Demonstrations

October 21, 2011

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Applying Lascaux Acrylic Adhesives to Paper Conservation
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by Eleonora Pellizzi, Agnès Lattuati-Derieux, Bertrand Lavédrine, and Hervé Cheradame
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Effects of Calcium Hydroxide Nanoparticle Consolidants on Limestone
by Alanna Campbell, Andrea Hamilton, Timothy Stratford, Sevasti Modestou, and Ioannis Ioannou
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by Zhen Hailing, Zhao Feng, Hu Zhiwen, Zhou Yang, and Huang Xiaofang
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Decorative Arts and Plaster

The Double-Cantilever Beam (DCB) Test as a Suitable Method for Determining the Fracture Properties of Unconsolidated and Consolidated Multilayered Decorative Coatings with Gesso-Type Foundation Layers

Nanke C. Schellmann

(Room 201 — 10:00–10:30; 12:00–12:30; 14:00–14:30; 16:30–17:00)

Determining the efficiency and performance of polymer formulations used as consolidants for fragile, multilayered decorative coatings applied to wooden substrates is often a great challenge for conservators. Therefore, recent research has investigated a new approach (i.e. adapting a standardized test method borrowed from the field of fracture mechanics) for determining changes in the mechanical properties of such fragile layers induced by the application of consolidants. This method, known as the double-cantilever beam (DCB) test method, was shown to be an improved means to gain valuable information on the fracture properties of the layer structure both before and after consolidation.

This demonstration introduces the principles of the DCB test and the details of test specimen design and their preparation. Two types of specimens that facilitate the measurement of the independent material property fracture energy (G_{Ic}) of the brittle foundation layer both before and after consolidation with various consolidants will be presented. Furthermore, the evaluation of the overall fracture behaviour, including the identification of the failure loci and the uniformity of the consolidation treatment, will be demonstrated, as well as the determination of the consolidant distribution using cross-section analysis and various staining methods.

Nanke C. Schellmann is a conservator for furniture, musical instruments, and decorative objects, with a specialization in mixed materials and the characterization and treatment of degraded decorative surfaces. After training as a violin maker, she gained several years of work experience in the conservation departments of major museums in both Germany and the United Kingdom, and received an MA in Conservation from the Royal College of Art / Victoria and Albert Museum (RCA/V&A) Joint Conservation Programme, London. She has since worked in a private conservation studio, the V&A, and has undertaken additional studies in natural sciences at University LMU Munich. Currently, she is in the final stages of her PhD studies at the Academy of Fine Arts Dresden, in collaboration with the V&A Mazarin Chest Project and Imperial College London, investigating the changes in mechanical/fracture properties of porous, gesso-type foundation layers in multilayered East Asian lacquer coating structures induced by various consolidants.

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A New Non-Shrink Adhesive/Grout for Plaster Conservation

Rod Stewart

(**Room 117** — 09:30–10:00; 10:30–11:00; 15:30–16:00; 16:30–17:00)

The late Morgan Phillips, a materials scientist with the National Park Service, published a seminal article in 1980 ("Adhesives for the Reattachment of Plaster" in the *APT Bulletin*, Vol. XII, No. 2). It included many recipes, all of which revolved around the use of acrylic resins in combination with various fillers and chemical thickeners. Only one recipe was provided for a non-shrink adhesive, and it has proven so difficult to use that almost no plaster restorers can be induced to try it. Instead, most of the time his simple unfilled adhesive, which is very susceptible to shrinkage, is used.

The sticky problem of creating a convenient-to-use, long-shelf-life, and non-shrink filled adhesive is now solved with the "HPCS Plaster Lug and Key Replacement NON-SHRINK" — an apparatus and formula variation that is being demonstrated publicly for the first time.

The new apparatus holds the activating ingredient, Petroleum Fluid Coke (PFC), in a separate chamber in an ordinary 800-mL caulking cartridge, apart from the resin, inert fillers, and chemical thickener. When mixed with a simple mixing shaft, off-gassing from the PFC commences and the adhesive is activated. Dispensing within an hour or so is as simple as the application of any caulking.

Participants will see both the terribly messy traditional mixing method and the new procedure, and will have an opportunity to try the new apparatus themselves.

Rod Stewart has worked in the heritage building restoration field for more than 30 years. He formed Historic Plaster Conservation Services (HPCS) in 1988 to pursue opportunities in the very specific field of plaster conservation. HPCS furthers the work of the late Morgan Phillips, a noted American architectural conservator who pioneered a method of strengthening fragile plaster by the application of acrylic resins. Over time, Stewart developed practical applications for the Philips' experimental work and has applied the technology to many of the most significant historic buildings in Canada and several in the United States (e.g. the Library of Parliament and the Royal Suite of Rideau Hall in Ottawa, Ontario; The Colonial Building, St. John's, Newfoundland and Labrador; several provincial legislature buildings in Canada; and the Gould Memorial Library in New York). Rod currently owns HPCS with his wife and co-conservator Masumi Suzuki. His professional memberships include the Association for Preservation Technology (life member), ICOMOS Canada (former board member), the Architectural Conservancy of Ontario, and the Canadian Association of Professional Heritage Consultants (founding member).

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Furniture

Epoxies and Fillers for Furniture Conservation

James Hay and Amanda Salmon

(Room 116 — 10:30–11:00; 12:00–12:30; 15:30–16:00; 16:30–17:00)

This demonstration will present different ways to combine epoxy and various fillers to make jigs and repairs when conserving furniture.

Epoxy can be combined with other materials to produce complicated shapes for use as cauls, in order to apply pressure for gluing operations. It can be modified with a filler to produce stiff dough that can be quickly hand-modelled to prototype an experimental shape. Alternatively, uncured epoxy dough can be pressed into a complicated shape. After curing, depending on the blend of mixed materials, the resulting solid can be softer or harder. These characteristics make epoxy a good candidate for replacing the horsehair/plaster mixture that cabinetmakers once used for many functions.

Epoxy has a number of advantages that allow its use where other adhesives would be unsuitable. For example, unlike many other adhesives, epoxy does not shrink much upon curing. This means an epoxy repair below the surface of wood will not eventually shrink and telegraph its presence by allowing the wood surface to collapse into the joint.

James Hay received a BA in American and European History from the University of California in Los Angeles, subsequently became a journeyman cabinetmaker after a 4-year apprenticeship under European masters in Alberta, and completed formal studies with a Master of Art Conservation from Queen's University (Kingston, Ontario) in 1987. He has a wide range of experience in the conservation of wooden cultural objects, having conserved everything from musical instruments to water craft, from small ethnographic sculptures to monumental totem poles, as well as all manner of wooden furniture pieces. He interned at the Smithsonian Institution (Washington, DC), at the Montreal Museum of Fine Arts (Montreal, Quebec), and spent 12 years at the Canadian Museum of Civilization (Gatineau, Quebec), where he worked on all the totem poles as well as about 200 other exhibits. He has been the Senior Conservator of Furniture and Decorative Arts at the Canadian Conservation Institute since late 2000.

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Amanda Salmon has a BA Honours in Art History and English from Queen's University (Kingston, Ontario) as well as diplomas in Collections Conservation and Management from Fleming College (Peterborough, Ontario) and Cabinetmaking from Algonquin College of Applied Arts and Technology (Ottawa, Ontario). She has also completed internships at Parks Canada and the Canadian Conservation Institute (CCI), and has worked extensively in the private sector for several museums and institutions across Ontario including the Ontario Heritage Trust, the Ontario Museum Association, and the Royal Canadian Mounted Police (RCMP). She became an Assistant Conservator of Furniture and Heritage Interiors at CCI in 2011. Amanda has been a member of the Canadian Association for Conservation of Cultural Property (CAC) since 2004, and is currently their Ottawa Regional Representative.

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General

Making "Hot-Melt" Adhesive Sticks From BEVA 371®

Tristram Bainbridge

(**Room 253** — 10:30–11:00; 11:30–12:00; 14:00–14:30; 15:00–15:30; 15:30–16:00)

This demonstration will reveal the process of making "hot-melt" adhesive sticks for use in low temperature glue guns. It will focus on using the dry mixture of BEVA 371®, an ethylene-vinyl acetate (EVA) copolymer based adhesive, with well-known and conservation-approved properties. The polymers will be heated and melted in a large syringe and then injected into a silicone mould. With no solvent involved, the procedure is safe and the subsequent adhesion issues surrounding solvent retention and thickness loss are removed. Most adhesive sticks include an EVA base with other thermoplastic tackifying resins and waxes. In industry, there is a large variety of hot-melt adhesive compositions designed for many applications. With specific conservation requirements and with knowledge of the different working properties of the polymers, sticks can be made to suit particular adhesion situations.

Participants will have the opportunity to experiment with a professional glue gun, fitted with a number of precision nozzles and spreaders. Materials including metal, wood, and leather will be available for testing with a BEVA 371® adhesive stick.

Tristram Bainbridge came to conservation with a background in scenographic model-making and fireworks display design. He holds a degree in Art History from the Courtauld Institute of Art (London, United Kingdom) and completed a Master in Conservation at West Dean College (Chichester, United Kingdom) in 2011. He specializes in furniture and related objects with research focusing on decorative surfaces. Internships at the Victoria & Albert Museum and the British Museum (both in London) were followed by conservation work at The Freud Museum (London). He was a speaker at the May 2011 meeting of the American Institute for Conservation of Historic and Artistic Works and won the Society of Architectural Historians dissertation medal.

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The Parylene Coater

Cliff Cook

(**Room 137** — 09:30–10:00; 12:00–12:30; 14:30–15:00; 16:00–16:30)

Research on the use of Parylene as a treatment for museum objects started at the Canadian Conservation Institute (CCI) in 1988. Over the next several years, many different types of objects provided by museums, libraries, and archives from across Canada were coated. The equipment continues to be used at CCI, with recently treated objects including burnt paper, insect specimens, and porcelain sculpture.

This demonstration of the Parylene coater will describe the apparatus and the coating process. Various materials that have been coated with Parylene will be available for examination by the participants, including paper, plant and animal tissue, fibrous materials, rubber and plastics, and photographic materials. The example materials will illustrate how the coating process can consolidate fragile materials and surfaces without inflicting further damage. After the demonstration, participants will be given a sample of a Parylene coated object!

Cliff Cook received a Chemical Engineering Technology Diploma from Algonquin College of Applied Arts and Sciences in Ottawa, Ontario in 1978. He first joined the Canadian Conservation Institute (CCI) that summer and researched methods to preserve waterlogged wood and wood/metal composites. In 1985, he completed the Scientific Principles of Conservation course at the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM). He joined the National Museum of Science and Technology (now the Science and Technology Museum of Canada) in the late summer of 1986 to work as an objects conservator, and a few months later moved to the Historic Resource Conservation Branch of Parks Canada to become an archaeological conservator. Cliff returned to CCI in 2004 as a Project Development Advisor in the Preventive Conservation Services division; in 2007, he moved to his current position of Senior Conservator in the archaeology lab of CCI's Treatment & Collections - Textiles, Archaeology, Objects, and Paper division.

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Adhesive Research Projects at the Canadian Conservation Institute

Jane L. Down

(**Room 249** — 09:30–10:00; 10:30–11:00; 14:30–15:00; 16:00–16:30)

The Canadian Conservation Institute (CCI) has been conducting research on adhesives since 1978. Many of the experimental samples, reports, and papers from these research projects will be on display:

- yellowed epoxy resin adhesives
- pH, yellowing, and stress/strain samples from poly(vinyl acetate), vinyl acetate/ethylene copolymer, and acrylic adhesives
- samples from the degradation of cyanoacrylate adhesives in the presence and absence of fossils
- work carried out for the Archimedes Palimpsest
- removability, pH, and colour samples from the current project on tapes and heat-set tissues along with the actual samples of all the tapes and heat-set tissues examined

Also on display will be assorted adhesive testing equipment.

Participants will have a chance to examine the range of research conducted and speak directly to CCI's adhesive specialist.

Jane L. Down is a graduate of Queen's University in Kingston, Ontario (BSc Honours in Chemistry and Mathematics). She joined the Canadian Conservation Institute (CCI) in 1978, and is currently a Senior Conservation Scientist. Over the course of her career, Jane has been responsible for all the adhesive research done at CCI and for answering all the adhesive-related queries received from around the world. She has published papers, presented her work at national and international conferences, supervised interns, organized and chaired CCI symposia, organized and taught adhesive workshops, and is currently writing a book on adhesives for conservation. Jane has carried out research on epoxy resins, poly(vinyl acetates), acrylics, and vinyl acetate/ethylene copolymers. In 2002, she received the Preparator's Award from the Society of Vertebrate Paleontology to investigate cyanoacrylate adhesives for fossils. She is also a co-recipient of two Department of Canadian Heritage Deputy Minister Awards for outstanding contributions (2002, 2003), and is an accredited member of the Canadian Association of Professional Conservators, a Fellow of the International Institute for Conservation of Historic and Artistic Works, and a member of the Canadian Association for Conservation of Cultural Property.

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Conservation Science Meets Computational Chemistry

Melina Glasson, Carl H. Schiesser, and Robyn J. Sloggett

(**Room 216** — 10:00–10:30; 11:30–12:00; 15:00–15:30; 16:30–17:00)

Computational chemistry is a theoretical technique to model molecular structures in three dimensions using various methods and levels of theory. Although widely used in other areas of materials science and pharmaceutical industries, it is only just starting to gain recognition in conservation science. Once a molecular model is calculated, data based on physical properties of the molecule can then be predicted, for example infrared and Raman spectra. By building up a series of these molecules, it is possible to calculate activation energies for each of the steps in a reaction. These calculations can then be used to predict which reactions are likely to occur in practice.

This demonstration will show how to build up molecular structures to obtain data and how this technique can be applied to conservation.

Melina Glasson completed a BSc Honours in Synthetic Chemistry in 2009 at the University of Melbourne, Australia. She is a PhD candidate attached to the Australian Research Council (ARC) funded project "Twentieth Century in Paint" and is a part the ARC Centre of Excellence for Free Radical Chemistry and Biotechnology and the Centre for Cultural Materials Conservation in Melbourne, Australia.

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Carl H. Schiesser is a Professor of Chemistry, University of Melbourne (Australia) and Director, Australian Research Council Centre of Excellence for Free Radical Chemistry and Biotechnology (Melbourne). His research focuses on the development and application of novel free radical chemistry with specific emphasis on the chemistry of selenium and the development of new reagents. He has developed world-leading expertise in haemolytic substitution chemistry and applies this to the preparation of novel molecules of therapeutic value, specifically in the areas of hypertension, inflammation, and heart disease. Carl is a Fellow of the Royal Australian Chemical Institute and the Royal Society of Chemistry.

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Robyn J. Sloggett is Director of the Centre for Cultural Materials Conservation (CCMC) in Melbourne, Australia. She has qualifications in Art History, Philosophy, and Applied Science in Cultural Materials Conservation. As Director of the CCMC, she manages the diverse conservation, teaching, and research programs of the Centre. These programs include the responsibility for the conservation of the cultural collections of the University of Melbourne (with more than 32 separate collections owned or managed by the University) and the provision of commercial programs for external clients delivered by specialists in painting, frame, paper, objects, and textiles conservation. The CCMC also delivers the only comprehensive postgraduate conservation professional program in the Australasia-Pacific region, as well as courses in Art Authentication and Photographic Preservation.

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Gilding

Gilding Using Plextol®B500

Malgorzata Sawicki

(**Room 116** — 09:30–10:00; 11:00–11:30; 14:00–14:30; 15:00–15:30)

Research was conducted to identify stable polymers that could successfully replicate traditional matte water-gilding, thereby bringing the ethical standards regarding detectability and reversibility for gilding conservation in line with those that have been achieved in other fields of conservation. Several stable synthetic materials that have been used extensively in cultural heritage conservation were methodically assessed in terms of their suitability for gilding, appropriate concentration in solutions, methods of activation, aging behaviour, and practicability.

In all experiments, the acrylic dispersion Plextol®B500 provided the best results. Applied as a very thin layer over a matte surface, double gilded, and activated using a combination of exhalation and a low-alcohol water mixture, Plextol®B500 can facilitate a perfect replication of an original matte water-gilded surface. It was also empirically determined that Plextol®B500 combined with Plextol®D360 forms a mixture that simulates traditional oil-size.

This demonstration will show:

- preparation of solutions and their application on prepared samples
- gilding with gold leaf using
    - a foundation of Plextol®B500, and a mixture of Plextol®B500 and watercolours simulating bole (both activated with an exhalation or with a low-alcohol water mixture)
    - a mixture of Plextol®B500 and Plextol D®360 simulating traditional oil-size

Participants may have the opportunity to try gilding themselves.

Malgorzata Sawicki is Head of Frames Conservation at the Art Gallery of New South Wales, Sydney, Australia. Her education includes training in gilded/ polychrome objects conservation at the Decorative Art Conservation Department of the State Institute for Heritage Preservation, Warsaw, Poland (1975–1981) as well as studies in Preservation of Architectural Heritage at the University of Nicholas Copernicus, Torun, Poland (1978–1981). She also received a Master of Applied Science (Materials Conservation) from the University of Western Sydney in 2000, and a PhD from the same university in 2009, for research on non-traditional gilding techniques. Malgorzata was honoured by the Australian Institute for the Conservation of Cultural Material with the Conservator of the Year award in 1999, and the Certificate of Appreciation for Outstanding Research in the Field of Materials Conservation in 2009. She has been the Coordinator of the International Council of Museums – Committee for Conservation (ICOM-CC) Working Group on Wood, Furniture, and Lacquer since 2008, and published a book (*Non-traditional Gilding Techniques in Gilded Objects Conservation: Research Into Loss Compensation in Water-gilded Surfaces Using Synthetic Polymers*) in 2010.

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Glass

Aging and Resulting Colour Changes of Epoxy Adhesives Used in Glass Restoration by Exposure to NO_x Fumes

Sophie Calonne and Claude Totelin

(**Room 120** — 10:00–10:30; 11:00–11:30; 14:30–15:00; 15:30–16:00)

This demonstration will provide photos and physical samples that illustrate the effects of exposing various epoxy adhesive samples to NO_x vapours. All the samples show discolouration, which in some cases is quite strong. Participants will be able to examine and compare these samples. The presenters will provide all the details on the experiments carried out and will discuss the hypotheses explaining the observed phenomena. The demonstration will draw attention to this poorly known aspect of epoxy resins aging and could initiate a joint research program on this topic.

Sophie Calonne is a Graduate Student in "Conservation-Restoration of Art Works" at Ecole Supérieure des Arts Saint-Luc (Liège, Belgium). On May 31, 2011, she presented a 2nd Master's thesis titled *Etude du vieillissement chromatique des résines époxydes utilisées en restauration du verre*.

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Claude Totelin has a PhD in Chemistry from the University of Liège (Belgium), and has worked in the chemical industry as a specialist in processing and formulation of plastics for many years (1977–2007). He has been a professor at Ecole Supérieure des Arts Saint-Luc (Liège, Belgium) since 1996, teaching materials science and chemistry in programs for Industrial Design and Conservation Restoration of Art Works.

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Casting Paraloid B-72 for Filling Losses in Glass

Stephen P. Koob

(Room 224 — 10:30–11:00; 11:30–12:00; 12:00–12:30; 14:00–14:30; 16:30–17:00)

This demonstration will present a new technique for loss compensation (gap-filling), which involves making films or sheets of B-72 that are then cut and shaped to fill losses in glass. The major difficulty in this process is that B-72 is a solvent resin, and cannot be used as a direct casting resin in an open or closed mould.
The following will be demonstrated.

- preparation of B-72 as a 30% resin solution w/v in acetone
- addition of 15 % ethanol (ethyl alcohol)
- addition of pigments/dyes/modifiers for individual special effects (to match the glass that requires fills)
- pouring of the B-72 into moulds and placement of the moulds in plastic bags to retard solvent evaporation
- removal of the B-72 films, when set
- shaping and cutting with scissors or a scalpel of the B-72 films (which are still flexible) to the specific curvature and loss area on a glass object
- attachment of the B-72 film to the glass with a very small amount of B-72 adhesive or very careful wetting of the edges with acetone

This new technique for casting B-72 has been successfully developed to produce thin to thick films or sheets of the resin, without air bubbles. With careful preparation, the technique is simple, minimally invasive, and can produce transparent, translucent, or opaque fills. In addition, the B-72 fills will never yellow like epoxy or polyester resins. B-72 fills are inexpensive, stable, and easily reversible. They can be made to fill losses on ancient, historic, or modern glasses.

Stephen P. Koob received an MA in Classical Archaeology from Indiana University (Bloomington, Indiana) in 1976, and a BSc in Archaeological Conservation and Materials Science from the Institute of Archaeology, University of London (London, United Kingdom) in 1980. He spent the next 5.5 years working as conservator of the Agora Excavations with the American School of Classical Studies in Athens, Greece. In 1986, he joined the Smithsonian Institution in Washington, DC, working as a conservator (specializing in ceramics and glass) at the Freer Gallery of Art and Arthur M. Sackler Gallery. He left the Smithsonian in 1998 to come to The Corning Museum of Glass, where he is now Chief Conservator.

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Coloured Glass Adhesives for Stained-Glass Windows

Martina Raedel, Manfred Torge, and Michael Bücker

(**Room 120** — 09:30–10:00; 10:30–11:00; 15:00–15:30; 16:00–16:30)

In a research project for glass adhesives for stained-glass windows a modified adhesive was developed, which has the capability of joining and bridging larger gaps. The modified adhesive consists of an adhesive often used in conservation mixed with specially prepared coloured glass powder.

In the demonstration, the diverse and multifunctional possible applications will be shown as well as the spectrum of colours which can be achieved by using glass powder. The match of colours with the mixture process will be presented by using model glasses. Coloured glass samples prepared during the research project and historic glass samples from the dome of Cologne which are fixed with the modified adhesive will serve as examples.

The application of the modified adhesive will be demonstrated. Using glass samples with different fractures it will be shown, how the amount of glass powder influences the viscosity and adhesive process. Also combinations of pure adhesive with the modified adhesive will be presented.

The colours of glass powder and variations in viscosity and hardness permit multiple applications. Especially in the conservation of coloured stained-glass windows with different gaps the modified adhesive is a complementation for the actual application.

Martina Raedel has an educational background in architecture and conservation — a Dipl.-Ing. Architektur (TU Technische Universität Berlin, Germany) and a Dipl.-Rest. (University of Applied Science). She works as a scientist at the Federal Institute for Materials Research and Testing BAM in Berlin, Germany, in the working group "Environmental Impact and Damage Mechanism." Her research focuses on the development of materials for restoration and conservation of art and cultural heritage, including topics such as:

- anti-corrosion systems for historic iron and cast-iron monuments
- reproduction of historic gold mosaics
- adhesives for the conservation of stained glass windows

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Manfred Torge studied at the TU Bergakademie in Freiberg, Germany (process engineering, glass, and ceramics) and at the Academy of Science in Berlin, Germany (research in the field of ion transport processes in glass). He has worked at the Federal Institute for Materials Research and Testing BAM in Berlin since 1992, and is currently a project manager in projects for conservation and restoration of medieval stained glass windows. His key activities in include:

- analytical investigation of historic glass composition
- damage mechanisms of glass weathering
- simulation of environmental conditions in climate chambers to study glass corrosion processes

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Michael Bücker has an educational background in materials science and engineering (Dipl.-Ing. Materials Science, Dr.-Ing. Engineering), and is currently leader of the working group "Environmental Impact and Damage Mechanism" at the Federal Institute for Materials Research and Testing BAM in Berlin, Germany. He manages restoration and conservation research projects, and is engaged in:

- the development of methods to protect against damage caused by environmental factors
- the simulation of environmental damage to materials in climate chambers

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Instrumental

Scanning Electron Microscopy Imaging of Adhesives for Textile and Wood Projects at the Canadian Conservation Institute

Jane Sirois

(**Room 140** — 10:00–10:30; 11:00–11:30; 14:00–14:30; 15:30–16:00)

This demonstration will show how scanning electron microscopy (SEM) was used to establish the effectiveness of adhesives and consolidants for textile and wood artifact treatment projects at the Canadian Conservation Institute (CCI).

The textile project investigated textile samples prepared using different concentrations of Lascaux 360/498 HV solution, different modes of reactivation (solvent/heat/temperature), different exposure times to the reactivating agent, and different degrees of pressure during reactivation. The adhesive coatings on peeled support fabrics were examined to assess the relationship between the bond strength and the degree of artifact embedding in the adhesive. Strong bonds corresponded to deep, even imprints while shallow, patchy imprints corresponded to weak bonds.

In the wood project, SEM was used to determine the penetration depth of the consolidant into the charred wooden surfaces when applied using different consolidant concentrations and application methods. The resins evaluated were Conserv Epoxy 100, Butvar B98, Aquazol, and Epo-Fix applied by brushing, surface flooding, or immersion of the samples with vacuum impregnation. The consolidants that proved to be best suited for this treatment were low-viscosity epoxy resins (Epo-Fix and Conserv Epoxy) applied using the immersion/vacuum impregnation method or the surface flood/vacuum impregnation method. SEM imaging showed these resins penetrated the charred layer into the wood below.

Jane Sirois graduated from Carleton University in Ottawa, Ontario in 1981 with a BSc in Chemistry, and then worked with Environment Canada and the Geological Survey of Canada. She joined the Canadian Conservation Institute in 1982 and is currently a Senior Conservation Scientist in the Conservation Science division. Her work includes the application of X-ray diffraction, light and electron microscopy, and X-ray spectrometry to the identification of a wide range of materials in conservation science. Her research interests include the study of historic objects (particularly metals and glass) and artists' materials, the investigation of the materials and techniques of Canadian artist David Milne, and the detection of inorganic pesticide residues on museum objects.

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Analysis of Adhesives and Adhesive Tapes Using Mid and Near Infrared (IR) Spectroscopy

R. Scott Williams

(**Room 231** — 10:30–11:00; 11:00–11:30; 15:00–15:30; 15:30–16:00)

Many adhesive and adhesive tape products were selected for evaluation in the Adhesive Tape and Heat-set Tissues project at the Canadian Conservation Institute (CCI). Because there were so many products, a screening process was used to reduce the number that would have to undergo extensive testing. All products were analysed by mid IR spectroscopy, primarily by attenuated total reflectance (ATR), and from these results adhesives and tapes were classified into groups. A few representative samples were selected from each group for comprehensive testing.

This demonstration will show the methods of sample preparation, spectroscopy, and data handling used to identify and classify the products. Depending on time available, limited analysis of samples presented by attendees at the demonstration may be possible. Near IR spectroscopy is being evaluated to determine if this technique can be used as a non-invasive analytical technique to determine the composition of adhesives and tapes on objects. It is hoped that portable near IR spectrometers can be used for in situ analysis of objects. Results of this evaluation will be demonstrated.

R. Scott Williams has been an analytical chemist and Conservation Scientist at the Canadian Conservation Institute since 1977. He has performed thousands of analyses of materials from all types of museum and cultural objects: paintings, paper, textiles, and ethnographic and archaeological objects. He has a particular interest in plastics, particularly the degradation, interaction, and conservation of museum objects and storage materials composed of plastics and other synthetic materials. His current work includes the development of portable mid and near infrared (IR) spectroscopy to carry out non-destructive on-site chemical analysis of objects at heritage institutions. Scott has published or presented more than 80 papers for conservation, museum, and scientific professionals.

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Measurement of the Glass Transition Temperature of Adhesives by Thermal Analysis

Gregory S. Young

(**Room 228B** — 10:30–11:00; 11:30–12:00; 14:30–15:00; 15:30–16:00)

Techniques to measure the glass transition temperature (Tg) of various adhesives will be demonstrated using differential scanning calorimetry. Participants will have the chance to see sample preparation and to have the science of the process explained. Examples of the Tg of various poly(vinyl acetate) resins such as AYAA, AYAC, and Vinac B-15 will be on display.

Gregory S. Young (BSc Honours, PhD) studied cell biology at Carleton University, Ottawa, Ontario and developed analytical technologies for collagenous materials at the University of London, Ontario. He joined the Canadian Conservation Institute in 1977, and is currently a Senior Conservation Scientist. Over the course of his career, he undertaken analysis and fundamental research of natural materials and published in several fields, including artists' materials, stone biodeterioration, paleobotany, wet organic archaeological materials, and analytical development. His recent research has included study of the effects of fumigants on a model protein, the virtual deconstruction of a historic flag from the War of 1812 using image analysis, and the application of hyperspectral imaging in fine art.

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Leather

Adhesives and Backing Materials for Leather and Skin Repairs

Janet Mason

(**Room 244** — 10:00–10:30; 11:30–12:00; 15:00–15:30; 16:00–16:30)

This demonstration will give participants a chance to examine various adhesives and backings that could be considered for repairs to leathers and skins.

Samples of three types of prepared skin (rawhide, brain tanned, and deteriorated vegetable tanned leather) with six different backings applied with nine different adhesives will be displayed. Some of the adhesives were applied wet, some were reactivated with heat or solvent vapour, and some were bonded with pressure. Participants can examine the samples and see the combinations that hold the repair with minimal saturation of the skin, which samples work well with a particular skin type, and the effects of different methods of application.

A small selection of backing materials and water-based adhesives will be available to participants for application on leather. As a comparison of the application methods, prepared backings can be applied by reactivating with heat, or bonding with applied pressure.

The condition of the skin and configuration of the tears greatly influences the adhesive and backing material selection. Deteriorated skin may not be able to tolerate water-based adhesives, or a resin in solvent may easily create a stain.

Janet Mason graduated from the Art Conservation program at Fleming College in Peterborough, Ontario in 1980. Her association with the Canadian Conservation Institute (CCI) began in 1979. From 1986 to 1988, she worked primarily with the Polynesian Collection at the Bishop Museum, Hawaii, as a Mellon Fellow. Now a Conservator in the Objects Lab at CCI, Janet consults on and undertakes the treatment of artifacts as well as the development and delivery of workshops on the care of organic materials, including CCI's Advanced Professional Development workshop *Adhesives for Textile and Leather Conservation*.

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Paintings

The CCI Lining Project: A Display and Discussion

Debra Daly Hartin and Eric Hagan

(**Room 134** — 10:00–10:30; 11:00–11:30; 14:30–15:00; 16:00–16:30)

The CCI Lining Project, which is assessing the effectiveness of linings to support the stress in a painting and ultimately minimize defects, has been ongoing for more than 20 years. The first phase measured the mechanical properties of model paintings under different conditions of relative humidity (RH) [some of these results were presented at the triennial meeting of the International Council of Museums – Committee for Conservation (ICOM-CC) in Sydney in 1987, and subsequently published in the proceedings of that conference]. The second phase investigated the bond strength of BEVA 371 flocked adhesive and wax-resin adhesive with different lining supports (presented and published, ICOM-CC Washington 1993). In the final phase of the project, uniaxial lined-painting samples are being tested to determine the ability of selected lining supports to dominate the stiffness in a painting over short and long periods of time, [interim results presented and published, ICOM-CC Edinburgh 1996 and Helsinki 2010 (video available)]. Testing on replicate samples is now underway using a new, more versatile testing apparatus in a sealed case that permits control of RH and temperature (T). Recent testing at fast times approaching transit shock and at extreme conditions of RH and T was reported at ICOM-CC Lisbon 2011 (web publication).

This demonstration will showcase the new testing apparatus, provide a summary of the main results, and provide an opportunity to discuss lining issues.

Debra Daly Hartin graduated with a BA Honours in Visual Arts from the University of Western Ontario (London, Ontario) in 1976 followed by a Master of Art Conservation from Queen=s University (Kingston, Ontario) in 1979. After internships at the National Gallery of Canada and the Pacific Regional Centre of the Canadian Conservation Institute (CCI) in Vancouver, she worked privately on the conservation treatment of several large contemporary paintings at Pearson International Airport in Toronto, Ontario. In 1979, she accepted a position in the Fine Arts and Polychrome lab at CCI. Now a Senior Conservator at CCI, her work involves the examination, treatment, and preventive conservation of paintings, supervising interns, giving CCI workshops (*Basic Care of Paintings* and *The Permanence of Artists' Techniques*), and providing advice to municipal groups on conservation guidelines for outdoor murals. Specific research and development activities include lining techniques, the mechanical behaviour of paintings, use of the Willard multi-purpose table, and suction techniques in the treatment of paintings.

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Eric Hagan graduated from Queen's University in Kingston, Ontario with an MSc in Mechanical Engineering (2002) and a Master of Art Conservation (2004). He went on to complete a PhD at Imperial College London (United Kingdom) with funding from the Natural Sciences and Research Council of Canada (NSERC) and Tate (United Kingdom). His research focused on temperature, humidity, and strain rate effects on the mechanical properties of artist paints. In 2009, he joined the Canadian Conservation Institute (CCI) as an NSERC Visiting Fellow to study stress relaxation of lined painting samples, and develop risk models for the CCI website. He was recently appointed a Conservation Scientist in the Preservation Services division of CCI.

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Thread-by-Thread Tear Mending Method

Petra Demuth

(**Room 134** — 09:30–10:00; 10:30–11:00; 14:00–2:30; 15:30–16:00)

This demonstration will provide an insight into the different adhesives, tools, and techniques used in the thread-by thread tear mending method for canvas paintings.

The focus of the demonstration will be the treatment of typical tear phenomena in canvas paintings. Different pulling devices for the realignment of torn edges will be attached on the stretcher and canvas back. These include, for example, the "Trecker" and a new prototype developed by Winfried Heiber in 2008.

The main steps of the thread-by-thread tear mending method will be carried out under the microscope using fine dental tools. The main technical aspects will be explained in detail as follows:

- reweaving of torn threads
- choice and application of adhesives
- joining process

The advantages of the method for re-establishing the visual and mechanical integrity of the canvas will be pointed out. A live demonstration via monitor will visualize the principles of thread-by-thread tear mending based on selected case studies of torn canvas paintings.

Petra Demuth has been a technical lecturer in the Department of Restoration and Conservation of Paintings, Polychrome Sculptures, and Modern Art at the Cologne Institute of Conservation Sciences (CICS), Cologne University of Applied Sciences (Germany) since 2003, and has taught conservation of paintings and modern art at the Conservation Department of the Academy of Fine Arts in Dresden, Germany, as a research assistant with Professor Winfried Heiber.

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Paper and Parchment

Ultrasonic Misting to Consolidate Powdery Pigments

Carole Dignard, Sherry Guild, and Stefan Michalski

(**Room 244** — 11:00–11:30; 12:00–12:30; 14:30–15:00; 16:30–17:00)

Ultrasonic misting is a technique that allows for a high degree of precision and control of the consolidation process and delivery. The technique will be demonstrated using a "home-made" device as well as the commercially available Becker AGS 2000 model. A 0.5% gelatine solution and various powdery pigments (no binder) applied on glass plates, on wood, and on paper will be available for the participants so they can test this technique. The goal is to demonstrate that improved pigment cohesion is possible while minimizing colour change. The results depend on:

- the pigment, consolidant, and solvent used
- the quantity of consolidant applied
- the degree of penetration of the consolidant

Often, adding only a small amount of consolidant significantly improves pigment cohesion. Incremental applications make it possible to achieve a range of results. The consolidant solution must penetrate the full depth of the pigment layer by capillary action before evaporation takes place; thus, non-viscous, dilute solutions that do not evaporate too quickly are ideal. Ultrasonic misting allows the controlled delivery of minute quantities of dilute consolidant solutions, in a localized and precise manner, using a light, finger-held nozzle. Alternative techniques such as drop, brush, or spray applications will be discussed for comparison.

Carole Dignard graduated from the University of Ottawa in Ottawa, Ontario with a BSc in Physics and Italian (1981) and a BA Honours in Classical Studies (1983); she also has a Master of Art Conservation with a specialization in Objects from Queen's University in Kingston, Ontario (1986). She joined the Canadian Conservation Institute (CCI) in 1988 and is currently a Senior Conservator (Objects). She has published on treatments of basketry and leather objects, adhesives for skins and leather, laser-cleaning, ultrasonic misting, mount-making, training, ethics, and preventive conservation. She was Program Chair for CCI's Symposium 2007 *Preserving Aboriginal Heritage: Technical and Traditional Approaches*, and has been the Coordinator of the International Council of Museums – Committee for Conservation (ICOM-CC) Working Group on Ethnographic Collections since 2005. She is also a Fellow of the International Institute for Conservation (IIC) and the American Institute for Conservation of Historic and Artistic Works (AIC).

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Sherry Guild is a Senior Conservator (Paper) at the Canadian Conservation Institute (CCI). She studied fine art at the University of Guelph in Guelph, Ontario and graduated from the Art Conservation Techniques Program at Fleming College in Peterborough, Ontario. She joined CCI in 1984, specializing in the conservation of works of art on paper.

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Stefan Michalski graduated from Queen's University in Kingston, Ontario in 1972 with a BSc Honours in Physics and Mathematics. From 1977 to 1979, he trained as an artifacts conservator in the Master of Art Conservation program of Queen's University. Since 1979, he has been employed at the Canadian Conservation Institute, currently as a Senior Conservation Scientist. He is a consultant to Canadian museums, libraries, and archives on preventive conservation and risk assessment, and a researcher in physical aspects of deterioration and conservation processes.

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Aminoalkylalkoxysilanes for the Reinforcement of Papers and Books

Anne-Laurence Dupont, Zied Souguir, Bertrand Lavédrine, and Hervé Cheradame

(**Room 201** — 10:30–11:00; 11:30–12:00; 14:00–14:30; 15:30–16:00)

This demonstration will display artificially aged model papers and naturally aged book sheets treated with various aminoalkylalkoxysilanes (AAAS). The treatment was carried out by immersing the papers in solutions of AAAS at different concentrations in hexamethyldisiloxane, the working solvent, for durations that did not exceed 60 minutes. No pre-drying of the papers was needed before the treatment. Immediately after treatment, the papers were dried under vacuum at room temperature. The treatments resulted in different uptake values (% wt. AAAS / wt. paper), which provided different alkaline reserve values and mechanical strength properties to the papers.

Anne-Laurence Dupont has two Master's degrees [an MSc in Biochemistry from the University of Montpellier in France (1988) and an MSc in Art Conservation (specializing in Paper Conservation) from the University of Paris - La Sorbonne (1994)] as well as a PhD in Chemistry from the University of Amsterdam (2003). She works at the Centre de Recherche sur la Conservation des Collections (CRCC) in Paris, where she is the principal researcher in charge of the paper and cellulose section. Her current research focuses on the characterization and diagnostic methods of the degradation of cellulose and paper using microdestructive analytical techniques, the impact of the environment on cellulosic artifacts, and new methodologies for long-term stabilization of paper.

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Zied Souguir received a PhD in Chemistry and Polymer Science in 2006, with a dissertation that focused on the chemical modification of polysaccharides and the study of the chemical and physico-chemical properties of colloidal systems. In 2007, he undertook a Postdoctoral Fellowship at the Centre de Recherche sur la Conservation des Collections (CRCC), where he studied the degradation of paper at the wet–dry interface. The following year (2008), he joined the Laboratory of Physical Chemistry of Polymers and Dispersed Media (CNRS - PPMD) for a Postdoctoral Fellowship on the study of hybrids nanoassemblies and, more precisely, on the formation of hybrid inorganic-polymer nanocomposites and their stability. Since February 2010, he has been working with the CRCC and the Laboratoire Analyse et Modélisation pour la Biologie et l'Environnement (CNRS -LAMBE) on deacidification and strengthening of paper with aminosilanes.

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Bertrand Lavédrine has a Master's in Organic Chemistry and a PhD in Art and Archaeology. He is a professor at the Muséum national d'Histoire naturelle in Paris and, since 1998, has been the Director of the Centre de Recherche sur la Conservation des Collections (CRCC), a national scientific research institute on the conservation of museum collections. He is currently coordinator of POPART, a research project (funded by the European Commission) for the preservation of plastic artifacts in museum collections.

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Hervé Cheradame has a degree in Chemistry Engineering from École Nationale Supérieure de Chimie de Paris and a PhD in Cationic Polymerization of Olefins from the University of Paris - La Sorbonne (1966). He became an Assistant Professor at the University of Paris in 1969 and a Professor at the University of Grenoble in 1972, and founded a laboratory in the Polytechnic Institute of Grenoble in 1973. In 1992, he joined the recently founded Université d'Evry, and created the Laboratory of Polymeric Materials and Interfaces (now Laboratoire Analyse et Modélisation pour la Biologie et l'Environnement) devoted to the synthesis of model polymers, and to the physico-chemistry of biological membranes and formulations for use in gene therapy. He is currently an Emeritus Professor at the Université d'Evry and Vice-President of the Centre de Conservation du Livre (Arles).

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Using Aquazol-Coated Remoistenable Mending Tissues for Book and Paper Treatments

Katherine Lechuga

(**Room 118** — 10:00–10:30; 11:30–12:00; 14:00–14:30; 15:00–15:30; 16:00–16:30)

This demonstration supplements the symposium paper *Aquazol-Coated Remoistenable Mending Tissues*, which examines Aquazol's suitability as an adhesive for book and paper treatments. It will showcase the preparation of Aquazol-coated tissues and the adhesive reactivation methods that were outlined in the above-mentioned paper. Participants will be welcome to evaluate and handle samples of prepared mending tissues of varying thicknesses as well as try the demonstrated working methods on provided materials.

This research has revealed that Aquazol has characteristics (such as retention of flexibility upon drying, stable aging characteristics, easy reversibility, and solubility in a wide range of solvents) that are favourable for book and paper conservation. Reactivation of the adhesive layer occurs very quickly, resulting in a significantly tacky mending tissue. Upon drying, adhesion strength is comparable to that of precipitated wheat starch paste. In addition, due to Aquazol's hydrophilic nature, very minimal moisture is required for reactivation, making this adhesive an ideal candidate for mending coated papers or those prone to tide line formation.

Katherine Lechuga is Assistant Conservator for the University of Notre-Dame Hesburgh Libraries in Notre-Dame, Indiana, where she previously completed a 3rd-year conservation training internship. She earned a Master of Science in Information Studies and Certificate of Advanced Studies in Conservation from the University of Texas at Austin, Texas in 2010. Previously, she held paraprofessional positions in the book and paper conservation labs of the Indiana Historical Society in Indianapolis, Indiana, the Dolph Briscoe Center for American History in Austin, and the textile conservation labs of Textile Conservation Services and the Indianapolis Museum of Art (both in Indianapolis).

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Mounting Oversize Works on Paper

Anne F. Maheux

(**Room 248** — 09:30–10:00; 11:00–11:30; 15:00–15:30; 16:30–17:00)

Over the last 20 years, a number of innovative solutions have been developed for the mounting of oversize works on paper. Non-aqueous adhesives and synthetic fabrics for hinges and auxiliary supports have been employed because of their strength, translucency, and non-reactive properties. Methods include mounting works to canvas supports, and directly to the wall for temporary exhibition.

This demonstration will feature mock-ups of a variety of hinging and mounting techniques for participants to examine.

Anne F. Maheux has a Master of Art Conservation from Queen's University in Kingston, Ontario and a Certificate in the Conservation of Works on Paper from the Center for Conservation and Technical Studies, Fogg Art Museum, Harvard University in Cambridge, Massachusetts. She is also a Fellow of the American Academy in Rome. She was Conservator of Prints and Drawings at the National Gallery of Canada for more than 25 years, and is now Head Conservator, Works on Paper, at Library and Archives Canada.

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Avoiding Risks From Peeling Mode Failure

Christopher McGlinchey

(**Room 216** — 09:30–10:00; 12:00–12:30; 14:30–15:00; 15:30–16:00)

This demonstration will focus on traditional and novel ways to avoid peel mode stresses.

Although conservators rely upon reversible thermoplastic adhesives to support photographs and works on paper, the Achilles' heel of this class of polymers is in the peeling mode. Under normal circumstances, joint failure is not a high risk for lightweight objects. However, the tug of heavier works can easily result in creep or outright failure. This can be averted by using an adhesive of greater cohesive strength or by switching to a joint design that does not include peeling stresses. Unfortunately, thermoplastic resins with high cohesive strength are typically more difficult to reverse with solvent or heat. By designing mounting systems that rely on exclusively shear mode, an adhesive that is both cohesively weaker and more easily reversible may be used. These factors are typically common knowledge to paper and photograph conservators, but could be important details for conservators of other media to consider when deciding on adhesives for objects.

Christopher McGlinchey has a Master's in Polymer Science from the Polymer Research Institute at Polytechnic University, Brooklyn, New York. He started work in 1983 as a scientist in the Paintings Conservation Department at the Metropolitan Museum of Art in New York, where he assisted with the development of stable and optically correct varnishes for Old Master paintings. In 1999, he joined the Conservation Department of the Museum of Modern Art (MoMA) in New York, where he is now the Sally and Michael Gordon Conservation Scientist. In addition to leading scientific research at MoMA, Chris is a visiting lecturer at the Escuela Nacional de Conservacion, Restauracion y Museografia in Mexico City, and has co-taught the American Institute for Conservation of Historic and Artistic Works workshop *Adhesives for Conservators*. He has also served on the adjunct faculty of the Conservation Program at New York University. He is a recipient of the 2009 Heritage Preservation Award for Distinction in Scholarship and Conservation from the College Art Association.

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Using Goldbeater's Skin and Gelatine as Parchment Repair Materials

Christine McNair and Kate Westbury

(**Room 118** — 11:00–11:30; 12:00–12:30; 14:30–15:00; 15:30–16:00)

This demonstration will present parchment repairs using goldbeater's skin and gelatine, and will allow participants to try this method themselves on test samples.

Parchment conservation often presents unique and difficult challenges. The materials used in the stabilization of parchment must be chosen carefully: they must be strong enough to support such a robust material, but also be reversible and sympathetic to the inherent sensitivities of the hygroscopic skin.

Using goldbeater's skin as an adhesive carrier is an excellent option. It is both strong and flexible and it complements the parchment well. Since it is also animal tissue, it expands and contracts along with the parchment and can be applied to the parchment without causing any added stress or tension as the environment fluctuates.

Gelatine is an organic adhesive that is also derived from skin. This makes it a similarly sympathetic choice for repairing and consolidating parchment. Once set, it can flex with the materials without causing unwanted tension, and yet is fully reversible and very strong.

Gelatine and goldbeater's skin repairs are challenging. Their working properties are quite different from other archival conservation repair materials. However, with practice, they can be expertly applied and easily used.

Christine McNair is a Conservator (Books) at the Canadian Conservation Institute (CCI). She has a Master's degree in Conservation Studies from West Dean College (United Kingdom), where she specialized in the conservation of books and library materials. Her thesis examined the history and conservation of textile bookbindings. Before joining CCI, she worked at Library and Archives Canada (Ottawa, Ontario), the Archives of Ontario (Toronto, Ontario), and the London Metropolitan Archives (United Kingdom). She also completed an internship at the Centre de Conservation du Livre in France in 2005. She is the former editor of the newsletter/journal of the Canadian Bookbinders and Book Artists Guild and former treasurer of the Book and Paper group of the Institute of Conservation (Icon, United Kingdom).

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Kate Westbury graduated from Queen's University in Kingston, Ontario in 1997, where she earned a BA Honours in History and Geography. She continued her studies at Fleming College in Peterborough, Ontario, graduating from the Collections Conservation and Management program in 2001. Kate has worked as a conservator in Ottawa, Ontario since that time, participating in significant conservation projects with the Canadian Conservation Institute (CCI), the Senate of Canada, the House of Commons, and the Supreme Court of Canada. She has also acted as the course director for the Ontario Museum Association course *Artifacts* and instructed conservation students in the Applied Museum Studies program at Algonquin College of Applied Arts and Technology in Ottawa. She is currently employed as a conservator in the Paper Lab at the Parks Canada Ontario Service Centre in Ottawa.

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JunFunori and Funori: Two Related Consolidants With Some Surprising Properties

Françoise Michel

(**Room 252** — 10:30–11:00; 11:30–12:00; 14:30–15:00; 16:00–16:30)

This demonstration will familiarize participants with Funori and JunFunori, two consolidants based on red algae. Practical examples will illustrate the use of these materials as cleaning agents as well as retouching media for matte paint.

The processing of both consolidants (from the raw material to all intermediate products through to the prepared solution) will be shown. This will make the differences of the two products easily comprehensible. Useful tips for the preparation and application of the solutions will be explained and published recipes will be discussed.

The reduction of dirt deposits and tide lines with JunFunori applied on a simple tissue pad will be demonstrated on a panel of a painted wooden ceiling. If the soiled paint layer is additionally flaking and/or powdering, the cleaning process can simultaneously be combined with the consolidation treatment.

Participants will also be given the opportunity to work with JunFunori as a retouching medium.

Françoise Michel has worked in conservation since 1984. From 1998 until 2002, she was responsible for the conservation aspects of a research project on Funori and JunFunori at the Swiss Federal Laboratories for Material Testing and Research (EMPA). Since 2003, she has worked at the Collection Center of the Swiss National Museum in the Department of Painting Conservation.

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Pressure-Sensitive Tapes and Water — New Developments in Industry and Conservation

Elissa O'Loughlin

(**Room 249** — 10:00–10:30; 11:00–11:30; 11:30–12:00; 14:00–14:30; 15:00–15:30)

In recent years, pressure-sensitive tapes have been designed to meet performance as well as environmental "green" needs. Interesting developments have taken place in both formulation and in manufacture of these materials. Surfactants play a large role in how the new adhesives function, both during manufacture and removal. Interestingly, water interacts with the newer formulations quite readily, and can be an effective removal mode in some cases.

This demonstration will show how a conservator can identify these adhesives and plan treatment strategies. The presence of alkaline salts, optical brighteners, and other additives such as fluorescent dyes will be discussed. Examples of water-based removal protocols will be shown. Samples of the new tapes will be available for participants to take away, and a handout with a summary of the demonstration will also be available.

Elissa O'Loughlin obtained a BFA from Moore College of Art and Design in Philadelphia, Pennsylvania in 1975. She worked as a conservator at the United States National Archives in Washington, DC from 1983 until 2000, when she joined the staff of the Walters Art Museum in Baltimore, Maryland as Senior Paper Conservator. She has developed and taught the 5-day class *Removal of Pressure Sensitive Tape and Tape Stains* at numerous venues over the past 16 years.

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Applying Lascaux Acrylic Adhesives to Paper Conservation

Samantha Sheesley

(Room 228 — 10:00–10:30; 11:30–12:00; 14:30–15:00; 16:00–16:30)

This demonstration illustrates paper conservation treatment techniques using Lascaux 360HV and 498HV acrylic adhesives.

Lascaux acrylic adhesives can be used in combination with Japanese paper to make reactivated and pressure-sensitive supports for mending and lining. These techniques are of particular interest when treating objects with media sensitivity or objects with hydrophobic or hydrophilic supports. Using dry Lascaux film diminishes the risk of stain or tide line formation. Depending upon which Lascaux adhesive is selected, pressure, heat, or any number of solvents can be used to attach the mend or lining.

Lascaux 360HV and 498HV can also be combined with pigments and used as a toned fill material for rigid supports with sprung breaks or losses. A Lascaux fill can help to reinforce a mended support from the front. Because the Lascaux is cast onto polyester film and dried, the formation of stains caused by lateral movement of water or solvents into the primary support is precluded. The fill can be smoothed with heat through silicon release paper to harmonize with a slick surface, and further toned with acrylics to blend with a modeled support.

Samantha Sheesley is a paper conservator at the Conservation Center for Art & Historic Artifacts (CCAHA) in Philadelphia, Pennsylvania. Before joining the permanent staff at CCAHA, she worked as a conservation intern in the Lunder Conservation Center at the Smithsonian American Art Museum in Washington, DC; the Museum of Modern Art in New York City; the Benaki Museum in Athens, Greece; the Philadelphia Museum of Art; and the Belmont Hills Art Conservation Studio outside of Philadelphia. Samantha has an MA with a certificate of advanced studies in Art Conservation with a specialization in Paper Conservation from Buffalo State College in New York. Before studying conservation in Buffalo, she earned a BFA from Temple University's Tyler School of Art in Philadelphia with a major in Sculpture and a minor in Art History.

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Preparation and Application of "Gelatine Mousse" for Archive Repair

Yuki Uchida and Antoinette Curtis

(**Room 228** — 09:30–10:00; 12:00–12:30; 14:00–14:30; 15:00–15:30)

Gelatine is commonly used as an adhesive for archive conservation. There are many varieties of gelatine defined by grade/quality, specification, and type. The material is categorized under food, technical, scientific, photographic, or pharmaceutical grade, as well as type A and type B. However, the type of gelatine and how it is prepared and applied are often unclear. The physical characteristics of gelatine vary in viscosity, texture, and strength according to temperature and method of preparation. Therefore, it is important to specify an approach for a specific usage.

This demonstration will show the preparation of a "gelatine mousse" and its application for repair at room temperature. It will have four main components:

- a comparison of 10 types of gelatines to illustrate the differences in colour
- an explanation of the tools and procedures to prepare the gelatine
- sieving of two types of gelatine to show the different consistencies of the high and low Bloom types
- the application of gelatine as an adhesive for paper and parchment

This practical, illustrated demonstration will also allow participants to sieve and apply the "gelatine mousse" themselves.

Yuki Uchida undertook an MA in Conservation at Tokyo University of the Arts (Japan). During and after her initial training, she worked as an assistant restorer of Japanese scroll paintings for a private workshop and later the National Research Institute for Cultural Properties, Tokyo. In 2008, she completed an MA in the Conservation of Works on Paper at the University of Northumbria, Newcastle (United Kingdom), during which she undertook internships in various London museums. Since 2008, she has worked as an archive conservator for the Norfolk Record Office (United Kingdom). In 2010, she studied techniques in parchment conservation under the Society of Archivists' Conservation Training Scheme.

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Antoinette Curtis qualified as a conservator in the Society of Archivists' Conservation Training Scheme (United Kingdom) in 1976, and has had a varied career in conservation with the Norfolk Record Office's Designated Collection (Norfolk, United Kingdom). Her knowledge and experience were particularly challenged when working on items damaged in the fire at the Central Library, Norwich in 1994 — work that was particularly demanding in the field of parchment conservation. In 2006, she qualified as an Instructor for the Society of Archivists' Conservation Training Scheme (Parchment Module), which has allowed her to share her knowledge and enthusiasm while retaining an eagerness to learn more.

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Poly(methyl methacrylate)

Sample Preparation for Assessing Conservation Adhesives for Poly(methyl methacrylate): A Reappraisal After 20 Years

Donald Sale

(**Room 252** — 10:00–10:30; 11:00–11:30; 14:00–14:30; 16:30–17:00)

This demonstration will present techniques for preparing samples to assess conservation adhesives for poly(methyl methacrylate) (PMMA). Two types of samples that had been prepared nearly 20 years ago to assess six conservation adhesives (HXTAL NYL-1, Neocryl BT20, Norland OA65, 1:1 Paraloid B-67:Paraloid F-10, Plextol D514, and Tensol 70) for PMMA furniture, objects, and sculpture were reassessed. The samples had been aged naturally and artificially, and had been stored in the dark for 19 years.

The focus will be the preparation of the two types of samples:

1. open samples with a rectangular island of adhesive on a sheet of PMMA
2. laminate samples with adhesive between two sheets of PMMA

Both sample designs have provided useful information on adhesives for the conservation treatments of PMMA. The adhesives have been assessed for visual acceptability, yellowing, and aging characteristics for conservation repairs and can be assessed further. Sample preparation methods for long-term aging studies will also be presented.

Donald Sale has a BFA in Art History from Virginia Commonwealth University (1984) and an MSc in Objects and Sculpture Conservation from the Winterthur Museum / University of Delaware Graduate Program in Art Conservation (1988). He completed an Advanced Internship at Tate in London, United Kingdom (UK), worked in Sculpture Conservation at the Victoria and Albert Museum in London, and initiated Plastics Conservation Research in association with Tate. In 1992, he became Assistant Keeper (Conservation) and later Head of Conservation and Collections Management at the Sainsbury Centre for Visual Arts, University of East Anglia, Norwich, UK. He joined the Royal Pavilion & Museums, Brighton, UK in 2003 as Preventive Conservator, and became Preventive Conservation Manager in 2006. In 2009, he undertook a 14-month secondment as Preventive Conservation Manager for Historic Royal Palaces in London, returning to the Royal Pavilion in 2010. Donald Sale is an Accredited Conservation-Restorer through the Institute of Conservation (Icon), UK.

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Polyurethane

Flexible Polyurethane Ester Foam Consolidation: Preliminary Study of Aminopropylmethyldiethoxysilane Reinforcement Treatment

Eleonora Pellizzi, Agnès Lattuati-Derieux, Bertrand Lavédrine, and Hervé Cheradame

(**Room 201** — 09:30–10:00; 11:00–11:30; 15:00–15:30; 16:00–16:30)

This demonstration will highlight the reinforcement effect of aminopropylmethyldiethoxysilane (AMDES) treatment on unaged and artificially aged samples of industrial flexible polyurethane ester foam.

Hydrothermal aging of polyurethane ester foam causes polymer chain hydrolysis, which changes the mechanical properties of the foam. As a result, the artificially aged samples become more fragile, more difficult to manipulate, and show a considerable colour change (yellowing) compared to unaged samples.

AMDES treatment improves the mechanical properties of both aged and unaged samples. For example, all foams show an improvement in the resistance to compression, although the difference between treated and untreated foams is greater for aged samples than for unaged ones. No perceptible colour change occurs for unaged samples following treatment, while a slight colour change is noticed for aged samples

Participants will have a chance to manipulate the polyurethane ester foam samples. This will provide an increased awareness of the conservation issues related to these foams and of the effects of AMDES treatment.

Eleonora Pellizzi has a Master's degree in Science and Technology for Cultural Heritage from the University of Turin (Italy). From September 2008 to September 2009, she carried out postgraduate work (through a grant from the Fondazione Cassa di Risparmio di Torino) on the degradation of paper by iron gall ink at the Centre de Recherche sur la Conservation des Collections (CRCC) in Paris. In October 2009, she began work on a PhD (co-directed by the CRCC and the Université d'Evry-Val-d'Essonne) that focuses on the degradation and conservation of polyurethane ester foams used in works of art. This research is part of POPART, a research project (funded by the European Commission) for the preservation of plastic artifacts in museum collections.

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Agnès Lattuati-Derieux obtained a PhD in Organic Chemistry and Spectrometric Analyses from the University of Paris VI in 1998. From 1999 to 2001, she worked as a conservation scientist at the Institut National du Patrimoine in Saint-Denis, where she was in charge of the Organic Analyses section. This work dealt with the determination of natural substances sampled from different works of art by chromatographic techniques. She became a conservation scientist at the Centre de Recherche sur la Conservation des Collections in Paris in 2002, and currently heads the Organic Analysis and Conservation Material section. She has been involved in both national and international projects, including POPART, a research project (funded by the European Commission) for the preservation of plastic artifacts in museum collections. Her recent research includes molecular characterization of volatile organic compounds from exhibition and conservation materials, aged books, as well as archaeological and natural substances.

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Bertrand Lavédrine has a Master's in Organic Chemistry and a PhD in Art and Archaeology. He is a professor at the Muséum national d'Histoire naturelle in Paris and, since 1998, has been the Director of the Centre de Recherche sur la Conservation des Collections (CRCC), a national scientific research institute on the conservation of museum collections. He is currently coordinator of POPART, a research project (funded by the European Commission) for the preservation of plastic artifacts in museum collections.

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Hervé Cheradame has a degree in Chemistry Engineering from École Nationale Supérieure de Chimie de Paris and a PhD in Cationic Polymerization of Olefins from the University of Paris - La Sorbonne (1966). He became an Assistant Professor at the University of Paris in 1969 and a Professor at the University of Grenoble in 1972, and founded a laboratory in the Polytechnic Institute of Grenoble in 1973. In 1992, he joined the recently founded Université d'Evry, and created the Laboratory of Polymeric Materials and Interfaces (now Laboratoire Analyse et Modélisation pour la Biologie et l'Environnement) devoted to the synthesis of model polymers, and to the physico-chemistry of biological membranes and formulations for use in gene therapy. He is currently an Emeritus Professor at the Université d'Evry and Vice-President of the Centre de Conservation du Livre (Arles).

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Stone

Effects of Calcium Hydroxide Nanoparticle Consolidants on Limestone

Alanna Campbell, Andrea Hamilton, Timothy Stratford, Sevasti Modestou, and Ioannis Ioannou

(**Room 135** — 11:00–11:30; 12:00–12:30; 14:30–15:00; 16:30–17:00)

This demonstration will show the effects of applications of CaLoSil, a commercial dispersion of calcium hydroxide nanoparticles in ethanol, absorbed into Portland limestone samples.

CaLoSiL is a relatively new stone strengthener for consolidating calcareous historic materials. DiLoCarb, a carbonizing agent, was also applied to the limestone to ensure full carbonation of calcium hydroxide into calcite. The CaLoSiL concentrations used were the lowest, mid-range, and highest concentrations available. Samples were treated with 1, 5, and 10 applications, giving three limestone samples for each concentration. Some samples show pronounced colouration due to the treatment. Each sample has been cut, allowing the treatment penetration depth to be determined.

This will be an interactive session where the samples, treatment method, and results will be discussed. Participants will also be able to view scanning electron microscope images of CaLoSiL and limestone, and to view and handle all nine limestone samples and samples of CaLoSiL, DiLoCarb, and a nanolime-based repair mortar.

Alanna Campbell received a MChem in Chemistry with Forensic Science from Heriot-Watt University (United Kingdom) and is an Associate Member of the Royal Society of Chemistry (AMRSC). Her PhD research at the University of Edinburgh is on nanoparticles for conservation and colloidal stability.

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Andrea Hamilton [BEng Honours (Glasgow), PhD (Edinburgh), MRSC] is a materials scientist at the University of Edinburgh and supervisor of Alanna Campbell. Her research interests include synchrotron X-ray diffraction, atomic force microscopy, mineral geochemistry and interactions at the nano-scale, and salt crystallization damage to the built environment. She has been a Visiting Research Fellow to Princeton University, Oxford University, the National Museums of Scotland, the University of New Brunswick, and the University of Cyprus.

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Timothy Stratford [MA, MEng, PhD (Cantab)] is a structural engineer at the University of Edinburgh, whose interests include new applications of construction materials, and strengthening and repair techniques. His work has included studies of the mechanical, thermal, and fire performance of materials such as masonry, concrete, adhesives, and fibre-reinforced polymers.

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Sevasti Modestou has a BSc in Earth Surface Science from the University of Guelph (Guelph, Ontario, Canada), and is an MSc candidate at the University of Cyprus in environmental engineering.

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Ioannis Ioannou [BSc Honours, PhD (University of Manchester)] is a civil engineer at the University of Cyprus. His research interests focus on the physicomechanical characterization of building materials, capillary liquid transport in porous materials, salt crystallization, and deterioration and conservation of the historic environment. He is an Affiliate Member of RILEM and a member of the Cyprus Technical Chamber.

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Textiles

Applying Paper Repair Patches and Linings to Cellulosic Textiles Using Klucel G®

Pippa Cruickshank

(Room 119 — 9:30–10:00; 11:30–12:00; 15:00–15:30; 16:00–16:30)

The aim of this demonstration is to show the versatility of Klucel G® (hydroxypropylcellulose) in the treatment of textiles. Its solubility in both water and organic solvents enables its use in a wide variety of treatments. Where stitched repairs are not possible, paper patches can be more sympathetic for cellulosic textiles than a semi-transparent fabric. Klucel G® can be mixed with starches, used as a thick paste, or made into a dried film for later reactivation.

- **Demonstration 1: Lining a painted linen "textile"**
  A mulberry paper prepared with a film of 3:1 3% Klucel G®: 3% arrowroot starch in water will be reactivated with water vapour to line a painted linen "textile." This demonstration will be carried out using GORE-TEX® and glass weights, but a suction table is helpful to attain a good even bond when a full lining is being applied.
- **Demonstration 2: Supporting a hole and a tear in a painted linen "textile"**
  Patches of mulberry paper will be secured to the reverse of a painted linen "textile" using a thick paste of approximately 15% w/v Klucel G® in industrial methylated spirits applied by brush.

Materials, samples, and methodology notes will be on hand, and a PowerPoint presentation will show examples of treatments. Pros and cons of each technique and factors that influence decision-making regarding appropriateness of selected technique will be discussed.

Pippa Cruickshank (Accredited Conservation-Restorer, Institute of Conservation, United Kingdom) is the Manager of the Textile and Fibres Studio in the Department of Conservation and Scientific Research at the British Museum, specializing in archaeological, ethnographic, and painted textiles, Inuit gut artifacts, and amber. In 1994–1995, she helped to organize the United Kingdom Institute for Conservation Textile Section Adhesives Forum II: *Starch and Other Carbohydrate Adhesives for Use in Textile Conservation*. In 1996, she was awarded a Winston Churchill Travelling Fellowship to study the use of adhesives in textile conservation in Canada. In 2002, she organized the starch and carbohydrate adhesives day at the British Museum as part of the joint Victoria & Albert / Canadian Conservation Institute / British Museum Professional Development Workshop: *Adhesives Today: Exploring Current Adhesive Options and Application Techniques*. Previous adhesive treatments and projects include work on a number of ancient Egyptian painted linen shrouds as well as a badly degraded North American black-dyed skin bag, and research into suitable adhesives and consolidants for use with amber.

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Clip Peel Test for Measuring Bond Strength of Flexible Laminates

Irene F. Karsten

(**Room 253** — 09:30–10:00; 12:00–12:30; 16:00–16:30; 16:30–17:00)

This demonstration will present a simple test that provides quantitative, categorical assessment of peel strength of flexible laminates.

Clip-on weights are constructed from unbleached cotton bags, lead shot, and fold-back binder clips to give masses from 10 to 150 g. Mock-up test samples of consistent width and length are prepared from "artifact" material adhered to a support material using standard treatment methods. These are peeled partly open and hung by the artifact material from a stand. Beginning with the lightest one, a clip-on weight is attached to the peeled end of the support and lowered gently until the sample bears the full weight. The first weight that causes the bond of the adhered sample to fail immediately gives the strength category of that sample. This test will be demonstrated on silk and nylon fabrics adhered to silk, polyester, and nylon support fabrics with a variety of adhesives.

The results of this test with adhered fabric laminates show good correspondence with Instron peel strength values, indicating that the clip peel test is an appropriate tool for classifying bond strength of laminates. Clip peel testing of mock-up samples permits more systematic comparison of treatment options than subjective hand peeling.

Irene F. Karsten has an MSc (1998) and PhD (2003) in Human Ecology with specialization in textile conservation science from the University of Alberta (Edmonton) as well as a Diploma in Art Conservation Techniques (1994) from Fleming College in Peterborough, Ontario. She was the Conservator for the Clothing and Textiles Collection at the University of Alberta from 2004 to 2009, and is currently a Preservation Development Advisor at the Canadian Conservation Institute.

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Some Adhesive Film Casting Techniques for Textiles

Zenzie Tinker

(**Room 119** — 10:00–10:30; 12:00–12:30; 15:30–16:00; 16:30–17:00)

This demonstration will present a method for casting adhesive films on both crepeline and net weave support fabrics laid over a polyethylene substrate using a roller technique. The resulting fine, adhesive films can then be used as either heat or solvent reactivated adhesive supports for textiles. The method is suitable for making films from many acrylic, poly(vinyl acetate) (PVAC), and ethylene-vinyl acetate (EVA) adhesive dispersions.

The demonstration will aim to show the crucial role of good preparation of materials in a successful adhesive treatment. Both the careful alignment / laying out of the support fabric and the application of the adhesive to that support fabric will be demonstrated and discussed. Potential problems will be highlighted and some tips for avoiding problems will be shared.

Both samples of variously proportioned dry adhesive film as well as a range of different types of adhesive film will be available for examination and discussion.

Zenzie Tinker earned a BA Honours in the History of Design (specializing in textiles) and completed apprenticeship training in textile conservation in 1988, under Ksynia Marko. She continued working at the Textile Conservation Studio and gained a Museums Association Certificate in Textile Conservation (Trevor Waldon prize winner) in 1991. She then joined the Conservation Department at the Museum of London, remaining there until 1998 at which time she moved to the Victoria and Albert Museum (V&A) as a Senior Textile Conservator. While at the V&A, she attended the Canadian Conservation Institute (CCI) workshop *Adhesives for Textile and Leather Conservation: Research and Application* (1999) and was inspired to organize a successful collaborative adhesives workshop at the V&A with CCI and the British Museum in 2001. She left the V&A in 2002 and now runs a busy private conservation studio in Brighton specializing in the conservation of large textiles and historic costumes. Zenzie has published several papers on the use of adhesives in textile conservation and chaired the United Kingdom Institute for Conservation of Historic and Artistic Work Textile Section Adhesives Group. With the Adhesives Group, she helped organize several workshops and conferences on adhesives, co-edited *Starch and Other Carbohydrate Based Adhesives for Use in Textile Conservation* (1995), and was involved in surveying textile conservators on their use of adhesives — work that culminated in a joint paper *Evaluating the Use of Adhesives in Textile Conservation* (1997). Zenzie has been an Accredited Conservation-Restorer [Institute of Conservation (Icon, United Kingdom] since 2000 and is currently an Accreditation Assessor for Icon.

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Fibroin–EGDE Consolidation: A New Method for Conserving Fragile Silk Textiles

Zhen Hailing, Zhao Feng, Hu Zhiwen, Zhou Yang, and Huang Xiaofang

(**Room 235** — 10:30–11:00; 12:00–12:30; 14:30–15:00; 16:00–16:30)

This demonstration will present a new consolidation methodology for fragile silk. The two key components are fibroin protein and ethylene glycol diglycidyl ether (EGDE). The choice of fibroin protein as a consolidant was suggested by the homologous nature of the fibroin and the silk samples; EGDE was an auxiliary reagent. Following experiments with various solution concentrations, temperatures, times of exposure to the activation, and solvents, a standard process for applying the fibroin–EGDE solution onto fragile silk textile was formulated:

- First, 1.25% silk fibroin solution in ambient temperature and humidity is spayed on the fragile silk surface until the silk is hypersaturated.
- Second, after 10 minutes, 5% EGDE solution is sprayed on the silk in the same temperature and humidity conditions.
- Last, the silk is air-dried for 2 days.

Mechanical properties tests and consolidation experiments concluded that the fibroin–EGDE solution has certain advantages over other types of consolidants:

- It improves the strength of fragile silk.
- It does not change the flexibility and other properties of the silk.
- It ages well due to the homologous nature of the fibroin and the silk samples.

Zhen Hailing graduated in Textile Materials and earned a Master's at the Zhejiang University of Science and Technology in Hangzhou, China. She is working in the conservation department of the China National Silk Museum in Hangzhou.

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Zhao Feng graduated in the History of Chinese Textile Science and Technology and earned a PhD from the China Textile University (today's Donghua University) in Shanghai, China. He is Director of the China National Silk Museum (Hangzhou, Zhejiang), Director of the Chinese Centre for Textile Identification and Conservation (CCTIC), and a Professor of Textile and Costume History at Donghua University. He has authored more than 40 publications on the appraisal and conservation of heritage textiles, and has served as a textile expert for many conservation items and international communications.

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Hu Zhiwen graduated in Textile Materials and is a professor of silk textile material at the Zhejiang University of Science and Technology (Hangzhou, China). He is the scientific director of more than 20 research projects and has authored more than 50 publications on the study of silk.

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Zhou Yang graduated in Biochemistry and earned a Master's in Analytical Chemistry at Zhejiang University of Science and Technology in Hangzhou, China. She is a conservation scientist in the conservation department of the China National Silk Museum (Hangzhou, Zhejiang), and conducts research on the development of analytical strategies for the identification of archaeological fibres and adhesives in silk relics.

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Wax

Testing of Adhesives for Wax Artifacts

Johanna Lang

(**Room 135** — 10:00–10:30; 11:30–12:00; 14:00–14:30; 16:30–17:00)

This demonstration will present the results of testing that was carried out for adhesives for wax artifacts. The following items will be on display:

- Perspex sheets with adhesive samples
- wax samples on which solvents have been dropped
- tools and steps for preparing the test specimens
- wax specimens before and after testing
- photographs

The testing comprised the following steps.

- Step 1. Selected adhesives were spread on Perspex to gain information about application and curing behaviour.

- Step 2. Because some adhesives are applied as solutions, different solvents and solvent-mixtures were tested on wax samples to reveal any changes that might occur on the artifacts.

- Step 3. The six adhesives that proved to be the most efficient were further tested via tensile and bending tests. Test specimens of different waxes were produced and the testing was carried out on a tensile testing machine, which was modified to meet the concerns of the fragile wax samples. The resulting data were evaluated and the specimens checked for damage caused by the adhesives.

Three adhesives proved to be suitable for wax artifacts. The effectiveness of these adhesives was determined not only by their strength, but also by the chemical structure, shape, and weight of the wax artifacts as well as the consistency of the breakage area.

Johanna Lang studied at the Technical University Munich (Technische Universität München) from 2000 to 2005, and has a degree in Conservation, Art Technology, and Conservation Science. Following graduation, she worked at the Conservation Laboratory for Folk Art Objects at the Bavarian National Museum in Munich (Bayerisches Nationalmuseum München) from 2005 to 2006, and at the Conservation Section at the State Museum of Ethnology in Munich (Staatliches Museum für Völkerkunde München) from 2006 to 2008. Since July 2008, she has been the Senior Conservator for the "Wax Moulages: Precious Craftsmanship in Danger of Extinction" project at the German Hygiene Museum in Dresden (Deutsches Hygiene-Museum Dresden).

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