives content described and made accessible quickly and efficiently. So far, after one year of work, over 1,300 records for archival collections in the AMNH Science Departments have been created. This is in addition to the 1400 documented in the Library. Both projects will be completed this year. Currently, the extent of AMNH archival collections is estimated at 25,000 linear feet. More data will be developed to create complex authority records for individual and expedition names. Using these records with the emerging web technology of linked open data will allow linking archival records to specimen, publication and field book records.

ORAL

Innovative educational and collection management tools for natural history museums

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Natural Europe project refers to museum educators, science teachers and museum visitors who wish to be informed about how to efficiently design learning activities that will incorporate aspects both from the science curriculum as well as aspects from the exhibits/collections/material of the Natural History Museums.

The idea is to investigate the pedagogical considerations arising out of the project's intension to design innovative educational pathways, scenarios or fieldtrips to bridge formal and non-formal education of natural history and the environment, by an explicit focus on a NHM visit. Hands-on objects tend to be rather reactive, expressing predetermined responses. The unique strength of NH Museums is that they can provide schools with the real world context and the exploratory experiences that constructivists are advocating. With these in mind and technology becoming increasingly sophisticated, the Natural Europe project will be using numerous tools to enhance learning, such as the special multilingual software tool that will allow museum educators and visitors to create educational pathways using the existing digital collections. Moreover, Europeana portal shall be used, hosting the project's pathways along with the project's portal.

Natural Europe aims to provide the educational and collection management tools in the form of Software as a Service to small museums who do not have the resources and the expertise for hosting educational tools such as the Educational Pathway Authoring Tool and the collection management tool. To this end, the cloud service of okeanos (https://cms.okeanos.grnet.gr) will be used to create virtual machines with pre-installed the software tools. Museums will be able to get their own educational or collection management tool following a simple procedure and without the need of maintaining hardware resources. Software tools that will be "contained" in the virtual machine will allow the exposure of metadata to cultural and educational networks such as Europeana and ARIADNE, respectively.

ORAL

Riding the World Wide Web to fame and fortune

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Museums have traditionally shared knowledge of collections through exhibits of specimens and dioramas. As technology has evolved images, sounds, videos, and many forms of interactivity have been incorporated to provide the visitor with a more enriched experience. To stay modern and relevant, museums have had to work harder and harder to capture the imagination of their audiences. Radio, television, and print have been traditional ways to reach our audiences in their homes, however increasingly, these have been replaced by the World Wide Web through the home computer and mobile technologies. As Internet and social media developments impact the museum community at an amazing rate, can we ride this digital wave to success or will it scour us away?

The Field Museum is reaching out digitally in several new ways using our new content management driven website. Open access gives staff the ability to add their own content and publish directly to the live site. For example, the fossil invertebrate intern was able to post his own video on digitizing Silurian reef fossils (http://

fieldmuseum.org/explore/multimedia/silurian-reef-database) to the divisional page. The Museum has also launched a weekly video series, The Field Revealed (http://fieldmuseum.org/explore/the-field-revealed) that highlights staff research and collections including one on the Tully monster (http://fieldmuseum.org/explore/multimedia/video-tully-monster). An iOS app, Specimania (http://fieldmuseum.org/about/specimania) was recently launched and features specimens and artifacts from The Field Museum's collections in several games.

The collections home page is in the top ten most visited pages on our website and nearly half of the top 25 science webpages visited are collection focused. The Collections and Research newsletter (http://fieldmuseum.org/explore/crnewsletter) is online and through social media (http://www.facebook.com/fieldmuseum) has become one our most popular pages. People are interested in what we do, the challenge is how we package it, market it, and build up audiences on social networks.

ORAL

ConservationSpace

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The conservation community realized many years ago that a digital solution for managing documents could increase access, expand research opportunities, support workflow procedures, and reduce the loss of documents. The Mellon Foundation astutely recognized that a coordinated effort would improve success and reduce the costs for developing a software application to address this need. So in 2006 the Foundation organized a series of community and stakeholder meetings to characterize the challenges of conservation documentation in the digital age and to broker opportunities for collaborative solutions. To create momentum for the concept of a coordinated approach to open source software development, the Foundation funded a second initiative in 2009 (the "Design Phase of ConservationSpace") that was led by the Office of Digital Assets and Infrastructure (ODAI) at Yale University. Two community-design workshops were organized that included sixty-four conservation professionals from the United States, Europe, and Australia—representing forty-nine institutions and organizations. These meetings generated a set of common workflows and technical needs laying the groundwork for the development of a conservation-specific software system.

With the work of the 2009 "Design" Phase as their blueprint, the National Gallery of Art in Washington D.C. assumed a leadership role for the ConservationSpace project in 2010. Seven other institutions, the Denver Art Museum, the Indianapolis Museum of Art, the Metropolitan Museum of Art, the Statens Museum for Kunst, and Yale University, joined the NGA as project partners for the 'Planning" Phase of ConservationSpace. With the continued support of the Mellon Foundation, the NGA and their partners reviewed the workflows and began fleshing out the technical requirements. Most importantly, the NGA and partners developed a proposal detailing the costs and process needed to finally realize an open source software application specific to the needs of conservators and the scholarly community.

The "Build" Phase of ConservationSpace was begun in January of 2012 with a week-long workshop and meeting of the partners. The ambitious project plan for the system build calls for the development of a prototype capable of being tested by the partners by the end of 2012. As has been the case in all phases of ConservationSpace, the participants include conservators and information technology specialists from both the US and abroad and represent a wide range of conservation specialties and collection contexts. The goal of all involved, partners and the Mellon Foundation, is create a 21st century system that will be useful to the conservation community at-large across specialty and collection lines, and in laboratories large and small.

POSTER

A high volume production method for wedge-type storage mounts used to house ceramic pots

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The nature of high object-volume projects although superficially intimidating can often result in the multiplication of opportunities due simply to economies of scale when combined with thoughtful design.

This presentation describes and illustrates one approach to the manufacture of wedge-type storage mounts for housing large quantities of ceramic pots. The idea was to retain the best characteristics of the wedge and counteract to a large degree its disadvantages. Also the end result in this case provides a unique function not normally found in either wedge or ring type mounts.

The method shown utilizes a traditional storage mount technique applied to inexpensive and widely available materials employing common tools and mass production techniques borrowed from the commercial crating profession to result in a product that is less expensive and more effective than even the best wedges commonly made.

The resulting design allows relatively inexperienced workers to produce wedges that conform perfectly to the shape of each vessel in a fraction of the time that even the most skilled mountmaker would need to achieve the same result. As well the system results in a degree of

consistency across the entire collection that is not normally found with multiple workers making mounts all while minimizing the amount of wasted materials.

Technically the design features improved distribution of surface contact as well as a superior *quality* of contact allowing the wedge to conform to slight surface irregularities and enabling the wedges to actually mitigate vibration—a feature not found in standard wedges or rings.

ORAL

New approaches to combat an old infestation: Webbing clothes moths at the Natural History Museum, a case study

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Regular trapping and periodical inspections alerted Natural History Museum's IPM Group of the rise in the number of webbing clothes moths, *Tineola bisselliella,* in the Museum's public galleries in late 2010.

Aware of the problem created in a major Museum in the area where moths had established a large colony, the NHM combined the use of pheromone lure traps and the new visual display of trapping data provided by the integration of this information into the KE-EMu collections management system to closely follow the evolution of the infestation.

At the time, a rodent infestation was discovered in the back stage of one of the Museum most popular themed galleries, far away from the Mammals corridor were the moths were occurring.

The same species of moths were discovered harbouring in textile materials contaminated by the rodents there. The use of pheromone traps and digital cameras proved that both infestations were linked and that there was a strong possibility that the moths were thriving in the welcoming environment created by the rodents.

Also using the under floor ventilation ducts to move around the Museum's public galleries, posing a dangerous threat to the Mammal specimens on display in those galleries.

While the rodents were being dealt with, the Museum's IPM group coordinated the efforts of several teams to apply remedies based on IPM principles and best practice.

Housekeeping, Design & Installation and Estates maintenance teams worked together coordinated by the IPM group in controlling this infestation.

A trial of a new pheromone distraction product is also underway.

ORAL

Catherine Parr Traill and Adam White: Challenges met and discoveries made while conserving their historical botanical scrapbooks

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The Green Plant Herbarium of the Royal Ontario Museum (TRT) maintains a special collection of historical scrapbooks, botanical artwork, seed necklaces and handicrafts. Many of the scrapbooks date to the mid 19th century and exemplify the Victorian era of natural history collecting. Among them, two scrapbooks compiled by Canadian pioneer and authoress Catherine Parr Traill, and three compiled by Adam White, an entomologist at the British Museum in London, all historically significant, were in ill repair and deemed to be at risk. Collaboration between ROM botanists and the ROM's paper Conservator led to the development of protocols for the cleaning and repair of the scrapbooks that could be carried out by second year university project students and casual staff. Radical measures were required for some of the scrapbooks including disassembly of the artefact and remounting of its pages as individual mounts so that they may be safely handled. Cataloguing of individual specimens and digital capture of pages facilitated the development of web pages to provide access to specimens and historical information while reducing the handling of them. The documentation process led to the discovery of type material collected by J.D. Hooker in the Kerguelen islands, and highlighted Parr Traill's connections to the botanical elite of North America at the time.

POSTER

Collection improvement and expansion feasibility studies: An essential planning tool for many collections

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Many collections exist today in buildings that were not planned to house them. This has led to insufficient space and inadequate protection. In order to respond to these problems various scenarios are considered including both renovation of existing facilities and new, fit for purpose builds. Typically, unknowns and complications result in a lack of action and the situation worsens. This can

lead to unfortunate decisions regarding the collection and even the loss of irreplaceable specimens. An effective way to deal with such a situation is to engage in a feasibility study. This action was recently taken by the Canadian National Collection of Vascular Plants (DAO) in Ottawa. A professional consultant was hired and the goal was to determine a working footprint for the collections, associated resources (e.g., library, digitization room, etc.), and their staff. The objective was to provide the level of comfort and detail that would allow prompt and sensible decisions and timely next steps. This important exercise necessitated a broad analysis of current and future requirements based on both internal and external knowledge. The internal knowledge included number of specimens, growth rate, types of shelving, water and fire damage risks, security, and temperature and humidity requirements. Building site restrictions and renovation limitations due to heritage status were among the kinds of external knowledge required. Conceptually, the footprint we developed could then be placed into the framework of existing or potential new facilities and allow costs to be calculated to aid decision makers. Although not all institutions would be able to pay for an extensive study, there is value in making an effort to document collection requirements for quick reference when opportunities are presented. We share some of our methodology and findings as they may be generally valuable to all caretakers of natural science collections.

ORAL

An overview of the Global Plants Initiative

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The Global Plants Initiative (GPI) is an international collaboration to develop a digital database of botanical type specimens and supplemental materials. Funded by the Andrew W. Mellon Foundation since 2003, the project began as the African Plants Initiative with the aim of electronically repatriating type specimen data. It then expanded in scope, first to incorporate type specimens from Latin America, and later all type specimens. GPI now includes more than 220 participating herbaria in over 60 countries on 5 continents. High-resolution scans of type specimens are produced using Herbscan equipment designed specifically for the project. Digitization methods have been adjusted to accommodate cumbersome collections, such as cryptogams and bulky specimens. All type specimen data and images from collaborating institutions are added to the JSTOR Plant Science database. In the project's ninth year, the resource now includes over a million type specimen records and an additional 250,000 digital objects including paintings, drawings, correspondence, and supporting materials. The JSTOR Plant Science online environment has become an invaluable resource for plant-related research. It is also a platform for participating institutions to update their content as users provide feedback. The project is nearing completion, but herbaria may still apply for funding if they wish to participate.

ORAL

The physicochemical characteristics and conservation of fossil resins (amber)

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Fossil resins recovered from deposits around the world are each chemically and physically distinct, reflecting their disparate botanical origins. The older Mesozoic resins are invariably produced by conifers (Gymnospermae), while many of the Cenozoic resins derive primarily from two distinct families of flowering plants (Angiospermae: Dipterocarpaceae and Leguminosae). Amber is a natural polymer, and it becomes harder (often also more friable) over millions of years (Nascimbene et al, 2010). It beautifully preserves fossil organisms (arthropods, botanicals, even occasional vertebrates) in subcellular detail, making these fossils of exceptional scientific value, since they can be meticulously compared to living species. When removed from anoxic sediments, however, all ambers, regardless of age or botanical affinity, react to exposure from light, heat and fluctuating humidity by darkening, crazing, and eventually cracking or disintegrating (Bisulca et al, 2012). Such deterioration threatens the integrity and survival of any inclusions, requiring specific steps to conserve specimens in natural history collections. Historical preservation methods, for instance mounting amber pieces in wells of Canada Balsam, or coating them with varnish, have proved to be less than adequate, and in some cases detrimental.

Chemically, most ambers are categorized as Class Ia, Ib or Ic (Anderson et al, 1992; Anderson and Crelling, 1995); these include resins from both conifers and flowering plants. In contrast, significant new amber deposits in India and Arkansas (produced solely by angiosperms) are Class II (dammar-type) resins (Rust et al, 2010; Dutta et al, 2011) – they are less polymerized, softer, and exhibit 'stickiness' on freshly exposed surfaces. A set of protocols has been developed to conserve both types of fossil resins to stabilize and protect specimens for long-term study and housing in museum collections. This includes embedding individual pieces of amber in a high-

grade epoxy under vacuum, as well as creating anoxic storage conditions.

ORAL

Common and effective digitization practices in biological and paleontological collections

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Staff of iDigBio (Integrated Digitized Biocollections), the U.S. National Science Foundation's National Resource for Advancing Digitization of Biological Collections, recently visited 28 active biological and paleontological collections digitization programs in 10 U.S museums for the purpose of documenting and assessing current digitization practices and tools. Using a grounded theory research approach, our observations identified five task clusters common to efficient and effective practices in the digitization of biological specimen data and media: (1) pre-digitization curation and staging, (2) specimen image capture, (3) specimen image processing, (4) electronic data capture, and (5) georeferencing locality descriptions. Examples of these clusters come from the observation of diverse digitization processes leading up to data publication. While not all institutions are completing each of these task clusters for each specimen, these clusters describe a composite picture of the digitization of biological and paleontological specimens. In successful digitization programs, these clusters are underpinned by institutional support, effective biodiversity informatics management, written workflows, and productive digitization personnel. We offer an overview and introduction to iDigBio and its activities, describe the five task clusters we identified and the importance of the infrastructure that supports them, and offer a set of workflow patterns for digitization programs.;

POSTER

Maximizing space: Wall mounted storage for long narrow objects

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Long, narrow objects like spears, lances and arrows present storage challenges. They are too long to fit in storage cabinets. If stored horizontally on open shelves, they can be difficult to retrieve. The Science Museum of Minnesota capitalized on an 8 inch wide gap between cabinets on compactors and an interior wall to create a wall mounted storage system for long narrow objects. Standard wall mounted shelf uprights are attached to the wall every 16 inches. A narrow shelf made from one-half-inch thick corrugated polypropylene supported by light duty shelf brackets runs along the lowest part of the uprights. The objects are supported vertically on the narrow shelf and secured to the uprights through a variety of custom ties and clasps. Bows are stored horizontally, supported by custom wire hooks stretched across several uprights. The affordable system is flexible and the objects are easy to see and to retrieve.

POSTER

Krypto-S: A user friendly collection database interface

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The Department of Cryptogamic Botany at the Swedish Museum of Natural History in Stockholm has developed a web interface to access the information in the botanical collection database called Krypto-S. Together with the Phanerogamic department Krypto-S is one of the largest on-line databases for botanical specimens in the world and currently holds over 1 322 000 registered specimens, all accessible via the web interface.

There are several benefits for the herbarium in having a quick and easy to use web interface. One is that loan handling has been made easier. All species represented in our general herbarium and 32 % of the specimens are registered including all of the 50 276 type specimens kept in the Cryptogamic department. The two botanical departments together make it possible to search and access nearly 100 000 type specimens directly on-line. The requests for loans are therefore more specified now, often with the collection number for particular specimens.

Over 48 000 of the specimens have photographs attached to their database record. You can view high quality images at a millimeter level. We have noticed a decline in the number of loans from the department. This is most likely because of the access to the high resolution images. Sometimes it is enough to look at a picture of the specimen. The search options provided in the web interface also give the user good query possibilities with many options of sorting the search result.

The new DINA database project, a collaborative effort involving institutions hosting major natural history collections in Sweden, Denmark and Estonia, organized from the Swedish Museum of Natural History is adopting the Krypto-S structure and interface for the purpose of displaying and accessing natural history collections.

POSTER

A textile hanging system composed of readily available hardware materials

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Best practices for long-term storage of flat textiles call for rolling them and suspending the rolls, to avoid damage to textile fibers caused by folding and stacking. A simple wall rack for hanging textiles can be built using materials that are available at most home-improvement or hardware stores.

The multi-row system installed at the University of Iowa Museum of Natural History consists of wall-mounted shelf standards, brackets, closet poles, J-bolts, and nuts from our local big-box home-improvement store. We attached two heavy-duty, 78-inch powder-coated steel shelf standards to the wall above a cabinet, six feet apart; 18 powder-coated steel shelf brackets were arranged to accommodate nine rows (nine brackets on each standard). Each row holds three or four six-foot, powder-coated-steel closet poles, each of which is suspended from the shelf bracket by two steel J-bolts that run through the poles at each end, secured by nuts. Today's cost for materials is $553 (about $60 per four-pole row, plus tracks).

Textiles in the UIMNH collections were rolled with acid-free, lignin-free, unbuffered tissue paper on three-inch-diameter archival tubes and tied with twill tape. The poles run through the tubes to suspend them. Tubes, rolled tissue paper, and twill tape were purchased from an on-line archival supply vendor ($933 plus s/h). Cheaper, non-archival tubes are available but are generally acidic and must be covered with a protective barrier before rolling.

With multiple textiles of varying width on each pole, the UIMNH textile rack accommodates 77 textiles, with some room for expansion, in a previously underutilized, 68 cubic foot space above a cabinet. Systems using similar hardware can easily be modified to fit the needs of other institutions.

ORAL

Using specimen collections databases to highlight significance of animal pollinators: A case study from East Africa

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The National Museum of Kenya's (NMK) zoological specimens collection has for more than a century been recognized as an important source of information on East Africa's natural history because of its representativeness of the region's biodiversity heritage. Of late, this reputation has been enhanced even more as a result of NMK's adoption of modern collections management techniques, consolidation of disparate database components into one system (SPECIFY) and initiating a process to develop a functional bioinformatics platform. As a result, we recently achieved an important milestone by tapping into our new informatics system to obtain practically applicable region-wide natural history information relating to animal pollination as an ecosystem service. Specifically, we sought to draw a list of 100 most important animal pollinators in East African countries (Kenya, Uganda and Tanzania) mainly to for the benefit of farmers, scientists and pollination entrepreneurs in the region. Information was derived chiefly from our zoological collections (and observation records) Specify Database at NMK with supplements from technical publications, direct contact with pollination experts, field observations and online resources. Data capture was three dimensional: taxonomic (identification); temporal (collection/observation date) and spatial (geo-reference). 100 most important pollinators for East Africa were determined by ranking using a function incorporating total number of plants they pollinate in the region; number of countries the pollinator occurs in; values of plants (for food, for ecosystem or market-value) they pollinate. Class Insecta (Arthropoda) accounted for 79% of the pollinators while Avea and Mammalia (Chordata) accounted for 15% and 6% respectively. Insect pollinators were from four orders and 77 families. Overall, *Apis mellifera* (Hymenoptera, Apidae) was the most important pollinator in the region, pollinating the most plants of diverse domestic, socio-economic and ecological significance. Our collections database has similar potential for spatial and temporal modeling for pests, invasives and climate change scenarios.

POSTER

Fleshing it out: New methods of taxidermy restoration with conservation-approved materials

Palumbo, B.; Sybalsky, J.; Nunan, E.; Levinson, J.; Elkin L.

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The habitat dioramas in the Hall of North American Mammals at the American Museum of Natural History are well known for their expertly crafted and naturalistic taxidermy. These mounts, fabricated by master taxidermists such as Robert Rockwell and the Jonas Brothers Inc, have been on continuous display at the Museum for approximately 70 years. During that time, exposure to unusually high light levels and environmental fluctuations have caused the deterioration of many specimens. In addition to fading and discoloration of their fur, exposed fleshy surfaces on these specimens had become desiccated, cracked, discolored, and sometimes visibly distorted in form. These accumulated damages had af-

fected their appearance and anatomical accuracy, compromising the overall effect of the dioramas.

Between 2010 and 2012, the Museum undertook an ambitious project to renovate nearly all of the North American Mammal dioramas, including the restoration of approximately 100 taxidermy mounts. In one aspect of this project, conservators worked alongside artists and a master taxidermist to develop methods for restoring gross contour and fine texture to deteriorated skin around the eyes, nostrils and lips of these mounts. This poster will focus on two examples of that work: restoration of the snouts of the Bison and Collared Peccary specimens.

The aim was to create a removable attachment that could easily be fit over areas of distorted skin, adhered, and inpainted. BEVA® 371, a commercially available thermoplastic, elastomeric polymer mixture, was bulked with glass microballoons and dry pigment, and then cast in silicon molds created from anatomically accurate models of the areas to be restored. Once the BEVA had set, the result was a soft, pliable imitation of natural skin. The cast Beva was attached to the mount using a heat-spatula. This method developed at the AMNH offers a new, reversible solution to one aspect of taxidermy conservation.

POSTER

Snowmaking at AMNH: New methods in the restoration of winter landscapes in natural history dioramas

Palumbo, B.; Sybalsky, J.; Nunan, E.; Levinson, J.; Elkin, L.

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In January of 2012, the American Museum of Natural History completed a year-long renovation of the dioramas in the Hall of North American Mammals. After seventy years on continuous display, unusually high light levels, thermal damage, environmental fluctuations, and dust accumulation had all contributed to the deterioration of the diorama components. Among the many specialized problems tackled in the course of this project was the dingy and discolored appearance of the snow in several of the winter scenes, particularly the Wolf, Kaibob Squirrel and Canadian Lynx dioramas.

Having become so discolored that it no longer tied it with the background paintings, the snow's appearance in these dioramas undermined their illusionism. Museum conservators and exhibition preparators sought new materials to replace the cotton batting and shaved acrylic that was used in their original construction. Research focused on inert and inorganic materials that could be used to simulate the original effect with a minimal likelihood of future discoloration.

Numerous types of crushed stone, glass products, and ceramic and silicate fibers were gathered for testing, alongside a selection of relatively stable organic materials such as polyethylene foams. Due to the timeframe of the project, opportunities for materials testing were limited, and samples were evaluated based upon their response to real-time exposure to heat and direct sunlight. A subset was selected for use and further experimentation. All three dioramas were successfully restored using a palette of inorganic materials alone or in combination with archival plastics and stable adhesives. The technique developed at AMNH offers a new approach not only for the restoration of existing examples, but also for the construction of new winter landscape dioramas, while prioritizing their longevity.

ORAL

A names-based cyberinfrastructure —What can names management offer to collection management?

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The Global Names Architecture is a concept for a names-based infrastructure that can be used to index, manage and organize information about organisms. The NSF-funded Global Names project is now assembling elements of that infrastructure in collaboration with other initiatives around the world. These components include ZooBank—the environment that will change how new animal names are introduced to science, and CiteBank—that part of the Biodiversity Heritage Library with special interest in articles. A number of web-based names services are now available or are under construction. They include tools that read documents and create a list of names that occur in them. This allows the documents to be indexed taxonomically. Name finding tools can be used to add hyperlinks to the names so that the documents, if web-compatible, can be used to access additional information at specified locations. Reconciliation services address the "many-names-for-one-taxon" problem by mapping alternative names against each other. While still under development, such tools can correct entries for minor variations in spelling such as might arise from transcribing hand-written notes, by poor quality OCR, or simply because of the differing conventions of institutions and curators. Later, reconciliation will include management of synonymies and taxonomic changes, so allowing users to "resolve" names, replacing the original names in document with names in current use. We wish to understand what services would best meet the needs of managers of collections of biological materials.

ORAL

iCBUG: The Peabody's collections in nature's classroom

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The scientific community stands to benefit directly from the acceleration in efforts to digitize museum collections, but can these efforts also leverage public outreach and education? The Interactive Connecticut Butterfly Utility and Guide (iCBUG) is a web application designed for mobile smartphones that exposes the Peabody Museum's large collection of scientific images of butterflies and herbarium sheets to the public. Growing out of the community-based Connecticut Butterfly Atlas Project (CBAP), iCBUG deploys the Peabody's digital assets to assist the public in identifying butterflies and caterpillar host plants in nature, and interfaces with social media resources and mapping resources to allow participants to build butterfly life-lists and record and share butterfly sightings. This product integrates museum specimen records with technologies that come built-in with smartphones—such as cameras, GPS coordinates, and date information—to rank candidate butterfly species by the likelihood of seeing them at a given point in time and space. The intention is to create a digital product that greatly transcends the limitations of traditional nature guidebooks by integrating the Museum's digital assets and specimen locality metadata with the GPS, social web, and mapping technologies.

ORAL

A ticking time bomb: Acid-caused decay of mammal skins

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Over the past years, several mammal collections in central Europe have identified a problem that affects larger skins: These skins contain and accumulate acids resulting from an unfinished tanning process and in many cases from alum. In a slow reaction involving exposure to light, warmth and a high relative humidity the alum used during tanning and remaining in the skin produces sulphuric acid that—when the concentration increases—starts destroying the skins. The damage is irreversible.

In the MfN mammal collection ca. 80% of the skins were treated with alum or even directly with acids. A ticking time bomb: Without any action, it is a matter of time and climate before even good-looking skins will show first signs of decay.

Similar problems of acid-caused decay are well-known for paper. Here, great effort has made to develop methods for neutralization and stabilization the paper. Several companies have specialized in this and developed methods for mass de-acidification of archives and libraries, e.g., papersave® (Zentrum für Bucherhaltung Leipzig/Germany) and Bookkeeper® (Preservation Technologies Cranberry Township, PA/USA).

On the basis of their expertise, our project aims at developing a similar method for skins. This will only succeed as common approach of partners facing the same problem.

Our presentation will give an introduction into the subject. By raising awareness for this issue, we hope to get a clearer overview of number and location of affected collections. That will help us to clarify whether this problem is tied to a certain tanning method, period or area and to find potential project partners for the development and evaluation of possible methods for (mass) de-acidification of skins.

POSTER

Broken bones and dirty stones: Preparing paleontological collections at the Museum of Comparative Zoology (Harvard University) for a major collection move

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The Museum of Comparative Zoology's Department of Invertebrate Paleontology began, in 2007, a renovation project to prepare over one million specimens for a move to new collection storage space in Harvard's neighboring Northwest Building. The goal of this project was to identify and resolve conservation issues in hopes to minimize the negative effects that may be imposed during the physical relocation process. As the project neared completion in 2011, it was expanded to incorporate over 100,000 specimens from the Department of Vertebrate Paleontology.

The workflow for the project included visually inspecting each drawer and noting any conservation concerns. The problematic drawers were then pulled and addressed individually. Specimens therein were cleaned, rehoused, and repaired as necessary. The project proved useful in upgrading the paleontological conservation protocols to the common and unique demands that exist within each collection, and will also help to standardize future collection management activities within each of those collections. In addition to customizing protocols, a new method for utilizing Paraloid B-72 as a clean gap-filling matrix was developed and employed.

One of the most challenging aspects of the renovation project for both departments involved the repair and

stabilization of over 1000 specimens from the fragile Solnhofen Limestone. The majority of these specimens were imbedded in an unstable sandy matrix, severely broken, and housed in century-old wooden boxes. The conservation methods used on this special collection are highlighted as a case study.

POSTER

Moving Rocky Top to Oklahoma: Integration of the University of Memphis Mammal Collection to the Sam Noble Museum of Natural History

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The University of Memphis mammal collection (MSUMZ) was the largest collection of Tennessee mammals anywhere and contained ca. 23,000 specimens collected over the past 50 years. The collection grew under the care of Dr. Michael L. Kennedy and represents nearly 40 years of his life's work. In August 2011, the MSUMZ collection was orphaned and transferred to the Collection of Mammals (OMNH) at the Sam Noble Museum of Natural History (SNMH). The incorporation of the MSUMZ collection is supported by a NSF Biological Research and Collections grant "Curation, Digitization, and Integration of the Orphaned University of Memphis Collection" (1057439). Protocols and procedures will be discussed that involve the renovation of the SNMH collection space, the packing and moving of the MSUMZ collection, and the curation of the specimens. The Memphis collection will increase the SNMH collection to more than 65,000 specimens and elevate it to the 8th largest university-based collection in the Western Hemisphere and the 15th largest overall.

POSTER

Digitization at the Chicago Academy of Sciences' museum collection and archives

Roberts, Dawn R.

Chicago Academy of Sciences, Peggy Notebaert Nature Museum, 2430 North Cannon Dr., Chicago, IL 60614 USA

As part of its strategic plan, the Chicago Academy of Sciences sought to expand accessibility to its museum collections and archives. To attain this goal, the institution began projects that incorporated digitization of its holdings in 2008. Digitization has included all aspects of the museum's collections, from digital photography of specimens and artifacts to digital scanning of publications, photographs, paper archives, and specimens.

Digital photography of our scientific specimens began with type specimens as part of a grant supported inventory and has since expanded to photographing all the catalogued specimens in the oology and mammalogy collections. Other specimens and items are scanned to create digital records. Specimens from the botany collection are being digitally scanned and those from Midwestern localities will be added to the VPlants Project for broader online use, a project organized by the Morton Arboretum, the Chicago Botanic Garden, and the Field Museum. Paper documents, such as field notes and the Academy's publication series, are being scanned and converted into searchable PDFs with OCR software. Additional grant support allowed the Academy to start scanning its 35mm slide photography collection containing images of plants and animals from the Midwest.

Having digital images of items in the Academy's collections provides a visual record of our holdings that can be attached to collection management database software and used for identification purposes or tracking preservation issues. In the case of a photography collection, digital images also enable greater preservation of the original as direct handling is reduced. Images may be utilized by researchers to do precursory work with the collection before an on-site visit or internally for educational programs or exhibits. This poster will explore some of the digitization projects in the Collections Department at the Academy, the established processes and techniques, as well as the use of these image files.

POSTER

Revitalizing a natural history collection: An institutional commitment to the public trust and the scientific legacy of the Chicago Academy of Sciences

Roberts, Dawn R.

Chicago Academy of Sciences, Peggy Notebaert Nature Museum, 2430 North Cannon Dr., Chicago, IL 60614 USA

Accessibility to materials in museum collections is hampered by inconsistent record systems, poor physical organization, or inappropriate storage. Museums with collections spanning a significant period of time are often faced with these issues and with how to implement a system that enables effective use and management of their collections.

The Chicago Academy of Sciences' collections hold specimens from many natural science fields, including entomology, malacology, ornithology, and paleontology. Manuscript and photography collections in the archives contain supplemental information for the scientific collections. These collections provide base-line data important to environmental studies. However, utilization of these materials proved difficult for internal and external groups—the collections had suffered from prior moves, and records about the collections were not organized and existed in many formats. Completion of information requests required a significant amount of time and effort

from staff to fulfill and often only partial information could be gathered.

To revitalize its natural history collections and make them more readily accessible for scholarly research and exhibition, the Academy initiated its Collections Inventory Project in 2008 with support from the Institute of Museum and Library Services. The inventory provided physical control of the collection. A digital catalogue constructed from specimen label data during the inventory is being merged with information from other records, improving intellectual control. To date, the project team has inventoried over 250,000 specimens and artifacts and is on target to complete a comprehensive inventory of its object collections by the end of August 2012. Support from the Gaylord and Dorothy Donnelley Foundation helped begin the organization, rehousing, and processing of the Academy's archives. As a result of the Collections Inventory Project, the Academy has accurate information about its holdings, and is seeing an increase in the number of information requests, and a reduction in the time necessary to respond.

POSTER

From seeds to dugout canoes: Methods for the long-term care of macrobotanical and megabotanical archaeological remains from 500- to over 5000-year-old archaeological sites

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The Archaeobotanical collections at the Florida Museum of Natural History (FLMNH) consist of dry, wet/waterlogged, and conserved plant specimens. Macrobotanical and megabotanical collections at the FLMNH include numerous specimens of charred seeds and wood (e.g., posts, bowls, planks, paddles), waterlogged seeds, wood and other plant parts, and conserved wood chips, masks, cordage and dugout canoes and fragments. Collections have grown as the result of 19th and 20th century traditional excavations where no or limited considerations were given to plant remains collected, donations, CRM work, salvage projects, as well as carefully planned research initiatives where archaeobotanical plant remains were factored into both analysis and curation. It was the latter that enabled us to better address the orphaned, extant collections that clearly required further attention. Typically excavated collections of the 19th and 20th centuries lacked carefully planned research designs, adequate recovery techniques, and no plans for curation of plant remains. Thus, facilities where such archaeobotanical specimens were housed were left with poorly curated and inaccessible collections. Recently, a major initiative at the FLMNH has focused on improving the long-term care, condition-reporting, and management necessary for the proper long-term curation of these important and highly variable types of remains. Project methods and procedures developed follow national standards and best practices, are inexpensive, and can be performed by in-house collections staff. The focus of the poster will be on this recent initiative, and will especially highlight the Museum's monitored programmatic plan for the preservation of the waterlogged specimens, including approximately 2000-year-old papaya and chili pepper seeds and dugout canoes and fragments that are 500 to over 5000 years old. Ultimately, this project and continuing research will improve the long-term stability and accessibility of these rich and rare, archaeobotanical collections, while offering some insights to their collections management, curation and future research potentials.

ORAL

Larger collection yet smaller location: Moving the ichthyological and herpetological alcohol collections of NCB Naturalis

Ruiter, R. de

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NCB Naturalis, the Netherlands Centre for Biodiversity, was launched on 28 January 2010. The centre is the result of cooperation between the Zoological Museum Amsterdam, the branches of the National Herbarium of the Netherlands, and the National Museum of Natural History Naturalis. The partners' collections will come together at NCB Naturalis into a collection totaling over 37 million objects. Because of this all collections had to be moved to the Leiden, where they would be merged with the Naturalis collection.

In this presentation I will focus on the process of moving and merging the ichthyological and herpetological alcohol collections. The almost 60,000 objects from the Zoological Museum Amsterdam had to move to Leiden where approximately 95,000 objects had to be rearranged to make room. During this process we had to tackle two big challenges. First, there was the strict deadline, since the ZMA buildings had already been sold and had to be empty by the end of 2011, and second, we had to fit in the ZMA collections in the existing Naturalis accommodations, while the accommodation available in Leiden at the same time had to be reduced by 30% for the herpetological and 20% for the ichthyological collections.

We managed to move and rearrange the entire ichthyological and herpetological alcohol collections within 4 months. I will describe the process of moving and merging these collections, the way we dealt with the challenges and the consequences of the choices we made. I will also indicate some of the aspects we will be focusing on in the coming years as the operation is not finished yet.

ORAL

3D and hyperspectral scanning at the Yale Graphics Laboratory

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We describe ongoing work with Yale museums and collections to capture object form and appearance. Three projects will be described. First, we describe a system for capturing data for bird specimens from the Yale Peabody museum that includes a 3D laser scanner and a hyperspectral scanner using compressive sensing to measure reflectance in from the ultraviolet to near infrared in 12 nm wavelength bands. Second, we describe the 2D imaging of a medieval manuscript from the Yale Beinecke with a 5 wavelength band imaging system for pigment identification. Third we show the results of using several different imaging modalities including 3D laser scanning, RTI imaging and multispectral imaging to document the conservation of a fifteenth century relief from the Yale Art Gallery. We close with the description of an open source software system being developed to examine and make use of the data from all of these projects.

ORAL

Building a service centre for outsourcing large-scale digitisation

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Digitarium is a joint initiative of the Finnish Museum of Natural History and the University of Eastern Finland. Supported by the EU structural funds available in peripheral areas of Europe, it was established in 2010 as a dedicated shop for large scale digitisation of natural history collections. Digitarium offers customers service packages, based on a well-defined digitization process, which includes receiving, tagging, imaging, data entry, georeferencing, filtering, validation, publishing, and archiving. Special features of the production process at Digitarium are imaging of all material, a distributed workflow that can employ distance workers in interpreting the images, and XML-based data management. Automation of imaging is being pursued for so that large quantities of material can be produced for a backlog of data entry that can take place much later. Remote access to images allows employees to work from home or library, but also is an opportunity to build on crowd-sourcing. It also enables reaching out to remote experts for species identification, handwriting recognition, foreign languages, georeferencing expertise, etc. Every specimen receives a two-dimensional barcode containing a globally unique URI to access the specimen details. Primary copy of data is managed in versioned XML documents, one for every specimen. A custom-built digitisation workbench manages the XML documents and drives the workflow. Customer receives the images and XML documents of the specimens. After filtering and validation, the data from the latest XML document version and images are being copied to Digitarium's Morphbank database service and Digitarium's GBIF IPT service. From there they will be published, if so agreed with the customer, or if publication has not been agreed, retained for Digitarium's internal use. Different service packages connecting these steps can be customised, responding to the specific needs of the customer.

ORAL

The Barneby Legume Catalogue: An integration of specimen data and published text

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Cataloguing and sharing information on the taxonomy, ecology and distribution of plants is a fundamental step to achieve global biodiversity conservation. When completed, the Barneby Legume Catalogue, based at the New York Botanical Garden Herbarium, will provide online not only information from plant specimens held in the herbarium but also content from the scientific monographs of 33 genera of Leguminosae that Rupert Barneby (1911–2000) and his collaborators, H.S. Irwin and J.W. Grimes, published in "The Memoirs of the New York Botanical Garden."

The project team is currently creating a database of specimen label information with KE EMu software, taking high-quality digital images of representative plant specimens of each taxon, and georeferencing a significant number of the specimens using hard-copy itineraries and maps and online maps and gazetteers. We are using optical character recognition software (ABBYY FineReader 11, Professional Edition) to convert the already scanned monographs into editable text, where corrections are made and the species descriptions copied to the database. These descriptions will appear as species pages in the online Barneby Legume Catalog. Future enhancements include using Plazi's GoldenGate editor to mark up the text in XML.

The Barneby Legume Catalogue will consist of two integrated parts: The electronic, searchable catalogue with data from ca. 88,700 plant specimens and the dig-

ital monograph including keys and genus and species descriptions. It will also have images and distribution maps (generated upon request), as well as supplementary photos and illustrations. Once completed, the Barneby Catalogue will be a very useful tool with applications in conservation, ecology, and taxonomy.

ORAL

Networking nature: Building cybercabinets of digital curiosities

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Natural history continues to be deeply important to a wide range of human endeavors, yet access to natural history is at an all-time low for the general public. In the age of the Internet, engaging the public online is critical to building audiences and broadening support for natural history. While collections managers have been providing online access to collections for the research community through specialized search sites, little effort has been made to present these resources in a public-friendly framework. Some museums are beginning to think in terms of networked online knowledge and radically shift the way they broker their digital content. This research examines ways natural history can be effectively presented online to the public by reviewing relevant literature, analyzing six model sites with an heuristic evaluation tool and a user survey, and exploring three case studies in depth by interviewing key project personnel. The heuristic analysis was designed using trends identified in the digital collections literature, as well as incorporating ideas from Internet epistemologists which are often overlooked in museum dialogue. User survey data was drawn from three groups: high school students, teachers, and professional adults and reveals their preference patterns. The case studies range from a well-established online collections portal to an in-progress pilot data mash up project and reveal how superficially disparate projects can share underlying philosophies and borrow lessons from each other. Findings summarize important strategies for building online access to natural history digital resources and culminate in offering best practices for initiating or participating in such projects. The public needs access to natural history as much as ever, presenting collections online is supported by a growing body of research, and natural history museums can take advantage of the new networked knowledge ecology on the Internet to create "cybercabinets" of digital natural history specimens.

ORAL

DNA barcoding for collection management and QA/QC: USNM birds case study

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Since it was proposed in 2003, DNA barcoding has gained wide acceptance as a standard tool for species-level taxonomy and for identifying species in a regulatory and legal context (e.g., agricultural pests in quarantine, endangered species in international trade, food products in the marketplace). To date, most barcoding has been done in "project mode" by researchers with the goal of adding a layer of standardized DNA data to the morphological, behavioral, ecological, geographic and other character data used for their research. Other researchers have conducted barcoding in "habitat mode" by gathering barcode data from all taxa present in one place in the tradition of an all-taxon biodiversity inventory. In recent years, "collection mode" barcoding has emerged as the practice of obtaining barcodes for the species and specimens in a biorepository collection, especially frozen tissue and DNA collections. Barcode data collected in this way can be used to verify species identifications and confirm that tissues have not been degraded. Submitting the barcode data in GenBank is also a registration system that increases the collection's visibility.

The Consortium for the Barcode of Life (CBOL), the USNM Division of Birds, and the Museum's Laboratories for Analytical Biology generate barcodes for 2808 frozen tissue samples representing 1403 species. The data have been released on GenBank and a public notification published (see http://goo.gl/AgWhv). In addition to these confirmed records, barcode data revealed 143 samples that failed to amplify/sequence and 166 that may have been mislabeled in the field or switched during lab procedures.

ORAL

Federal interest in scientific collections: A status report on two interagency working groups

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Approximately 20 Federal departments or agencies either own scientific collections or provide Federal support to scientific collections. An Interagency Working Group on Scientific Collections (IWGSC) has been active since 2005, led by co-chairs from USDA and the Smithsonian Institution. IWGSC issued a first report in early 2009 (http://goo.gl/XPHqe). The report included seven recommendations for improving the impact, sustainability, and accessibility of Federal collections. Three recommendations (clarifying policies, improving budgeting practices, and establishing an online information clearinghouse) were targeted for near-term implementation by OSTP and in the America COMPETES Act. Two IWGSC Task Groups are now compiling information on agency policies and budgeting practices with the goal of identifying effective practices and proposing government-wide guidelines and tools. A third Task Group is assembling metadata elements that could be used as collection-level descriptors for a government-wide database of scientific collections.

The Interagency Microbial Forensics Advisory Board (IMFAB) was chartered under the National Science and Technology Council in 2010 to coordinate implementation of the 2009 National Research and Development Strategy for Microbial Forensics (http://goo.gl/uma9Q). The goals of the strategy are to create a research agenda, promote interagency coordination, and develop education and training activities in microbial forensics. To support the research agenda of the strategy and the need for reference material for microbial forensics, the IMFAB conducted a survey of more than 40 Federal microbial collections including those in the departments of Agriculture, Defense, Health and Human Services, Homeland Security, Interior, and others. Data collection and analysis are nearing completion.

POSTER

Mount making at the UBC Museum of Anthropology

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In 2004 the University of British Columbia's Museum of Anthropology (MOA) began the Collections Research Enhancement Project (CREP), a six-year venture that included the re-housing of over 30,000 artifacts. One important aspect of the re-housing initiative was the customized mounting of fifteen thousand objects from MOA's diverse collection. The mounts, which were built at MOA, had to fulfill very specific criteria. They had to protect the object from physical vibration, be supportive yet unobtrusive and be constructed from materials that were inert, sturdy and visually streamlined. Finally, the mounts had to be designed not only to serve the needs of researchers, but also the whishes of community members. After several successions of material testing, prototyping and community consultations, a number of adaptable mounting systems were devised. This poster will present a selection of MOA's most successful designs including black trays used for drawer installation, handling sleds for large masks, "whistle mounts" and suspended rigid supports for two-dimensional objects.

ORAL

Advances in the computational photography tools: Reflectance Transformation Imaging (RTI) and Algorithmic Rendering (AR)

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We will present an overview of recent developments in RTI and AR technologies.

Reflectance Transformation Imaging (RTI) creates scientific digital representations from image sequences where the light illuminating the photo's subject is moved to a new location for each photograph. The lighting information from this image sequence is mathematically synthesized into an RTI image. The subjects shape and color is examined in an RTI by interactively re-lighting the subject from any direction and applying mathematical enhancements.

We will show preliminary work applying RTI to wet collection materials, captured in alcohol, discuss RTI acquisition of small subjects under magnification using macro and microscopic optics and show new developments in multi-spectral RTI.

New developments in the related technology Algorithmic Rendering (AR), which uses the same data sets as RTI, will also be presented. The development of new AR technology by Princeton University and Cultural Heritage Imaging is supported by a significant grant from the National Science Foundation. The end-product will be an open-source tool which will extract and merge visual information available only under certain lighting conditions, certain wavelengths, or certain imaging modalities. Users will be able to generate high quality, comprehensible illustrations for documentation, scientific study, and sharing with colleagues, collection visitors, and the public.

New software tools to better collect and manage the metadata surrounding the creation of RTI and AR will also be discussed. This "digital lab notebook" is an essential element in the generation of scientifically reliable and reusable digital representations. The notebook enables: data reuse for novel purposes; the information's long-term digital preservation; and aides the collection material's physical conservation.

ORAL

The Field Book Registry: Bringing consistency and cohesion to distributed collections

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The Field Book Project is a collaborative initiative between the Smithsonian Institution Archives (SIA) and the National Museum of Natural History (NMNH) to improve access to biodiversity field books. With funding from the Council on Library and Information Resources (CLIR) under the Hidden Collections program, the Field Book Project is developing a Field Book Registry which will serve as one online location for accessing field book content.

Many successful and innovative projects have been implemented to improve access to field books. However, these are generally being developed independent of one another and, without a set of community best practices available to support these efforts, it becomes challenging to replicate on a larger scale. The Field Book Project has developed a descriptive approach which can provide the foundation for bringing these resources together in a more integrated way. Natural Collections Description (NCD) and Metadata Object Description Schema (MODS) were selected based on their simplicity and their ability to easily map to other commonly used library, archive, and museum standards. Authority files are created for persons, organizations, and expeditions using Encoded Archival Context (EAC). Consistency and controlled terminology in named entity entries will be especially important as the Registry expands to accept records contributed by multiple institutions. The Field Book Registry will bring these metadata schemas together in the open-source Islandora environment.

This presentation will describe the need for and benefits of a large scale collective Field Book Registry; the approach that is being developed and implemented; progress in cataloging, conserving and digitizing SI collections; and the roadmap for opening the Field Book Registry to accept content from other natural history collections.

ORAL

Application of preventive conservation to solve the coming crisis in collections management

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Estimates of the total number of species range from 3 million to 30 million, but the number of taxa described to date is just 1.8 million, about 60% of the low estimate, or about 6% of the high estimate. The 1.8 million species named thus far are represented by about 2,500,000,000 voucher specimens in museum collections; at this rate, naming 30 million species will result in approximately 35,000,000,000 voucher specimens in collections (in addition to specimens for other research use). During the past 25 years, increased collection growth has not resulted in a proportional increase in trained collections care personnel to manage this resource; in fact, far more funding has been directed towards naming new species and acquiring additional voucher specimens than in caring for collections. If the oft-stated goal of naming most species is achieved, how will the very large collections of voucher specimens be managed with even more lopsided ratios of collections care workers to specimens? To manage very large collections, new methodologies must be developed based on the application of the principles of preventive conservation, with particular emphasis on collections storage environments and the factors that affect the long-term stability and useful life of individual specimens. New designs and standards must be developed for collection storage furniture to achieve maximum efficiency in monitoring specimen condition and conducting regular inventories; economy-of-scale methodologies must be implemented to control the storage environment; the functionality of collection databases must be greatly expanded to make them better collections management tools rather than mere data storage systems by incorporating preservation histories, integrated pest management, specimen use records, and storage environment data.

ORAL

Biodiversity Information Serving Our Nation (BISON): The national resource for discovery, linkage and re-use of organismal occurrence data

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The tide of biodiversity data is rising. Sensor networks, handheld field observation units, and high-throughput museum digitization efforts are all producing massive stores of data describing the species that comprise the biological heritage of the United States. In an effort to improve on our current capacity to aggregate, normalize and visualize the massive accumulation of species occurrence data, the newly-formed Core Science Analytics and Synthesis Program of the US Geological Survey (USGS) is developing the Biodiversity Information Serving Our Nation (BISON) project, as an integrated and permanent resource for biological occurrence data from the United States. BISON leverages USGS assets such as the full mirror and US Node of the Global Biodiversity Information Facility (GBIF), the USGS National Map, and the accumulated human and infrastructure resources of the Survey's long-term investment in research and data management and delivery

in biological and geospatial data. BISON currently contains more than 80 million occurrence records of species found in the United States and integrates dozens of environmental layers for visualization and spatial analysis purposes. Additional data sources are being recruited, with emphasis on a) federal data sources and b) an intial invasive species theme. BISON's infrastructure is under development through a partnership with Oak Ridge National Laboratory on their massive computing infrastructure which includes large amounts of storage, high capacity servers, and access to some of the world's fastest supercomputers.

ORAL

From *Acris* to *Xenopus*: Recuration of amphibians at Yale Peabody Museum

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The Yale Peabody Museum's Division of Vertebrate Zoology boasts an extensive collection of over 13,000 fluid-preserved amphibian specimens representing approximately 590 taxa from around the world. In January 2012 museum staff began the re-curation of these specimens as part of the division's larger NSF-funded curatorial project. The general process of re-curating specimens included changing storage fluids, replacing old labels and jars, verifying species-level identification and developmental stage,and updating specimen records in the database. The entire collection was then reorganized in a manner that reflected over 1,000 recent updates in amphibian taxonomy. In addition to the catalogued holdings, there was also a substantial number of unprocessed frogs from a variety of sources including expeditions to Cameroon and the Philippines. After identification and cataloguing, these "new" specimens greatly added to the diversity of the collection as a whole.

POSTER

What's underfoot? KE EMu's new IPM functionality identifies new moth habitat

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As the lingering effects of the now banned pesticide—Dichlorvos—fade away, museums and cultural institutions are seeing a marked increase in the numbers of webbing clothes moths (*Tineola bisselliella*). These tiny moths have a voracious appetite for natural fibres, fur, skins and feathers and thus pose a risk to natural history and cultural collections alike. In the absence of chemical deterrents the Natural History Museum, London (NHM) has developed a holistic approach to integrated pest management (IPM) that utilises consistent data capture and spatial technologies to inform decision makers.

At the heart of these strategic decisions is the raw insect trapping data captured into two new Modules within KE Software's Collections Management System (KE EMu). The proximity of this data to specimen information means that the risks posed by insect populations in certain areas can be appraised against the susceptibility of insect damage to specimens in those areas. Spatial technologies have been employed as a visualisation tool to explore and analyse the data, captured from across the institute, for readily identifying patterns and trends in insect pest populations over time.

Following migration of over 12 years of pest trapping data, a marked increase in the occurrence of webbing clothes moths at traps in the galleries since 2008 was noted—putting mammal and bird specimens at risk. Throughout the summer of 2011 the numbers escalated. Visualisation of the data at monthly intervals, using KE EMu's IPM Mapper tool, pinpointed hotspots that were further resolved by increasing the density of traps in the area. Focussing in on the risk in this way identified a community of webbing clothes moths thriving in an atypical habitat in the under-floor ducting.

POSTER

Revitalization of the Recent Invertebrates Collection of the Sam Noble Museum

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The Sam Noble Museum (SNM) is a non-profit, educational, and scientific organization that is the designated museum of natural history for the State of Oklahoma and an Organized Research Unit of the University of Oklahoma (OU). As part of a multi-phased long-term collections plan, revitalization efforts to date have focused on cataloging specimens and digitizing their associated information. In 2010, the department of Recent Invertebrates was awarded a Museums for America grant from the Institute of Museum and Library Sciences to catalog and digitize at least 50% of the over 500,000 invertebrates specimens in the collection during a 3-year period (2010–2013), including most of the insects. One particularly important collection of insects for the museum is the collection of Byrrhoidea (an aquatic beetle superfamily), collected by Dr. Harley Brown. This collection contains perhaps the largest and most comprehensive collection of Byrrhoidea in the world, focused primarily on the Americas (Mexico and the United States) but includes representatives from over 60 countries. The collection contains >100 type specimens for new genera and species as well as many hundreds of paratypes. Approximately one-third of the collection was preserved as pinned material, the rest in vials of alcohol. Despite previous and cursory assess-

ments of the specimens that initially suggested that they were threatened due to their being too crowded to investigate, or in discolored solutions or dried, respectively, the integrity of the collection is very good. We present our efforts in maintaining Dr. Brown's legacy of this large and significant collection with our cataloging, re-curation, and preservation efforts.

ORAL

The ecosystem of the archive: Scholarly and public interaction with natural history collections

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This presentation will report the outcomes of a study focusing on how scholars, curators, and archivists interact when using archival materials and specimens in natural history collections. The study draws data from institutions funded by the Council on Library and Information Resources (CLIR) through the Cataloging Hidden Special Collections and Archives program, and is affiliated with CLIR's Observations on Scholarly Engagement with Hidden Special Collections and Archives, a large-scale study that seeks to contribute "to the development of a better integrated, more potent scholarly environment" by "identifying and describing current practices, while also encouraging substantive conversation between librarians, archivists, and expert users about those practices."

"The Ecosystem of the Archive" reports the findings and outcomes of site visits to the American Museum of Natural History Library, the University of California Museum of Paleontology, and the Yale Peabody Museum of Natural History. This group represents the first cluster of natural history collections funded by CLIR's Cataloging Hidden Special Collections and Archives program, and thus presents an opportunity to broaden the scope of CLIR's Scholarly Engagement initiative. The study focuses on three goals, which will also be the topical foci of the presentation:

1) To learn how the organization of natural history collections—which may include specimens as well as associated archival materials—differs from or resembles that of other special collections archives.

2) To facilitate and study communication between teams of archivists and scholars engaged in work with special collections materials.

3) To study outreach and interaction with the public, including exhibitions, publications, and web presence.

Topics to be discussed include the linking of archival materials to specimen collections, the lack of awareness that many researchers have of the presence and value of archival documents related to natural history, and the enormous diversity of materials included in natural history collections.

POSTER

West Virginia mammals online

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West Virginia has a rich and diverse mammalian fauna, with over 60 species representing seven out of the ten North American Orders. Many taxa are common and found throughout the state; however, four species are now federally protected under the Endangered Species Act. The West Virginia Division of Natural Resources (WVDNR) recognizes another eighteen species as rare, very rare, or vulnerable to extirpation. Despite the fact that West Virginia has so many species whose conservation status warrants concern, literature and web content on West Virginian mammals is seriously lacking.

As part of a larger NSF grant to re-curate and update the natural history collections at the West Virginia Biological Survey Museum (WVBSM) at Marshall University, a website is being developed to deliver to both the public and professionals basic data on West Virginian faunal diversity. Species-level natural history accounts, taxonomic photographs, and field identification keys have been developed by undergraduate students in systematic and mammal courses offered at Marshall University.

Additionally, as there are no county-level distribution maps available, our project sought to rectify this deficiency by finding and compiling county-level data from the 17,023 specimens of West Virginian mammals housed in natural history collections throughout the United States. These data come from 35 museums, with the majority of specimens (8,171) being housed in WVBSM or the Carnegie Museum of Natural History (5,970). These museum records were then augmented with field data from the WVDNR, Wildlife Resources Section, Wildlife Diversity Unit and from the literature. County-level distribution maps were produced for all rare, threatened, and endangered taxa. Use of the WVDNR records, in combination with museum records, has revealed some significant differences in historical and recent distributional records.

ORAL

BiSciCol—A community effort and toolkit to link-up, tag and track biological collections data more effectively.

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The ability to survey and assess biodiversity on a planetary scale using modern tools and technology presents a curatorial and informatics challenge to the biological research collection community. Collections generate a cascade of downstream data products, including genomic DNA sequences, as well as taxonomic and ecological annotations crucial for urgent societal policy, e.g. climate change assessment. As biological research collections continue to grow along with new ways to generate digital data from these collections, the complexity of custody and ownership tracking, curation, data management and information archiving increases as well. Today, much of the information derived from biological research collections resides indifferent databases, managed by different entities, with different data storage structures, platforms and protocols. In current distributed data systems, information is typically passed oneway from data providers to users. No mechanism currently exists for these disparate, largely independent systems to report changes to, or absorb changes from, each other. BiSciCol takes the appropriate next steps to address a community-wide challenge facing the biological collections community-linking and tracking scientific collection objects(specimens, sequences, images, etc.) and their digital metadata across multiple institutional collections with heterogeneous information management systems. BiSciCol works from both ends of the problem; it provides tools to track collections data across the web and provides the means for data to be imported into appropriate Linked Data andSemantic web formats called triples. As of now, the applications that are currently available to create triples are either difficult to user not geared towards biological collections and their semantics. In this presentation we focus on a tool we have developed, the "Triplifier," that assists users with the conversion of spreadsheets,Darwin Core Archives, and databases to triples using classes and terms in the Darwin Core standard as main basis. The implementation relies on D2RQ (http://d2rq.org/) to translate from the source data to the triples, while using the D2RQ mapping file format to preserve state.Central to the application is the ability to easily step through the process of describing entities and attributes using Darwin Core classes and properties, and describing relations using the Dublin Core "relation" (non-directional) and "source" (directional) properties.When the user has converted their data to a triple format, the Triplifier gives the option to publish the triples as a SPARQL endpoint or load the triples directly into the BiSciCol interface (http://www.biscicol.org/) for visualization or further exploration.

ORAL

Consortium of Northeastern Herbaria: A regional, data-sharing collaboration

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The Consortium of Northeastern Herbaria (CNH, neherbaria.org) is a group of herbaria in Northeastern North America whose main goal is to provide online access to specimen data housed in member institutions, especially from regional collections. Since CNH was officially formed in 2008, the group has focused mainly on organizational and community development tasks, reaching a number of important milestones: establishment of a formal governance structure; development of a mission statement; holding annual meetings that include workshops and demonstrations; establishing a collaborative website; and increasing membership. Two recent developments will allow the Consortium to more completely realize its goals. One of these developments is the creation of a data-sharing portal, a Symbiota instance, where over 400,000 specimen occurrence records are being shared (neherbaria.org/CNH). A second important development is the award to a group of CNH member institutions of a National Science Foundation Advancing Digitization of Biological Collections Program grant to create a Thematic Collections Network that will electronically catalog and image their New England holdings. The collaborative grant will enable the digital capture of specimen data and images from about 1.3 million vascular plant specimens from 15 large to small herbaria across New England. The resulting dataset is specifically designed to support the study of the consequences of climate and land-use change in New England.

ORAL

Innovation through interdisciplinary exchange: Restoration of the North American mammal habitat dioramas

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In 2010–2012, the American Museum of Natural History (AMNH) undertook renovation of one of its premier diorama halls, the Hall of North American Mammals. On continuous display since the 1940's, many of the taxidermy specimens had become damaged to the point of scientific inaccuracy. As a result of the museum's participation in a citywide effort to decrease en-

ergy consumption, funding was provided to replace the diorama lights with more energy-efficient fixtures, thus providing the impetus for a fuller renovation of the dioramas.

The habitat dioramas are among the most popular and iconic exhibits at the AMNH. In exacting detail, they depict specific geographic locations from around the world, in some cases, documenting significant environmental change to habitats and locales occurring over the past 70 years. Each diorama is composed of three elements: taxidermy specimens, background paintings and foreground materials. The original fabrication of the dioramas at the AMNH was a collaborative effort, combining the talents of numerous artists and scientists to represent the complex inter-relationships between animals and their environments.

The current renovation revisits this spirit of collaboration with a team of conservators, taxidermists, artists, and curators assembled to document, clean, and restore the illusionism of the dioramas. Familiar conservation materials were successfully employed in new and innovative ways to achieve the required results, particularly in the adaptation of contemporary taxidermy restoration methods to ensure longevity and re-treatability. Additional challenges included the restoration of color to taxidermy specimens; cleaning and restoration of highly embrittled plants and paper foreground materials; and research and testing for replacement of discolored snow in winter scenes. This paper will examine the nature of the collaboration between AMNH conservators and non-conservation specialists, as well as some of the innovative techniques that were developed in the course of the project.

POSTER

The use of Orasol® dyes for in-situ recoloring of taxidermy specimens

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By December of 2010 when the American Museum of Natural History began its renovation of the Hall of North American Mammals, the iconic habitat dioramas installed there during the 1940s and 50s had begun to show their age. Deterioration was evident in the background paintings, foreground elements, and especially the faded taxidermy specimens. In many dioramas, discolored mounts no longer reflected the animals' natural appearance.

Conservators on the renovation team sought a means of recoloring the faded specimens, with attention to several key considerations: high light levels in the dioramas necessitated use of a colorant with excellent lightfastness; most mounts could not be removed from the diorama floor and had to be treated in-situ without rinsing of excess colorant; the colorant should not alter physical characteristics of the hair in a way that would hinder grooming and future re-treatment of the specimen. Reversibility was also a key concern.

Initial tests with a selection of materials indicated that 1:2 metal complex azo-dyes (Orasol®) held promise for this project. The dyes were applied to proteinaceous substrates including wool and bison fur and examined using polarized-light and scanning electron microscopy to visualize changes in fiber morphology. The lightfastness of each dye color was evaluated using microfadometry with UV-filtering and light-aging with a UV component. Subsequent analyses investigated the effects of solvent choice on lightfastness and dye penetration.

Good lightfastness, non-aqueous application, limited effect on hair morphology, and easy removal recommended the Orasol® dyes for recoloring the North American Mammal taxidermy. Through a variety of application techniques, complex and subtle visual effects were successfully achieved, revitalizing the mounts. The initial promise of this approach recommends it for further research to better understand its benefits and limitations in restoring color to faded natural science specimens.

ORAL

Effectiveness of entomological collection storage cabinets in buffering environmental fluctuations in a historic museum building

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Maintaining appropriate building environmental conditions is critical to safeguarding museum artifacts and collections. The Smithsonian's Museum Conservation Institute, in collaboration with the National Museum of Natural History, conducted a preliminary survey of environmental conditions inside museum storage cabinets in the National Insect Collection. This collection includes over 35 million specimens making it one of the largest entomological collections in the world.

The survey was an interdepartmental and multistage project initiated in 2008 in response to concerns that large fluctuations of relative humidity (RH) were occurring within the collection storage space. The first phase involved comparing environmental data collected in different locations within the Museum and within storage cabinets. This was correlated with meteorological readings obtained from NOAA for the same time-frame of

this study. Environmental monitors, Elsec 764s, were used to record the interior temperature and humidity of the cabinets while the conditions in the building were monitored by the building automated systems. While RH in the rooms ranged from 15% to 60%, inside the cabinets it was only 40% to 45%, demonstrating that modern museum cabinets can be highly effective in protecting collections from changes in RH.

In the second phase of the project, metal cabinets were meticulously selected, their air tightness tested using an ultrasound leak detector, and their interior environments measured over six months. The metal cabinets housed an equal number of wooden drawers storing pinned insects; all drawers were closed with glass tops. The construction of the cabinets had an impact on air tightness and consequently, on the interior environment. Our findings support the museum's approach of improving cabinet designs, testing cabinet seals, and monitoring temperature and RH within the cabinets as a major focus in protecting sensitive natural history collections rather than emphasizing constant room conditions in the collection storage.

ORAL

A shift in strategy for digitizing a large herbarium: Implications for managing the collection

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William and Lynda Steere Herbarium, New York Botanical Garden, 2900 Southern Blvd., Bronx, NY 10458 USA

The New York Botanical Garden Herbarium began cataloguing and imaging its collection of 7.3 million plant specimens in 1997. In 15 years we have digitized 1.3 million specimens, using roughly 130,000 hours of staff time. To continue at this rate, it would take an additional 68 years to complete the remaining 6 million specimens.

With the launch of the National Science Foundation's new Advancing Digitization of Biological Collections program, we have the opportunity to digitize larger portions of the herbarium at a fraction of the cost and time. To accomplish this we have shifted our strategy for digitization. Our original workflows created complete database records with all label data, manually entered from the specimen at a rate of just under 10 specimens per hour. With our new workflow strategy, we create skeletal records with images at a rate of 53 specimens per hour. These records will be completed from the specimen image with the help of several automated processes.

With proper funding, at this improved rate we could potentially digitize the rest of the herbarium in another 15 years. This exponential growth of the digitized portion of the herbarium will have implications in managing both the physical collection as well as the virtual collection we have created.

POSTER

Index Herbariorum, a directory to the world's herbaria and indicator of worldwide trends in natural history research

Thiers, B.M.
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Index Herbariorum contains information about the world's herbaria and the plant and fungal scientists and collections professionals associated with these collections. Between 1952 and 1990, eight hardcopy editions of *Index Herbariorum* were published. The *Index* is now available only in electronic form, and is edited continually. Comparison of current statistics with those available in the published editions affords the opportunity to summarize trends is collection management and collection-based research.

Currently there are 2885 active herbaria in 150 countries. Of these, 30% are located in Europe and the former U.S.S.R., 26% are in North America, 23% in Asia, 15% are in Latin America, 5% are in Africa, and 2% are in Australasia and Pacifica. Collectively the world's herbaria contain an estimated 325,000,000 specimens that document the earth's vegetation for the past 400 years. There are approximately 11,000 staff members associated with these collections.

Comparison of current data in *Index Herbariorum* with those published earlier indicates that the world's herbaria have shown steady growth over the years. Currently, herbaria hold almost 96 million more specimens than they did in 1990, representing a growth rate of almost 5 million specimens per year. The strongest growth in both number of herbaria and specimens has been in Asia and Latin America, whereas the number of herbaria in Europe, Australasia and North America has decreased through consolidation. The number of staff (scientists and collections managers) has grown by about 2500 since 1990. The highest number of staff per herbarium is in Australasia, the smallest in North America and Europe. The age distribution of staff has not changed much since 1990, except that the proportion of younger staff (39 years or younger) has increased. Worldwide, approximately 58% of staff associated with herbaria are men, 41% are women.

ORAL

Digitizing North American lichen and bryophyte specimens

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This Thematic Collections Network (TCN), funded through NSF's Advancing Digitization of Biological Collections (ADBC) program, aims to digitize ca. 2.3 million North American lichen and bryophyte specimens in four years. These specimens are held by about 60 herbaria, or 80% of the U.S. institutions with significant holdings of these organisms. Although not related phylogenetically, lichens and bryophytes share important traits that make them sensitive indicators of environmental change. The specific goal of this project is to provide high quality data to address how species distributions change or may change in the future in response to major environmental events. Large scale distribution mapping will support management decisions through identification of biodiversity hotspots, areas of most imminent environmental change, and greatest human impact.

Key to the success of this project are efficient workflows for digitization and data transcription. Images of specimen labels are captured at digitizing institutions and are then transferred to a central repository for text record creation. To create Darwin Core specimen records we will process specimen label images with OCR and then expose the resulting text to customized natural language processing (NLP). Also, we will leverage existing digital specimen records for creating records for not-yet-digitized duplicate specimens; rates of duplication among large collections can exceed 30 percent. Following these automation steps, the digitized information will be available online for review, adjustment, and key stroking, where necessary. For key stroking and record correction, we are planning on developing a vibrant volunteer community who in return for their help with record completion will be offered live and online lectures, local field events and workshops that will deepen their knowledge and hopefully interest in these organisms and biodiversity in general.

ORAL

What Henderson saw: Extracting observations from century-old field notebooks

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Part diary, part scientific record, field notebooks contain details necessary to understanding environmental conditions during collecting events. Despite their clear value in global change studies, the text-mining outputs from field notebooks have been idiosyncratic to specific research projects, and impossible to discover or re-use. Best practices and workflows for digitization, transcription, extraction, and integration with other sources are nascent or non-existent. Here we demonstrate a model workflow to generate structured outputs while also maintaining links to the original texts. The first step in this workflow was placing already digitized and transcribed field notebooks from University of Colorado Museum of Natural History founder, Junius Henderson, on Wikisource, an open manuscript editing platform. Next, we adapted Wikisource-specific templates for documenting places, dates, and taxa to facilitate annotation and wiki-linking. We then requested help from the public through social media. After three notebooks were fully annotated, content was converted into XML and annotations contained within individual entries and pages were extracted and placed into Darwin Core compliant record sets. Finally, these record sets were vetted, specifically to provide valid taxon names, via a process we call "taxonomic referencing." The result is the identification and mobilization of 1087 observations from three of Henderson's thirteen notebooks and a publishable Darwin Core record set. Although challenges remain, we demonstrate a feasible approach to unlock observations from field notebooks to enhance their discovery and interoperability without losing the narrative context from which those observations are drawn.

ORAL

Digitizing the Thera frescoes: Practical 3D acquisition methods for museum conservation

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Digital capture techniques are powerful tools for documenting, and disseminating information about the world's cultural and natural history treasures. Advancements in 3D imaging techniques and low-cost capture systems allow researchers and curators to analyze artifacts with greater scientific accuracy. In this session, I will demonstrate how we can combine several acquisition and processing tools recently developed in the computer graphics field into a system suitable for large-scale archaeological documentation and reconstruction. I will show how archeologists use the system to archive and reassemble fragments of wall paintings in situ at the Akrotiri Excavation on the volcanic island of Thera (modern-day Santorini, Greece).

Our system overcomes several challenges related to the practical acquisition of archeological artifacts. Tra-

ditional 3D scanning methods are costly, cumbersome to operate, and often lack sufficient levels of detail for accurate analysis. Many 3D scanners are not suited for on-site conditions and do not scale to the large volumes of data at some excavations. Our novel 2D acquisition pipeline uses high resolution color images of fragments, obtained from a flatbed scanner, to compute high quality normals (surface orientation). The system was deployed at Akrotiri, where the archaeologists themselves digitize several fragments per hour. The method combines 3D geometry from affordable 3D laser scanners with robust normal maps generated with photometric stereo algorithms. Our system is intuitive, requiring minimal supervision without interruption of the user's work flow.

The digitized artifacts have higher color and normal resolutions than 3D scans generated on-site, and are well suited for archival and preservation applications. Unique surface markings provide cues for matching fragments when erosion has rendered traditional cues (like color and contours) unreliable. Moreover, these techniques are adaptable to biological specimens in natural history collections where close examination of surface detail is also important for scientific analysis.

ORAL

Sam Mitchel Herbarium of Fungi: A case study in the future of collection information in a digital world

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The Sam Mitchel Herbarium is an example of a small, well curated herbarium helping to lead the way in the digitization of collection knowledge consisting of label information, critical ancillary items, as well as digitizing the actual three dimensional macrofungal specimens. This process could be applied to a range of three dimensional natural history specimens. Many small macrofungal herbaria from around the United States act as warehouses of information not readily available to the scientific community. To this end, the Sam Mitchel Herbarium has partnered with 35 other institutions to create the Macrofungi Collection Consortium (MCC), which will strive to provide digitized collection knowledge to the public. This Consortium helps the dissemination of knowledge throughout the Mycology community as well as linking this community with other scientific disciplines. The Sam Mitchel Herbarium faces many issues in digitizing this information for the MCC portal, but when this process is completed these solutions can be applied to various types of small natural history collections that have limited resources. A brief history and significance of this unique collection and the ongoing digitization of the collection, is used to illustrate what type of information is locked away in natural history collections, such as macrofungal collections, what may be digitized and made publically available, and how as a community, the MCC portal hopes to address these issues and make solutions that can be used broadly.

POSTER

A review of materials and techniques used for feather cleaning and reshaping at the Winterthur/University of Delaware Program in Art Conservation

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A wide variety of materials and techniques have been successfully employed by museum conservators in the past decade to clean and reshape feathers. At the Winterthur/University of Delaware Program in Art Conservation (WUDPAC), a number of these materials and techniques have been implemented in recent conservation treatments involving feathers in avian taxidermy specimens, ethnographic objects, and works of decorative art. This poster presents a review of feather cleaning and reshaping methods that are currently used at WUDPAC and in the field of conservation, and also includes three case studies involving recent treatments on avian taxidermy specimens. The first case study involves the treatment of a mounted blue hen chicken, a bird from the collections of the University of Delaware that was prepared in 1985 for an exhibition on the state bird and flower at the Delaware Museum of Natural History. The other two case studies involve the treatment of mounted small birds, all of which are displayed inside antique birdcages in different period rooms at Winterthur Museum. The avian taxidermy specimens in these case studies were in different states of preservation and prepared during different time periods with different mounting techniques. These factors subsequently affected the decisions made during their conservation treatment.

ORAL

THE Big Chill: A framework for the conversion of the Museum of Vertebrate Zoology genetic resources collection from ultra-cold to liquid nitrogen storage

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The Museum of Vertebrate Zoology (MVZ) Genetic Resources Collection is one of the largest museum vertebrate tissue collections in the world, with over 100,000 tissues vials representing approximately 95,000 individual specimens, collected since 1965. With NSF funding

we are converting our tissue collection from ultra-cold to liquid nitrogen (LN2) storage. We based this conversion on: 1) preventing catastrophic loss and needing to replace the aging bank of ultra-cold freezers that currently house the collection, 2) ensuring long-term viability and maximum research utility of genetic samples, 3) reducing carbon footprint and improving cost efficiencies, and 4) increasing opportunity for growth and storage. We created a new cryogenic laboratory facility, implemented a new tissue barcode labeling system for field and curatorial practices, and integrated the barcoded vials and their location into our Arctos database. This conversion provides a unique opportunity to re-inventory and consolidate the collection, discover and correct tissue issues, and to record both the volume of tissue per specimen and the exact location of each vial. All vials, boxes, rack slots, racks, and freezers are barcoded and exist as hierarchical containers in Arctos. We also examined existing curatorial practices related to data management and handling of tissue specimens for loans and curatorial workflow. The conversion was warranted in terms of cost/benefits, collection preservation, and growth. Such a conversion could be beneficial for many collections but requires dedicated resources and oversight. Challenges that arose during the conversion will also be discussed.

ORAL

Plants, herbivores, and parasitoids: A model system for the study of tri-trophic associations

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Data on plant taxa, insect herbivores, and their parasitoids are currently not accessible in a uniform manner, nor are comprehensive data on their relationships available online. The chief goal of the Tri-trophic TCN (thematic collections network) is to solve these problems through specimen digitization and online integration. This TCN, funded in July 2011, is utilizing the combined resources of 32 museums (14 herbaria, 18 insect collections) in an effort to capture and make available ca. 4 million specimen records, including ca. 2.6 million plants. One of the challenges of digitizing such a vast number of botanical specimens is streamlining the process to maximize digitization efficiency. We are using the high rate of duplication in plant collections as an opportunity to increase efficiency by 1) imaging specimens and creating skeletal records at all collaborating herbaria, 2) assembling the images and records in one database, 3) reconciling duplicates, 4) databasing the condensed records. A steering committee comprised of principal investigators, co-PIs, and project managers from seven collaborating institutions coordinate the project. By assembling and coordinating data on geographic distributions, host associations, and phenologies, our tri-trophic approach will benefit a wide range of research questions and practical applications in such fields as agriculture, systematics, conservation, ecology, climate change studies, and biogeography.

ORAL

Creating serendipity: How collaboration and a shared database can lead to eureka moments

Utrup, Jessica

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For decades the divisions within the Yale Peabody Museum operated as isolated units—they developed their own in-house systems for cataloging specimens, and they operated autonomously. They shared a roof, an institutional name with the other divisions, but frequently that was all. The museum's history extends back well over a century. Early curators and staff of the museum were not compartmentalized like we are today. They were gentlemen scholars; they had an interest in the natural world, and this interest extended beyond just fossils or fungi to birds, minerals, plants, and cultures. Over the last 20 years, the Peabody Museum has been working to integrate its divisions into a more cohesive unit through a single database with shared files. Now we are connected through shared accession records, shared constituents, and shared archives. These archives, in particular, are the threads that can lead us, modern museum staff, to discover so much about our collections that would otherwise be unknown.

This presentation will discuss some examples that highlight the importance of collaboration, and the value that can be found when links are made at various levels within a museum database. It will also touch on a recent push at the Peabody Museum to catalog all of the archive records. Currently, the archives are housed within divisions—accessible through constituent or accession links, but not nearly as accessible as they will be once the individual objects and groups of objects are catalogued.

POSTER

Georeferencing the past

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Most of the specimens in natural history collections were collected prior to the widespread use of GPS units. How then to best georeference these localities? With a little bit of work on our part, we can provide much more accurate georeferences for localities by looking at the area as it existed at the time the specimen was collected. Batch georeferencing may often overestimate the area from which these specimens were collected. For modern mobile organisms, a wider range is certainly plausible. However, for a fossil the locality is very much a single point fixed in space (and as we need to consider) fixed in time. Additional information (such as stratigraphic information) can help narrow down the original locality. The 'hills north of Cincinnati' is a very broad statement, but knowing that the specimen was collected from Maysvillian rocks in the 1920s can help narrow down what hills were actually collected. Similarly, some localities may seem completely lost to us, but through a bit of work, old place names can be rediscovered and mapped on to current maps. Localities that are long since destroyed or buried under subdivisions can be rediscovered through the plethora of online map resources.

POSTER

A comparison of packing methods for shipping human remains internationally

Utrup, Nathan

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In 2011 Yale University agreed to return the artifacts from Machu Picchu to the country of Peru. The first two shipments of artifacts were sent in March and December of that year. The first shipment consisted of the museum quality pieces, as well as all of the metal objects, 1,000 pottery sherds, and one nearly complete human skeleton. The second shipment consisted of the remaining human skeletal remains from 175 individuals and faunal material. The quantity and quality of the remains of each individual ranged from a few bones to nearly complete skeletons and from very poor condition to excellent condition. This poster examines the packing methods for the shipments of human remains, and the reasons for the differences.

ORAL

Large volume digitization: How to spend 18 million dollars

van der Mije, S.D.

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NCB Naturalis started in January 2010 as a merger between the major biodiversity research centre's in the Netherlands, resulting in a collection of 37 million objects. For the integration of their collections and research activities a special onetime grant was awarded covering the move, integration and digitization. For digitization in particular $18 milion became available, for which we aim to digitize 7 million objects before June 30, 2015, have a high level inventory of the rest and have a Permanent Digitisation Infrastructure (PDI) in place.

Primary goal of digitization is: disclosure of scientific relevant collection objects; not all associated data. Since the target is only a fraction of the total combined collections prioritization is crucial.

For digitization on a detailed level Digistreets were designed, production lines for digitization with a staff of 65. In the Digistreets the aim is to process 2 million objects in-house. These production lines are not organized according to taxonomic group, but follow the handling characteristics of the objects, for instance one Digistreet will cover all alcohol collections, there is one for entomology, herbarium specimens etc. Gradually the work in the Digistreets will be taken over by museum staff, leaving the infrastructure in place, ensuring a continuation of the process.

ORAL

Developing methods for the use of pulped paper in archival fossil repair

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Vertebrate fossil preparators access a wide array of techniques in their work, developed as a result of practical exigencies, availability of materials, physical dimensions of specimens, and the idiosyncratic history of the fields of vertebrate paleontology and natural history collection. The modern field of conservation of historical objects has developed a related but separate system for treating and preserving objects with attention to the use of tested, archival materials.

Conservators use pulped paper in the repair and restoration of a variety of both paper and non-paper objects. The peer-reviewed literature includes uses of cellulose in the repair of stone objects. Of the diverse techniques used in conservation, specific methods using admixtures of pulped paper with Paraloid B-72 have been applied in vertebrate fossil preparation. Stemming from the use of fibrous and granulated cellulose as adhesive thickeners, pulped paper impregnated with adhesive is beneficial for use in cracks, fills, and manifold other structural repairs. This is an introduction to the use of pulped paper in fossil preparation, disseminating the methods thus far developed, and discussing the future possibilities for paper pulp techniques in fossil preparation.

These techniques are simple, archival, cost-effective, and are beneficial in diverse scenarios faced by prepara-

tors. Along with a review of the uses of pulped paper attempted thus far, this talk will include a brief survey of the published references to similar techniques in conservation literature.

POSTER

AmphibiaWeb: 7000 species and counting!

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Since 2000, AmphibiaWeb (www.amphibiaweb.org) has served as an online resource for information on the world's amphibian species and their status. AmphibiaWeb will highlight this resource with the celebration of the description of the 7000th amphibian species in 2012. AmphibiaWeb has become an increasingly vital resource with accurate and current information for educators, researchers, and managers. Every species has a webpage and steady progress is being made in producing species accounts, which are accompanied by photographs, audio recordings, videos, and maps. Browse functions facilitate taxonomic, photographic, geographic and other searches. Unique services include a list (updated daily) of the number of valid amphibian species, mapping of type localities for recently described species, and ready access to the largest amphibian photo collection (nearly 25,000). Literature on amphibian declines is summarized monthly. On average, AmphibiaWeb receives 15,000–20,000 unique queries per day from visitors around the world. The mapping functions of AmphibiaWeb continue to evolve and currently integrate shape files from IUCN with mapped point locality data from scientific collections. An iPhone app enables searching and browsing of amphibian data, including locality-specific searches. A recent overhaul of AmphibiaWeb's taxonomy is based on increasingly stable phylogenetic hypotheses. Taxonomy is monitored by a subcommittee of amphibian specialists from multiple institutions and is updated as species are described and published revisions are evaluated. AmphibiaWeb is a community-contributed resource; volunteers produce the vast majority of species accounts and photos. AmphibiaWeb serves as a useful educational resource and we encourage integration of the website into herpetology courses.

ORAL

Cultural property risk analysis: A report on the state of the art as revealed at the 2011 International Symposium

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An International Symposium on Cultural Property Risk Analysis, in association with the International Council of Museums–Committee for Conservation–Preventive Conservation working group and sponsored by Society for Risk Analysis (SRA), was held at the Universidade Nova de Lisboa in Lisbon, 2011 September 14–16. The Symposium offered 34 papers by presenters from 14 countries dealing with all aspects of risk assessment and management to better preserve cultural heritage. Papers presented addressed cultural property in the form of sites, monuments, architecture as well as collections in museum, libraries and archives. The presentations included case studies, methodological developments, advances in balancing energy demands for preservation with pressure for energy conservation, and perspectives of management and educators. Case studies ranged from applications to large (ten million object) collections to simple guidance on general priorities in small museums. Methodological developments included examples of detailed risk modeling, modeling from different perspectives, and integration of risk descriptions and vulnerability assessments. The issue of balancing sustainability issues with energy requirements for preservation was addressed as a planning and communication issue and as a standards issue, critical knowledge gaps were identified, and risks were evaluated in controlled, uncontrolled, and intentionally intermittently controlled situations. Management and education issues were addressed from institutional, national and international perspectives. This presentation provides an outline of the historical development of cultural property risk analysis as well a review of the state of the art in the field as documented by the symposium presentations.

POSTER

Geo-visualizing a meteorite collection: Using ArcGIS 10 and WorldMap to create an online map for the Harvard Mineralogical Museum

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Assigning a geographic location to a specimen in a geological collection significantly impacts how that specimen is interpreted and understood by curators, researchers, and the public. Given the considerable effect a location can have on the scientific and historical value of

a specimen, museums are looking for meaningful ways to share and display such information. One way to communicate the importance of the connection between a specimen and its place of geographic origin is through the use of Geographic Information Systems (GIS).

To initiate the use of GIS at the Harvard Mineralogical Museum (HMM), a map of the meteorite collection was created. Coordinates for meteorites in the collection were compiled and mapped in ArcGIS 10. Data layers have been uploaded onto WorldMap, an open source web-mapping platform developed by the Harvard Center for Geographic Analysis, to geo-visualize the collection online. The interactive map features an attribute table containing name, fall/find, and classification information for each meteorite and currently consists of four layers. The first layer represents all meteorites found in the HMM's collection. The subsequent three layers separate the meteorites by type: Iron, Stone, and Stony-Iron.

The Map will be made public when it is linked to the museum's new website in 2012. Using GIS and Worldmap to visualize the collection online broadens collections access capabilities and offers a unique way for viewers to discover which meteorites are housed at the HMM. The map additionally provides museum staff with valuable information, such as indicating areas of collection strength and weakness, which can be used in acquisition decisions and in the overall management of the collection. Moreover, this work has established the baseline for future GIS projects at the HMM and reveals the advantages of geo-visualizing geological collections.

ORAL

Managing a collection of students

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Museums at academic institutions have a history of student interaction. The interactions could be in the form of students using museum specimens for course work or independent research. Students also are frequently collectors of new material and valuable members of the collection staff. At the Peabody Museum of Natural History undergraduate students serve as museum assistants participating in all aspects of collection management as well as specimen-based research. Students frequently take lead roles in some aspect of the collection that is often related to their own academic interests. At Peabody Museum all recent mammal specimen preparation has been done by students, including the preparation of three adult black bears and several dozen lemurs. Mixed lots of fish specimens are routinely identified, sorted and cataloged by students and students help design some exhibits. The Peabody Museum maintains a summer intern program for Yale undergraduates who conduct research that utilizes the collections. The Yale Department of Ecology and Evolutionary Biology offers an annual course for new Freshmen on the Peabody museum collections in which students conduct two independent projects in different divisions of the museum and present written and oral papers on the results. Inspiring student involvement in museum collection management, as well as ways to coordinate group projects, will be discussed.

ORAL

The PBI Miconieae project: A complete web-based monograph of the tribe Miconieae (Melastomataceae)

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With 1800 species in 19 genera, the tribe Miconieae constitutes the largest group within the plant family Melastomataceae. Having a strictly neotropical distribution, the tribe is ecologically important due to the diversity and number of individuals in forest understories, as well as for being an important food source for birds and mammals. Additionally, the Miconieae includes two of the worst invasive species in the Hawaiian and South Pacific Islands (Koster's curse [*Clidemia hirta*] and purple plague [*Miconia calvescens*]). The collaborative NSF-funded Planetary Biodiversity Inventory (PBI) Miconieae project will comprehensively monograph all species within the tribe, combining studies conducted in the field, herbarium, and laboratory. All information generated will be available online through a dedicated web interface hosted by The New York Botanical Garden's Virtual Herbarium [http://sweetgum.nybg.org /melastomataceae /index.php]. Stored within NYBG's content management system, KE EMu, online data will include: complete species descriptions with current taxonomic status, nomenclature, protologue citations, and type information; images such as field photos, botanical illustrations, scanning electron micrographs of seeds and other taxonomically significant characters; keys for species identification; catalogued and digitized NY herbarium specimens; distribution maps for each species; and an exhaustive bibliography of relevant literature. This website will be instrumental in determining the large back-log of specimens of neotropical Melastomataceae held at herbaria throughout the world. It will also support the first phylogenetically congruent, character-based taxonomy for the tribe. Providing a model framework for presenting the tools of modern monographic treatments, the PBI Miconieae project will make these tools available for postdoctoral associates, graduate students, and citizen scientists in the U.S. and around the world. Most importantly it will serve as a model for researchers studying other groups of organisms.

ORAL

Building a 21st century natural history museum

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As centers for both collections-based science research and informal learning, natural history museums are uniquely equipped among informal science education providers to promote public understanding, engagement and participation with the pressing scientific issues of our time, such as climate change, biodiversity loss, and how to nurture global cultural understanding. Natural history museums have vast collections that provide historical perspectives essential to addressing these challenges and active scientists whose expertise and passion for the natural world could inspire the same enthusiasm among a public eager to participate in authentic experiences.

Despite many excellent examples of innovation and collaboration that link audiences with researchers and collections, there is a growing consensus that we should play a greater role in engaging audiences in critical scientific issues. To do so requires innovative, collaborative staffing models and thoughtful use of emerging scientific and communications technologies. Building the 21st Century Natural History Museum will require closer and more authentic collaboration among scientists, collections managers, exhibition developers, educators, administrators, learning researchers, and evaluators within and across museums.

At the Smithsonian's National Museum of Natural History, a range of onsite and digital projects are being built and integrated under the umbrella of an Open Museum Initiative. The core of the Initiative is a 10,000 square foot hub of science learning that links physical collections, fully interactive online tools for using digitized collections to ask and answer questions, and mentoring from science and education staff. The initiative is linked to the 21st Century Learning in Natural History Settings Project, which seeks to link natural history museums worldwide into a network for learning research and program innovation to enhance our public value and maximize our potential for the millions of visitors we serve each year.

ORAL

Illumination and preservation of museum exhibitions: Tempering the beast with new technology

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A significant portion of objects on exhibition within natural history museums are susceptible to damage from light. The purpose of this talk is to review past, current and future practices for the protection of museum collections on exhibition from light. One of the key points is the distinction between preservation and exhibition concerns for natural history collections relative to art museums, particularly with respect to illumination requirements.

Looking backward, it is important to understand the basis of current lighting recommendations. Looking forward, it is essential to know how to evaluate and utilize newly emerging technologies for illumination and control, and how these developments can be merged with a new interest in energy sustainability. For example, LEDs are energy efficient, but are they cost-efficient? Is daylight a viable solution for museum illumination? Can new control technologies provide more efficient means for reducing light-induced damage to collections and yet enhance the visitor's viewing experience of the exhibition?

These new technologies and new opportunities provide the means to achieve successful solutions and avoid painful and costly mistakes.

POSTER

The Harvard Embryology Collection: A case study on archival histology slides

Williston, A.D.

Ichthyology Collection, Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge, MA 02138 USA

Extensive embryology and histology slide collections are rare or unnoticed in natural history collections. Collections focused on keeping alcohol preserved and skeletal whole animals may overlook histological slides and other micro-slides. Still, slide collections have the potential to be valuable museum resources.

The Harvard Embryology Collection is an example of a historic, archival histological embryology collection. The HEC was started in 1890 by notable American anatomist Charles Sedgewick Minot. The collection was designed to be broadly systematic, including 60 taxa. The HEC was founded in a collaborative spirit to provide the research community a "cyclopedia" to promote new research and reproducibility in embryology. The HEC was successful in the early 1900s—being cited in more than 100 papers including two volumes of Keibel's Normal Tables. Bashford Dean's notable hagfish embryo slides were later deposited in the collection. Fortunately, Minot (a former student of Louis Agassiz) constructed the collection according to strict archival standards so that HEC slides would act as permanent vouchers. Indeed, the slides have persisted to this day.

Unfortunately the collection sank into obscurity after the early 1900s. Still, the collection remained intact at the Warren Anatomical Museum at Harvard Medical School.

Now, despite nearly a century of relative disuse, the collection is safely kept at the Museum of Comparative Zoology (MCZ) and is available to researchers. The collection's history stands as a reminder that even the most seemingly out of place collection objects can have a great and unnoticed value. Curatioral improvements are now planned at the MCZ. The collection may also serve as a model for building modern, archival histology slide collections.

ORAL

Creating collection relevance: A museum's guide to values assessment

Work, Paula T.
Maine State Museum, 83 State House Station, Augusta, ME 04333 USA

Institutions hold collections in the public trust, making the public our partners as primary stakeholders for these collections, but without the tools for informed dialog this purpose is lost.

Over the past two decades the museum community has come to understand the need to define how collections are relevant to society. The result being an understanding that museum collection can be assigned many values. These values stem from the many uses of collections by society, and the significance assigned to those uses. Several easy to understand values are monetary, aesthetic, or educational.

The purpose of this presentation is to show the components of a value's assessment approach that can be readily adapted to disparate collection holding institutions, and acts to define the importance of a these materials to a targeted stakeholder community.

ORAL

Towards best practice in mounting and conservation of botanical specimens

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The Natural History Museum, Cromwell Rd., London SW7 5BD, United Kingdom

As part of the Natural History Museum's program to establish best practice in the conservation and storage of its collections, staff from the Botany Department have undertaken a survey to review materials, mounting techniques and procedures used world-wide.

The survey which was accompanied by a literature review established that generally, the principle of attaching dried pressed plant specimens to a mounting media has not changed for several hundred years being traced back to 16th century. However, a wide range of variations of this practice can be seen.

The available literature suggests that there have been trials on the use of a range of materials (and even methods) but there has been insufficient (published) research to determine what can/might be considered best practice. The general lack of substantial/extensive data reveal that there is a need for further research and discussion on the aims of mounting plants and best practice in techniques used.

The Natural History Museum (NHM) is currently reviewing the wide range of mounting techniques and materials (such as adhesives, glues, strips/gummed tapes, etc.) identified in the survey and literature to establish criteria for best practice and to look at the longer-term effects of these techniques in light of new demands for samples for genetic and morphological data.

This paper reviews the stability and suitability of these methods and materials in comparison with other studies already undertaken and covers the first stage of this review. Techniques and materials will be assessed against common criteria established from the survey and literature survey.

Preliminary results from this study are presented of what might be considered best practice for objects of long-term value to a research collection, using a non-invasive/invasive mounting techniques and materials.

ORAL

Survey of genetic resource collections associated with natural history collections

Zimkus, B.M.; Ford, L.S.
Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge, MA 02138 USA

Natural history collections and other repositories of preserved biological material have traditionally focused on the preservation of organismal whole specimens, but genetic resources have become a standard and integral part of traditional collections during the past decade. These collections may include frozen tissues, chemically preserved tissues, and/or associated extracts, and unlike typical museum specimens, genetic resources are consumptive. These types of collections are also expensive and time-consuming to build and maintain; samples must be carefully stored and monitored in a low temperature environment if their products are to remain useful for molecular analyses. For these reasons and numerous others, genetic resources present a number of unique management problems for natural history collections. In addition, despite more standardized methods for the management of traditional natural history collections, there seemingly is no best-practices standard for the documentation, arrangement, and housing for this new type of research collection. To learn more the current protocols, challenges, and concerns associated with genetic resources, we surveyed natural history museums and other collections that store genetic resources using an online poll that included 57 questions. The survey was advertised via the SPNHC newsletter and distributed directly to those who managed genetic resources at natural history museums, botanical gardens, colleges/universities,

herbaria, private institutes, science centers and zoos. Participants answered questions regarding sample types accepted, storage methods, location tracking, personnel, policy, security, safety, budget, funding and loans. Results of this survey are quantified and reported. This survey will be the first step to informing natural history collections and other repositories about suggested standards in relation to genetics resources and bringing researchers from disciplines that traditionally do not have collections towards standard protocols via best-practice guidelines for genetic resources collections. Both collections and independent researchers would improve efficiency and organization of collections with the availability of guidelines, allowing researchers to more readily donate, as well as access genetic material, with the availability of best-practice standards.

28th Annual Meeting of the Society for the Preservation of Natural History Collections and 10th Conference on Fossil Resources

June 17-22, 2013

Rapid City, South Dakota

Hosted by the SDSM&T Museum of Geology and the SPNHC/CFR Local Committee

- Joint SPNHC/CFR workshop
  - Repositories: Protecting Natural History Heritage for Everyone
- Pre-conference field trip
  - Natural History and History of the White River Badlands
- Session workshops
  - Collections digitization for the 21st century
  - Native American natural history collections concerns

Facebook: https://www.facebook.com/#!/groups/SPNHC2013CFR10/

DemoCamp

Arranged in alphabetical order by lead author. In the case of demonstrations with more than one author, presenter names are underlined. DemoCamp factsheets are in a separate section following the DemoCamp abstracts.

Collaborative digitization workflows with Specify

Bentley, A.

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The Specify Software Project supports more than 400 museum and herbarium collections with open source software and technical support services for digitizing and mobilizing specimen data. Most collections utilizing Specify are repositories at universities or smaller colleges with holdings in the tens to hundreds of thousands of collection objects, but Specify also supports collections with over a million data records, as well as large multinational projects.

Specify aligns with goals of the NSF ADBC Program, iDigBio HUB, and the Thematic Collection Networks to promote collaborative cataloging, by offering interfaces which can be individualized to local collection data workflows, as well as functions associated with collaborative data entry, duplicate specimen discovery, data reconciliation, and publishing records to species occurrence data aggregators.

In this 15-minute demonstration, we will quickly touch on Specify 6's capabilities for data entry, bulk data uploading and validation, as well as the integration of specimen images and labels into digitization workflows. We will nimbly show Specify technologies for image, label and OCR data archiving, duplicate data discovery and re-use (Scatter Gather Reconcile), and for data publishing. We will flash a preview of a new generation of Specify which moves specimen data management to the web. Finally, we will re-affirm our commitment to support curation and research with biological specimen data, and to collaborative development and co-ownership of open source software for biodiversity collections.

The Apiary Project—A framework and workflow for extraction and parsing of herbarium specimen data

Best, Jason[1]; Neill, Amanda K.[1]; Moen, William E.[2]

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[2]University of North Texas, Texas Center for Digital Knowledge, College of Information, 3940 North Elm St., Denton, TX 76207 USA

Millions of specimens in herbaria worldwide need to be digitized to be accessible to scientists. A key challenge faced by biodiversity collections is determining a transformation process that yields high-quality results in a cost- and time-efficient manner. The University of North Texas's Texas Center for Digital Knowledge (TxCDK) and the Botanical Research Institute of Texas (BRIT) have developed a web-based application workflow for combining human and machine processes to facilitate the transformation of herbarium label data into machine-processable parsed data. The workflow and framework, called the Apiary Project (www.apiaryproject.org), are made possible through integration of existing technologies and metadata standards. The workflow interfaces allow human participants to inspect and analyze digital images, extract text, and then parse this text into standardized metadata elements.

Apiary's web-based interface is designed for use by the general public, with minimal training, allowing collection managers and curators to assemble resources to meet the challenge of effectively and efficiently extracting data from images. Apiary can be integrated into existing and future workflows to speed the process of digitization and data mobilization. Apiary is built with open source components (including Fedora Repository, Islandora, Drupal, djatoka image server and OCRopus) and is available under the GPL open-source license.

Apiary is in active use in the digitization workflow at the Botanical Research Institute of Texas. An update of the progress and challenges of digitization will be presented.

The Apiary Project was funded by a National Leadership Grant (LG-06-08-0079) from the U.S. Federal Institute of Museum and Library Services.

GIGAmacro: Creating gigapixel photographs of macro and micro specimens

Cooper, Gene; Cooper, Naomi

Four Chambers Studio/GIGAmacro, 128 Ebbetts Pass Rd., Vallejo, CA 94589 USA

Purpose and intended users: GIGAmacro technology is a new system for creating gigapixel macro and micro photographs for conservation, research, science, and education applications. The technology provides an automated hardware and software solution to photograph entire specimens in full focus, along with software for sharing, annotating, and exploring gigapixel images online.

Current users include museum collections managers, researchers, scientists, exhibit designers, and conservation groups at the Carnegie Museum of Natural History, USDA, Historic Scotland, and Northern Virginia Com-

munity College. Fields of study using GIGAmacro include entomology, paleontology, historic document preservation, geology, and architecture.

Major Components:

—Robotic Linear Motion Control Hardware and Software
—DSLR Camera System with Telecentric Optics
—Focus Stacking with 3D Imaging Capabilities
—Image Mosaicing and Image Stitching Software
—Online Tools for Exploring, Annotating, and Sharing Gigapixel Imagery

Novelty and comparison: The combination of these technologies results in an innovative and novel approach to imaging. Typical photographs produced by the system are 100 to 1,000 times greater resolution than a standard 15 megapixel camera and at a fraction of the cost per pixel. The quality, accuracy, and capabilities go far beyond existing technologies (like Automontage) and can accommodate a much wider range of subjects (from one-quarter inch to three feet).

This technology is available right now, and can be customized to specific uses. The software we provide to capture and create the imagery is proprietary, though online software to share, explore, and annotate imagery is open source and available for anyone to use.

At DemoCamp, we will show the GIGAmacro Professional Imaging System in action, show gigapixel photographs from different research institutions and share a few large-format prints of images.

Connecting expert knowledge to specimens: Remote annotation of data in a Filtered Push network

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[2]Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge, MA 02138 USA

[3]Agriculture and Agri-Food Canada, Wm. Saunders Building, Ottawa, ON K1A 0C6, Canada

[4]UC Davis Genome Center, University of California–Davis, 451 Health Sciences Dr., Davis, CA 95616 USA

[5]Stanford Synchrotron Radiation Laboratory, 2575 Sand Hill Rd., MS 69, Menlo Park, CA 94025 USA

When data from natural science collections are aggregated and distributed across networks, the data as displayed on remote clients are disconnected from the authoritative records held in institutional databases. While the mobilization and distribution of data about collection objects makes that data more accessible to experts who can maintain and even improve data quality, it risks disconnecting this new knowledge about these objects from their curators. One of the functions of a Filtered Push network is to return to curators such knowledge elicited from experts wherever collections' information is displayed. We will demonstrate this Filtered Push of information in a network connecting an instance each of Morphbank, Symbiota, and Specify6. We will create a new determination based on an image of a collection object displayed in Morphbank, automatically formulate this new determination as an annotation document, and inject this annotation document into a Filtered Push network. Similarly, a second annotation will be generated by an expert using Symbiota. These annotations will be delivered to an instance of Specify6, which holds the authoritative record for the annotated collection objects. Incoming annotations will be reviewed by a member of the institution's collection management staff and examples presented of both acceptance and rejection of these annotations (Filtered). The accepted annotation will be automatically ingested into the Specify6 database (Push). Following this, a query of an annotation store in the network will show the network's knowledge of both annotations and actions taken on them by data curators. Annotations in a Filtered Push network can close the gap between experts viewing data remotely and authoritative collections database records. Supported by NSF DBI-0960535.

Georeferencing natural history collections data: The GEOLocate Project

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Over 2.5 billion biological specimens are archived in the world's natural history museums and herbaria. Major efforts are ongoing to digitize and georeference the data associated with these collections. The GEOLocate project is an effort to develop a suite of software and services for automated georeferencing of natural history collections data. Since 2002, the project has been responsible for the release of a desktop application, a framework for collaborative georeferencing, a web based application and georeferencing and validation services to facilitate direct integration with collection digitization efforts. Within the past year, version 2 of the web services for georeferencing have been released and include greater results metadata, improved ranking and filtering of results, georeferencing language selection (English, Spanish, Catalan, Basque or Galician), determination of uncertainty radii as defined by the GBIF Best Practices for Georeferencing, and determination of uncertainty polygons. We have also included a service to retrieve results from alternative georeferencing methods, such as Biogeomancer, and pass those results back to clients in a single standardized GEOLocate response format. This presentation will demonstrate the web based clients with a focus on integration services.

Reflectance Transformation Imaging for empirical documentation of natural history collections

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Reflectance Transformation Imaging (RTI) has the potential to revolutionize the documentation, treatment, and research of natural history and art museum collections. RTI Images also invite people to interactively experience collection materials. RTI enables museum professionals and other scholars to examine a surface's shape and color by interactively re-lighting the subject from any direction and applying mathematical enhancements.

RTI open-source software allows scholars to generate images that meet specific needs, using mathematical enhancements and display software to bring out intricate surface details not visible with the naked eye or with traditional magnification. Image capture and processing metadata are packaged with the RTI pictures enabling the automatic generation of process-history information. These 'digital lab notebooks' record the means and circumstances surrounding the creation of the digital representation, a necessary element for scientific evaluation and the use and reuse of data for novel purposes by others in the future. Sophisticated metadata management is undergoing major updates with the development of new tools in the RTI workflow.

We will outline the inexpensive and easy to learn image capture methodology and image processing open source software. We will demonstrate examples of the resulting RTI images using the RTIViewer, viewing and analysis tool.

RTI is part of a family of related methods, often called Computational Photography, based on the extraction of information from multiple digital photographs. The software tools are developed by an international collaboration of research labs and universities. RTI has already been adopted and deployed by many leading art museums in the US and around the world, with interest growing among Natural History collections.

High-throughput 3-D pinned insect data capture

Sieracki, Jeffrey M.[1]**; Favret, Colin**[2]
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[2]Institut de recherche en biologie végétale / Biodiversity Centre of the Université de Montréal, 4101 rue Sherbrooke est, Montreal, QC H1X 2B2, Canada

We describe SR2 Group's high-throughput robotic imaging and data capture system for physical insect specimens. Natural history museums are vast, largely untapped sources of biological data. Over one billion specimens reside in U.S. museum drawers and cabinets, their characteristics, associated data, and even their existence often hidden. Insects preserved on pins represent a significant proportion, with the ten largest U.S. collections housing over 100 million such specimens. We address a high-throughput system capable of manipulating pinned specimens, partitioning the 3D scene, photographing specimens, and extracting database information with OCR rendering of specimen labels. The system overcomes critical barriers to digitizing these important scientific resources by automating a process that has previously been prohibitively time consuming and expensive. The technology can radically accelerate the pace of insect specimen digitization and capture of critical data from museum specimens. Our results demonstrate that machine handling of pinned specimens is feasible and practical; expanded application to other large collections of irregularly-sized biological specimen is addressed.

EGEMS electronic geological management system: Preserving geological materials and information for our future

Timm, Sarah
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EGEMS is an intuitive and user-friendly database for anyone who wishes to better manage their geological materials. The database was developed as part of a master's thesis at Virginia Tech to provide a solution to rising collections management problems. The Department of Geosciences at Virginia Tech houses enormous amounts of geological materials, and provides a model example of this growing need. Without proper management, collections can become disorganized, and significant portions can be lost or discarded. Likely as a result of this problem the National Science Foundation now mandates that each grant proposal include a data management plan detailing how the materials and data collected under that grant will be accessible to the public and preserved for the future. This is a great step towards protecting our collections, however it requires that the natural history community have a tool to aid them in their collections management efforts.

Databases for natural history collections are often built by programmers unfamiliar with the materials being cataloged. EGEMS is unique in that it was created from the perspective of a geologist, and it incorporates suggestions from many potential users. Also as a result of being built on FileMaker Pro software, EGEMS is cross-platform and has networking and web-browsing capabilities.

EGEMS is also unique in that it is the first database to take into account the needs of both institutional and private collections within the same database. For example EGEMS has the ability to record information specific to research products (experimental powders, synthesized materials, etc.) as well as capture accession and loan in-

formation, print specimen and tray labels, and import/export images and documents. The combination of these exclusive and standard features makes EGEMS the ideal software for anyone with a geological collection. To find out how EGEMS can benefit you visit www.egemsinfo.com.

Natural selection: Finding specimens in a natural history collection

van der Mije, S.D.
Netherlands Centre for Biodiversity Naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands

The natural history domain is rich in information. For hundreds of years, biodiversity researchers have collected specimens and samples, and meticulously recorded the how, what, and where of these objects of research. In this contribution, we first present a new approach to collection digitisation, as well as a novel collection registration management system (CRS) as implemented at the Netherlands Centre for Biodiversity (NCB Naturalis). The new approach to digitisation at NCB Naturalis implements a cascaded digitisation approach: in parts of the collection that have not yet been digitised, first a shelf or drawer is assigned a unique ID in the CRS, along with a description of the specimens contained within it. Whenever the shelf or drawer is revisited, the new policy dictates that specimens that are taken and used from this set be recorded in the CRS. This ensures that at least series of specimens are registered and can be located, which is an important consideration in a collection of 37 million objects.

The CRS differs from other collection management systems in that it is not only a collection management tool for a wide range of users that allows retrieving objects in the collection, and inspect what is their condition or whether they are on loan, but also a tool for researchers. Although the CRS employs its own, custom-made underlying data model, it is based on the Access to Biological Collection Data (ABCD) standard, "Extension for GeoSciences" (EFG). It is furthermore compatible with existing protocols as CIDOC-CRM8, Spectrum9, and various technical standards. Our knowledge-based database cleaning approach utilises knowledge about the domain from temporal, geographical, taxonomies and other resources to infer whether a value is correct or suspicious. It works by combining pieces of information from the collection information system and an external resource or rule, to decide whether a value is correct or not.

DemoCamp

Factsheets are arranged across two pages in order of presentation.

Project Name Presenter Website	Purpose	Intended Users	Classification
GIGAmacro Cooper, Gene www.gigamacro.com	GIGAmacro is specifically designed for creating explorable gigapixel photographs of macroscopic and microscopic subjects (Gigapixel Macro Photography).	Collection managers, curators, scientists, researchers, exhibit designers and anyone interested in digital sharing and preservation of specimens and artifacts	High-resolution photography system, including hardware, software, and online viewing application
Reflectance Transformation Imaging (RTI) Schroer, Carla culturalheritageimaging.org	To create a high quality, scientifically reliable reflectance image that can be manipulated and mathematically enhanced to examine very fine surface details of objects that may remain invisible with other imaging technologies. This technology uses off-the-shelf digital cameras to take an image sequence that is processed with open source software to produce this new type of image.	Anyone interested in research, education and preservation of natural history collection objects with surface features such as fossils, botany samples, insects, and anthropology collections	This is a technology with multiple parts. Image sequence capture is performed with off-the-shelf digital camera and tripod. Image processing is performed with RTIBuilder. Analysis and viewing tool is RTIViewer. Both are desktop applications. Plans are under way for additional viewing and analysis tools.
High-Throughput 3-D Pinned Insect Data Capture Sieracki, Jeffrey www.sr2group.com	Bulk digitization and cataloging of insect specimens, including high resoution imaging and label capture. Other irregular physical specimen types can be addressed.	Collection managers and curators interested in large-scale, high-throughput digitization of their physical specimen resources	Data capture and digitization

demo camp

Technology and Integration	Licensing Model	Platform Requirements
The system combines robotics hardware, DSLR cameras, capture software, focus stacking software, and image stitching software to create the gigapixel photographs. Once created, the photographs can be explored, compared, shared, and annotated using our online viewing application. Annotations can be exported to XML, snapshots can be exported as JPEG, and the full resolution gigapixel photographs can be exported to Photoshop or other graphics programs.	The online viewing application is free for anyone to use. Capture, focus stacking, and stitching software is included in the system license as a commercial product.	Online Viewing: any PC or Mac computer The system includes a fully-configured PC computer for creation of the gigapixel photographs.
Capture is performed with camera, ideally tethered to a computer. RTIBuilder is a Java desktop application that runs on Mac, Windows, and Linux. RTIViewer is a desktop application written in C++ available for Mac and Windows. Other free viewers are also available, and a WebGL/ HTML 5 viewer is under development.	Open source under the Gnu General Public license v 3. Optional additional components are available as free for non-commercial use executables (without source).	Windows machines. Intel-based Macs running Mac OS 10.5 and later. 4GB of RAM and higher are recommended for processing. Lower performing machines are OK for viewing.
Integrated domain-specific robotics, imaging, and OCR rendering	TBD	TBD

DemoCamp

Factsheets are arranged across two pages in order of presentation.

Project Name Presenter Website	Purpose	Intended Users	Classification
EGEMS Timm, Sarah www.egemsinfo.com	EGEMS was developed to meet the rising needs of all geological collections, especially those reliant on National Science Foundation funding. EGEMS enables institutions and individuals to manage all of their geological materials, including research products, using one cost-efficient and user friendly program.	Anyone with a geological collections, including but not limited to: collection managers, curators, professors, graduate students, research scientists, mineral show dealers, and private collectors	Database Management System (DBMS)
GEOLocate Rios, Nelson museum.tulane.edu/geolocate	Georeferencing software and services for natural history collections	Collection managers, curators, collection users, scientists, and anyone interested in collection records	Georeferencing software
FilteredPush Morris, Paul etaxonomy.org/mw/FilteredPush	Quality control and enhancement of distributed data	Collection managers, curators, collection users, scientists, and anyone interested in collection records	Network Software and Clients
Specify Bentley, Andrew specifysoftware.org	Facilitate the acquisition, authoring, research analysis, mapping, reconciliation, re-use and publication of biological collection data	Digitization projects, consortia, herbarium and museum curators, scientists, collections researchers	Rich database management and digitization workflow application

demo camp

Technology and Integration	Licensing Model	Platform Requirements
EGEMS is the first database to combine functions beneficial to museum, university, and private collections. Images and documents can be uploaded to every record and each record has the ability to be related to one another. This means a user searching for information could learn what a material looks like, view any analytical data or photographs of original documentation, and read any information typed into the text fields, as well as see this same amount of information for any associated records. The text fields are unlimited in characters except when selecting a value from an authority file. Authority files in EGEMS are from trusted sources such as AGI and PetDB. Also, as a result of being built on FileMaker Pro, EGEMS is cross-platform and is unlimited in file size.	EGEMS is available online at www.egemsinfo.com. There are 3 versions of EGEMS currently available: Network, Stand-alone, and Student. If you have any questions you can send an e-mail to customersupport@egemsinfo.com	EGEMS is cross platform (Mac & PC), however the Network Version does require FileMaker Pro software. Information on educational discounts, site-licenses, and general pricing for FileMaker can be found at www.filemaker.com.
Web API available for integration. Core technologies: C#, HTML & Javascript	Desktop and web applications are freely available with no restrictions on use.	None
AO/AOD Annotation Ontology (engaged with W3C OA process). RDF. OWL representation of TDWG DarwinCore. J2EE Network software. Annotation Processor working with Specify 6. Adaptable to other SQL databases and to Java PDO layers over databases. Java Client Helper Library. PHP Client Helper Library. Morphbank and Symbiota clients	OpenSource. GPL2	Various. Annotation Processing Client: Tomcat or Jetty container. NetworkNode: Glassfish container
Specify is coded in Java for portability across desktop platforms. As a platform it supports user interface and capability plug-ins. Currently we include GEOLocate, Scatter Gather Reconcile, Lifemapper (GBIF) and NASA World Wind plug-ins. iReports is embedded for specimen label design and production. The new generation web client is built primarily with HTML5, ExtJS, and JPA, with Solr/Lucene in the new web portal.	GPL2, Actively managed as an open source initiative, Codebase: http://sourceforge.net/projects/specify/	Windows, Mac OS X, or Linux workstations and for server installations mySQL on any MySQL-supported server, internet connection for web service integration functions

DemoCamp

Factsheets are arranged across two pages in order of presentation.

Project Name Presenter Website	Purpose	Intended Users	Classification
CRS **NCB Naturalis Collection Registration System** van der Mije, Steven	Multidisciplinary collection management system for natural history collections. Combines collection management with public web presence to explicitly demonstrate collection usage and integration with other web services.	Collection managers, curators, collection users, scientists, and anyone interested in collection records	Database management system and web application
The Apiary Project Best, Jason www.apiaryproject.org	To speed the process of extracting valuable metadata from herbarium specimen images through a workflow that integrates human and machine processes	Herbarium collections managers, herbarium staff, and herbarium volunteers	Web application

demo camp

Technology and Integration	Licensing Model	Platform Requirements
An integrated suite of applications written in ColdFusion and running over Oracle. Collection records in CRS can be linked to any URI CRS wil be integrating other web services and its data will be automatically available to networks such as GBIF.	Licensing system will be available after completion and testing.	Client: any modern standards-compliant web browser. Database: Oracle
The front end uses Drupal Content Management System (PHP). The data repository is Fedora Repository. Components of the Islandora framework are used to connect Drupal to Fedora Repository. Djatoka image server is used to display and manipulate images. OCRopus and GOCR are used for optical character recognition. The primary metadata generated adheres to the Darwin Core standard. Metadata and images can be accessed and queried through the various protocols supported by Fedora Repository such as REST and SOAP APIs and SPARQL as well as metadata harvesting through OAI-PMH.	Open source - GPL	Client: any modern standards-compliant web browser. Server: Linux. Developed and tested on Ubuntu 10.04

Posters

AIC SPECIAL SESSION: STORAGE TECHNIQUES FOR ARTS, SCIENCE, AND HUMANITIES COLLECTIONS

Co-sponsored by the
American Institute for Conservation of Historic and Artistic Works

1. **Mount making at the UBC Museum of Anthropology**
   Schlichting, Carl; Swierenga, Heidi; Toutloff, Mauray; *UBC Museum of Anthropology*
2. **From seeds to dugout canoes: Methods for the Long-term care of macrobotanical and megabotanical archaeological remains from 500- to over 5000-year old archaeological sites**
   Ruhl, Donna L.; LeCompte, Elise V.; *Florida Museum of Natural History*
3. **A textile hanging system composed of readily available hardware materials**
   Opitz, Cindy; *Museum of Natural History, The University of Iowa*
4. **Maximizing space: Wall mounted storage for long narrow objects**
   Newberry, Rebecca; *Science Museum of Minnesota*;
   Anderson, G., *Carnegie Museum of Natural History*
5. **A high volume production method for wedge-type storage mounts used to house ceramic pots**
   McGrew, Ashley, *Private Consultant*
6. **Stabilizing special collections for high-density storage at the Library of Congress**
   Lewis, Jennifer; Greek, Ashley; *Library of Congress*
7. **Considerations for compact storage of the collection at a large natural history institution: A case study at the Royal Tyrrell Museum of Palaeontology**
   Housego, G.C.; Strilisky, B.C.; *Royal Tyrrell Museum of Palaeontology*
8. **Re-housing archaeological textiles during the National Museum of the American Indian collections move**
   Anderson, Lisa; Heald, Susan; *National Museum of the American Indian*
   Chang, Lauren; *Art Institute of Chicago*
9. **Supporting old bones, storage jackets for oversize dinosaur bones**
   Fox, Marilyn; Fitzgerald, Vicki; *Yale Peabody Museum of Natural History*
10. **Odd lots: Storage supports for special situations**
    Covell, Amy L.; Harding, Deborah G.; Anderson, Gretchen; *Carnegie Museum of Natural History*

SPNHC

11. **Dr. Robert F. Thorne's botanical collections at Rancho Santa Ana Botanic Garden: A legacy of fieldwork to be processed**
    Gardner, Erika M.; *Rancho Santa Ana Botanic Garden*
12. **Moving Rocky Top to Oklahoma: Integration of the University of Memphis Mammal Collection to the Sam Noble Museum of Natural History**
    Revelez, Marcia A.; Braun, Janet K.; Mares, Michael A.; Hites, Roxie R.;
    Sam Noble Museum of Natural History
13. **The University of Colorado Museum's Fossils in the Classroom Project**
    Karim, T.S.; Culver, T.; Hakala, J.S.H.; Eberle, J.; *University of Colorado Museum of Natural History*

14. **The bird collection and the management at the Yamashina Institute for Ornithology: Overview**
Kobayashi, Sayaka; Yamasaki, Takeshi; Saitoh, Takema; Asai, Shigeki; Iwami, Yasuko;
Yamashina Institute for Ornithology

15. **Revitalization of the Recent Invertebrates Collection of the Sam Noble Museum**
Sohl-Smith, Laura; Menard, Katrina; Yuri, Tamaki; Braun, Janet K.; Hites, Roxie;
am Noble Oklahoma Museum of Natural History

16. **The Harvard Embryology Collection: A case study on archival histology slides**
Williston, Andrew D.; *Museum of Comparative Zoology, Harvard University*

17. **Revitalizing a natural history collection: An institutional commitment to the public trust and the scientific legacy of the Chicago Academy of Sciences**
Roberts, Dawn R.; *Chicago Academy of Sciences and Peggy Notebaert Nature Museum*

18. **Digitization at the Chicago Academy of Sciences' museum collection and archives**
Roberts, Dawn; *Chicago Academy of Sciences and Peggy Notebaert Nature Museum*

19. **What's underfoot? KE EMu's new IPM functionality identifies new moth habitat**
Smith, David A.; Kelly, Claire; Mendez, Armando; *Natural History Museum, London*

20. **A tale of two systems: Synergy in managing risks to people and to collections**
Hawks, Catharine; Waller, R.; *National Museum of Natural History, Smithsonian Institution*

21. **Training in natural history conservation: An interns perspective**
Jones, Natalie; *Horniman Museum and Gardens*

22. **Collection improvement and expansion feasibility studies: An essential planning tool for many collections**
Mitrow, Gisele; Catling, P.; Macklin, J.; Cayouette, J.; *Agriculture and Agri-Food Canada*
Weatherston, J.; *WeatherstonBruer Associates*

23. **Engaging students in hands-on and project-based learning —Using specimen preparation as an educational tool in the MVZ Undergraduate Program**
Albe, M.J.; Cicero, C.; Trápaga, A.; Spencer, C.L.
Museum of Vertebrate Zoology, University of California–Berkeley

24. **A comparison of packing methods for shipping human remains internationally**
Utrup, Nathan; *Peabody Museum of Natural History, Yale University*

25. **Broken bones and dirty stones: Preparing paleontological collections at the Museum of Comparative Zoology (Harvard University) for a major collection move**
Renczkowski, M.; Cundiff, J.; *Museum of Comparative Zoology, Harvard University*

26. **Detecting arsenic in vertebrate specimens at the Michigan State University Museum using a handheld X-ray fluorescence (XRF) analyzer**
Abraczinskas, L.M.; Siciliano, L.M.; Lundrigan, B.L.; *Michigan State University Museum*

27. **Snowmaking at AMNH: New methods in the restoration of winter landscapes in natural history dioramas**
Palumbo, B.; Sybalsky, J.; Nunan, E.; Levinson, J.; Elkin, L.; *American Museum of Natural History*

28. **Fleshing it out: New methods of taxidermy restoration with conservation-approved materials**
Palumbo, B.; Sybalsky, J.; Nunan, E.; Levinson, J.; Elkin L.; *American Museum of Natural History*

29. **Salvage and restoration activity for the bird specimens destroyed by tsunami in the Tohoku Earthquake, Japan**
Iwami, Yasuko; Yamasaki, Takeshi; *Yamashina Institute for Ornithology*
Kumagai, Masaru; *Rikuzentakata City Museum*
Tomioka, Naoto; *Okayama University of Science*

30. **Fragile creatures: Reboxing Blaschka jellyfish**
Lowe, Miranda; *The Natural History Museum, London*

31. **From the American Museum of Natural History with love: Packing fossil specimens for shipment**
Gishlick, A.; Jurgielewicz, L.; Mehling, C.; *American Museum of Natural History*

32. **The use of Orasol® dyes for in-situ recoloring of taxidermy specimens**
Sybalsky, J.; Palumbo, B.; Nunan, E.; Levinson, J.; Elkin, L.;
American Museum of Natural History
Pollak, B.; Rogge, C.; *Buffalo State College*

33. **A review of materials and techniques used for feather cleaning and reshaping at the Winterthur/University of Delaware Program in Art Conservation**
Torok, Elena; Pack, Crista; Pouliot, Bruno;
Winterthur/University of Delaware Programi in Art Conservation

34. **Developing digital resources for the University of Iowa Paleontology Repository Amoco Conodont Collection**
Adrain, T.; Hawkinson, K.; *University of Iowa*

35. **Digitising the bird egg card index of the Natural History Museum, London**
Brooks, Lawrence; *Natural History Museum*

36. **Reality check: Our experience integrating invertebrate paleontology and paleobotany collection databases**
Landis, M.; Lupia, R.; Burkhalter, R.; *Sam Noble Oklahoma Museum of Natural History*

37. **Planning an ApplePie network based on Filtered Push technology to connect botanical collections**
Macklin J.A.; *Agriculture and Agri-Food Canada*
Dou, L.; Ludaescher, B.; U*niversity of California–Davis Genome Center*
Hanken, J.; Kelly, M.; Lowery, D.B.; Morris, P.J.; *Museum of Comparative Zoology, Harvard University*
Morris, R.A.; *Harvard University Herbaria*

38. **Krypto-S: A user friendly collection database interface**
Ohlsson, Elin; *The Swedish Museum of Natural History*

39. **Connecting the dots: Wireless data nodes and environmental planning**
Anderson, Gretchen; Lyon, J.; Santioanni, K.; *Carnegie Museum of Natural History*
Kreitler, P.; *Landmark Facilities Group, Inc.*

40. **Georeferencing the past**
Utrup, Jessica; *Peabody Museum of Natural History, Yale University*

41. **Vertebrates in the cloud (vertnet.org): Are we there yet?**
Bloom, David; Spencer, Carol; Koo, Michelle; Cicero, Carla; Steele, Aaron; Wieczorek, John;
Museum of Vertebrate Zoology, University of California–Berkeley
Rios, Nelson; Bart, Hank; *Tulane Museum of Natural History, Tulane University*
Gurlanick, Rob; *University of Colorado Museum of Natural History, University of Colorado*
Russell, Laura; Vieglais, David; *University of Kansas Biodiversity Institute, University of Kansas*

42. **West Virginia mammals online**
Strait, Suzanne; Hamden, Joseph; *Marshall University*

43. **AmphibiaWeb: 7000 species and counting!**
Wake, D.B.; Bloom, D.A.; Gross, L.J.; Koo, M.S.; Spencer, C.L.; Whittaker, K.; Wittsche, J.; Zhuang, M.;
Museum of Vertebrate Zoology, University of California–Berkeley
Blackburn, D.C.; *California Academy of Sciences*
Cannatella, D.C.; *Texas Natural History Collections, University of Texas*
Vredenburg, V.T.; *San Francisco State University*

44. ***Index Herbariorum,* a directory to the world's herbaria and indicator of worldwide trends in natural history research**
Thiers, Barbara; *The New York Botanical Garden*

45. **Planning an effective workflow for digital photography of collections**
Mansfield, S.; Willard, S.; DeMouthe, J.; *California Academy of Sciences*

46. **Have camera, will travel: Interdivisional application of digital imaging best practices**
Hochgraf, Susan; *Peabody Museum of Natural History, Yale University*

47. **Geo-visualizing a meteorite collection: Using ArcGIS 10 and WorldMap to create an online map for the Harvard Mineralogical Museum**
Warmington, Tracy L.; *Harvard Mineralogical Museum, Harvard University*

48. **Quantitative evaluation reveals taxonomic over-splitting in extinct brachiopods from deep time: Implications in conserving biodiversity**
Bose, R.; Polly, P.D.; *Indiana University*
De, A.; *Columbia University Medical Center*

Author Index

Names of presenters are underlined.

Notes

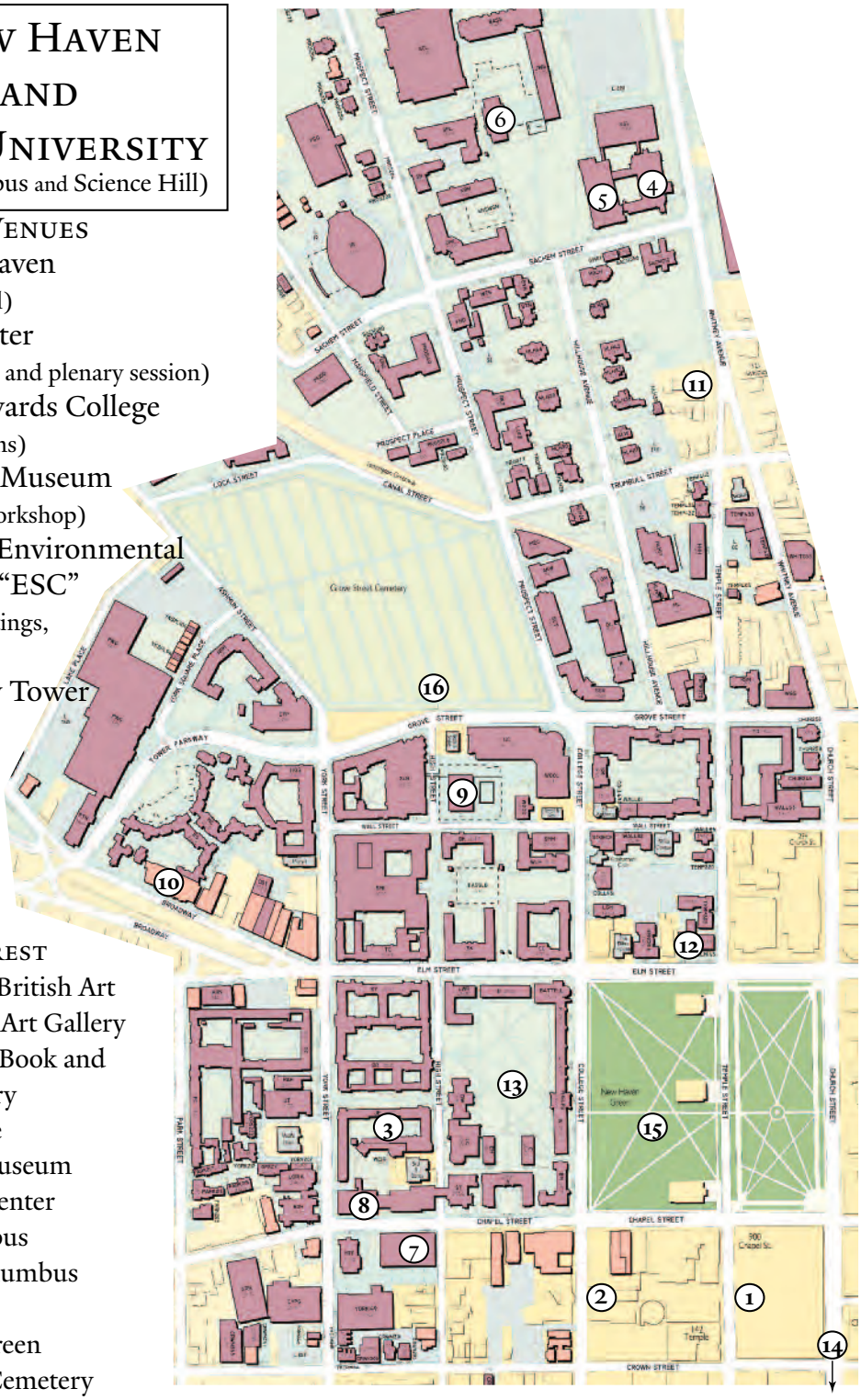
Notes

New Haven and Yale University

(Main Campus and Science Hill)

Conference Venues

1. Omni New Haven
   (conference hotel)
2. Shubert Theater
   (keynote address and plenary session)
3. Jonathan Edwards College
   (conference dorms)
4. Yale Peabody Museum
   (social events, workshop)
5. Class of 1954 Environmental Science Center "ESC"
   (committee meetings, workshop)
6. Kline Biology Tower "KBT"



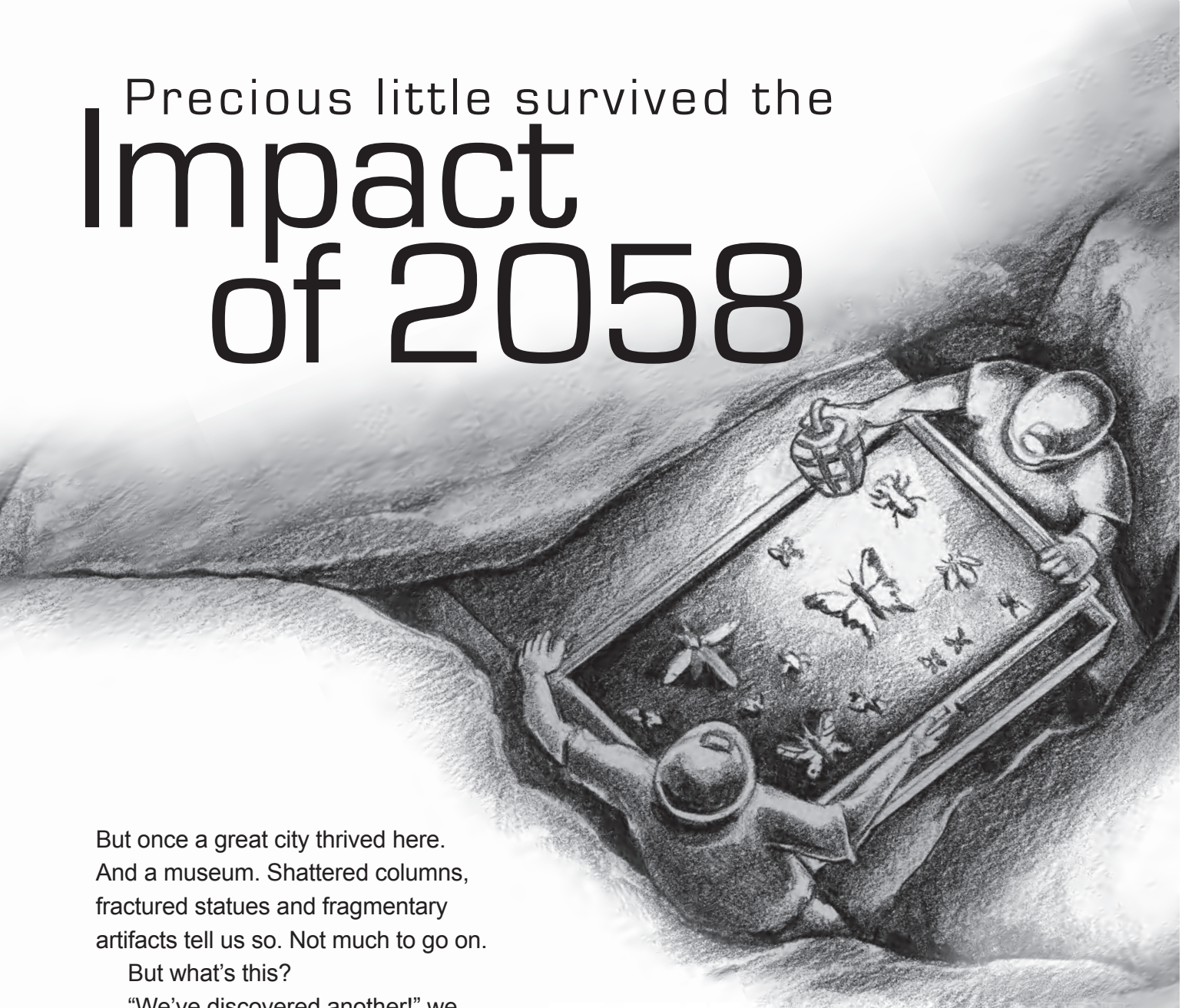
Yale

Points of Interest

7. Yale Center for British Art
8. Yale University Art Gallery
9. Beinecke Rare Book and Manuscript Library
10. Yale Bookstore
11. New Haven Museum
12. Yale Visitors Center
13. Yale Old Campus
14. Knights of Columbus Museum
15. New Haven Green
16. Grove Street Cemetery

Scan this QR code for an online interactive map of the Yale University campus with links to information on campus buildings and disability accessibility.

Precious little survived the Impact of 2058



But once a great city thrived here. And a museum. Shattered columns, fractured statues and fragmentary artifacts tell us so. Not much to go on.

But what's this?

"We've discovered another!" we cheer. Eagerly we unseal it, confident that marvelous treasures await. Securely nestled inside. Butterflies. Brilliantly beautiful. Fearfully fragile. And wholly intact. Imagine!

We know little of the culture that produced this safe-guarding wonder. But we know the maker's name: **Delta Designs.** If only everyone had used these ...

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