

Chemistry and Materials Research at the Interface between Science and Art

A workshop sponsored by
The National Science Foundation and The Andrew W. Mellon Foundation

July 6, 2009: The Freer Gallery of Art
July 7, 2009: Hilton Hotel, Arlington, Virginia

Cultural heritage objects can inspire through their artistic merit and through their encapsulation of the art, science, and technology of past and present cultures. Scientific investigation of such objects informs us about the specific societies from which they emerged. It is also a prerequisite for determining how to care for them. This field of inquiry has been called conservation or preservation science. It draws heavily on a wide range of scientific disciplines, and advances in the field require a sustained effort in basic research to improve preservation and understanding while stimulating discovery, innovation, and education.

Expertise and resources to address the challenges in the science of examination and preservation of art and cultural property already exist in academia, national laboratories, industry and cultural heritage research institutions. However, the research effort is fragmentary, and much more can be achieved if the problems and challenges are clarified and disseminated through these diverse research communities. To that end, more than forty scientists from various constituencies will convene to discuss areas where new research in basic science can provide fundamental physical information on cultural heritage. The ideas that emerge from this workshop will inform future efforts and will bring about significant improvements in the field's ability to understand the way art and artifacts were created and how best to preserve them.

Workshop participants will consider three areas of grand challenges (see table below):

- Development of analytical techniques
- Investigation of processes of deterioration
- Development of new conservation methods and materials

Grand Challenges and Areas for Research	
Advancing analytical technologies for the study of irreplaceable and precious objects	Non-invasive spectroscopic analysis; large and small-scale mapping; nanotechnology; synchrotron-based studies; computational modeling; information technology; portable instrumentation.
Understanding material degradation	Chemical and material instabilities; kinetic influences; transport phenomena; reactions in the (nearly) solid state; structure-property relationships in and physical performance of highly degraded materials; predictive models.
Developing methods for material stabilization, strengthening, monitoring, and repair	Preservation issues and conservation treatments; new materials for coatings and adhesives; new ways to strengthen weak materials such as plastics and paper; new sensors for evaluating condition and change; investigation of chemical reactions occurring during conservation treatments involving the surfaces of the materials or occurring within the pores or molecular spaces; photochemical reactions involved in laser cleaning; transport processes governing the effectiveness of treatments such as consolidation, de-acidification, or the use of poultices.

The National Science Foundation is in an ideal position to begin this strategic enterprise. Its support will foster collaborations among scientific colleagues, both nationally and internationally, who will work together to conduct research into the underlying chemistry of real issue to conservators and heritage professionals. The need for basic science driven by the desire to study and preserve cultural heritage will draw students into careers in science. Strengthening the scientific foundation of the activities that will preserve our nation's artistic and historic heritage is of vital public interest. The cultural and scholarly resources of the nation and its future as a scientific leader would stand to benefit.

In preparation for the workshop, an opening session will take place the evening of July 6 at the Freer Gallery of Art. Participants, together with NSF program officers, conservation experts, and representatives of cultural heritage institutions will hear keynote presentations exploring the theme of scientific discovery and cultural heritage, and will have the opportunity to meet one another during the reception that follows.

On July 7, the participants will convene in Arlington for the day-long workshop. Divided first into small groups, they will devote approximately one hour to each grand challenge to: specify related research topics, define and refine possible approaches and their advantages, and identify expectations for what will be learned from the suggested approaches. Group findings will be summarized into “quadrant slides,” which will then be gathered and presented to the entire workshop. The steering committee will prepare a summary of the conclusions that will be posted shortly after the workshop.

Example Quadrant Slide	
Specific Topic	Approach
Advantages of Approach	What is Learned

Agenda for Tuesday July 7, 2009

Gallery 1 Meeting Room, Hilton Hotel
950 North Stafford Street, Arlington, Virginia

- 8:00-8:30 Breakfast
- 8:30-9:00 Introduction to the workshop and presentation of grand challenges (Richard Van Duyne)
- 9:00-10:00 Introduction to Challenge 1: **Advancing analytical technologies for the study of irreplaceable and precious objects.** (Francesca Casadio – 5-10 minutes). Each group discusses the challenge and creates 2-3 quadrant slides
- 10:00-10:30 Presentation of quadrant slides
- 10:30-10:45 Coffee break
- 10:45-11:45 Introduction to Challenge 2: **Understanding material degradation.** (Paul Whitmore – 5-10 minutes). Each group discusses the challenge and creates 2-3 quadrant slides
- 11:45-12:15 Presentation of quadrant slides
- 12:15-1:45 Box lunch and presentation: **The European Experience**
- 1:45-2:45 Introduction to Challenge 3: **Developing methods for material stabilization, strengthening, monitoring, and repair.** (Barbara Berrie – 5-10 minutes). Each group discusses the challenge and creates 2-3 quadrant slides
- 2:45-3:15 Presentation of quadrant slides
- 3:15-3:30 Coffee break
- 3:30-4:30 **Scientific research in cultural heritage: its impact on science, education, and society in general.** General discussion (Steering Committee to create quadrant slides after close of workshop)
- 4:30-5:30 General discussion on all three scientific challenges