New methods and materials for the Conservation of Cultural Heritage

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FACTS ON ART

Cultural heritage is a strategic resource for a sustainable society

If properly managed, it can:

- enhance **social inclusion and cohesion**, 
- encourage **intercultural dialogue**, 
- improve the quality of the immediate **living environment**, 
- and stimulate **tourism**.

**Effective strategies to ensure the long-term** conservation of irreplaceable cultural heritage resources are therefore necessary.
FACTS ON ART

The best way to realize these benefits is to increase the access to cultural heritage. However, access is possible only if the original artefacts are properly conserved, which is NOT an EASY TASK.

An example: MODERN and CONTEMPORARY ART ONLY

<table>
<thead>
<tr>
<th>Museums</th>
<th>Modern/contemporary Works of art</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOMA</td>
<td>150,000</td>
</tr>
<tr>
<td>Musée d’art moderne de la ville de Paris</td>
<td>10,000</td>
</tr>
<tr>
<td>Centre G.Pompidou - Le Beaubourg</td>
<td>100,000</td>
</tr>
<tr>
<td>MAV/VAL - Musée d’Art Contemporain du Val-de-Marne</td>
<td>2,000</td>
</tr>
<tr>
<td>Tate</td>
<td>ca. 1,000 on display</td>
</tr>
<tr>
<td>Museo Nacional Centro de Arte Reina Sofía</td>
<td>10,000</td>
</tr>
<tr>
<td>Peggy Guggenheim Collection - Venice</td>
<td>ca. 500</td>
</tr>
<tr>
<td>Rijks Museum of Amsterdam</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Huge # of artefacts: cannot be conserved with conventional technologies

NEED FOR NEW FAST AND SAFE METHODS

A NEW SCIENTIFIC FRAMEWORK IS NECESSARY
What is conservation?

ICOM-CC resolution adopted at the 15th Triennial Conference held in New Delhi in September 2008

Conservation - all measures and actions aimed at safeguarding tangible cultural heritage while ensuring its accessibility to present and future generations.

Accessibility means the possibility to access and enjoy not only the conceptual value of the artwork (i.e. by using ICT technologies such as 3D reconstruction) but also (more important) the ACTUAL OBJECT.
ART: natural aging, degradation

WORKS OF ART DEGRADE

Beato Angelico wall paintings, Florence

Templo Mayor (Mexico City)
Although the conservation of cultural heritage involves a different code of ethics, it can be compared to medicine, where artefacts are analogous to patients and conservators are similar to doctors.

Diagnosis, treatment and prevention are relevant to the conservation of artefacts: SCIENCE is contributing to such activities.
What’s being done? A comparison with medicine..

- Diagnosis ➔ diagnostics
- Prevention ➔ preventive conservation and
- Treatment ➔ remedial conservation

The main tools are already available to transfer to future generation our patrimony.

The treatment is *(therapy)* the final action, and the drugs used for therapies are *new smart materials and methods* coming from groundbreaking technologies.
New groundbreaking materials and methods

so far more than 50 new materials, 36 from CSGI based on nanoscience for the conservation of our HERITAGE are now available
New materials and methods for Cultural Heritage

1) **NANOPARTICLES**, from 1991-
   - calcium hydroxide nanoparticles (magnesium, strontium barium, and zinc)

2) **DETERGENCY (MICELLES AND MICROEMULSIONS)**, from 1986-

3) **SOFT CONTAINERS**, from 1999-
   - physical and chemical gels

4) **CONFINED AND RESPONSIVE SYSTEMS**, from 2002-
   - hybrid systems: nanoparticles/gels; microemulsions/gels
Synthetic strategies: 
**Microparticles 1989-1992**

**Nanoparticles**
- Top-down 1995
- Bottom-up 1997

**Confined systems 1997**
- Alkoxides 1998
- Sol-gel 2001

**Direct reaction 2012-2017** (particles from 2nm – up)

**Atomic force microscopy**
- AFM

22 different systems
- Ca(OH)₂, Ba(OH)₂, Mg(OH)₂ in 2-propanol, and/or ethanol and cyclohexane dispersion
BEATO ANGELICO
WALL PAINTINGS, FLORENCE

PIERO DELLA FRANCESCA
Wall paintings by Beato Angelico - Italian Renaissance

FERRONI & DINI 1967, BAGLIONI 1979
ADVANCED CHEMICAL HYDROGEL FOR WATER SENSITIVE CLEANING 2016-18

THE PEGGY (GUGGENHEIM) FAMILY GELS and TATE FAMILY GELS

PABLO PICASSO

GIORGIO DECHIRICO

JACKSON POLLOK
Horizon 2020
European Union Funding for Research & Innovation
JACKSON POLLOCK

ALCHEMY
Partly Cleaned

Pollock paintings are water sensitive and were cleaned with water
Cleaning with chemical gel: J. Pollock
WHAAM – Roy Lichtenstein
Roy Lichtenstein
Piero Baglioni, Emiliano Carretti, David Chelazzi

Nicole Bonelli, Costanza Montis, Antonio Mirabile, Debora Berti, and Piero Baglioni
PNAS May 21, 2018. 201801962
Eva Hesse
(1967)

© The estate of Eva Hesse, courtesy Hauser & Wirth, Zürich
CHCD2018 SYMPOSIUM
The 5th International Symposium on Cultural Heritage Conservation and Digitization

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www.nanocathedral.eu

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ECHOES is a community driven bottom-up action to connect all conservation science activities and stakeholders in Europe.

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