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Musée du quai Branly – Jacques Chirac

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SUSTAINABILITY IN PRACTICE: GREENART'S PUBLIC TRAINING SESSION IN PARIS

Lead scientists and conservators on the EU's GREENART project recently offered a public update and training session in Paris, sharing the latest results from their groundbreaking research.

On 10 and 11 April 2025, representatives of EU's GREENART Project gathered at the Musée du quai Branly – Jacques Chirac in Paris to offer the latest update to their project. GREENART's stated mission is to develop new sustainable tools and methods "to preserve, conserve and restore cultural heritage". Inherent in that goal is the development of novel cleaning solutions, packaging materials, solvents and other products that could replace current non-sustainable solutions used in the field. The public training session included a comprehensive series of lectures from leading researchers working on various projects, who shared progress reports in their areas of interest — including stakeholders from various international museums where GREENART's products and methods are being tested in real world situations. Following the talks, five practical training workshops were offered elucidating the topics discussed in the talks.

Session one began with Martina Menegaldo, a PhD student in Environmental Sciences at Ca'Foscari University of Venice, Italy, giving a talk about Life Cycle Assessment (LCA) and Life Cycle Costing (LCC). These are metrics used to compare the environmental and economic impact of GREENART's solutions compared to existing products. Menegaldo outlined the steps of the assessment process as goal scope definition (the case study), inventory analysis (collecting information about the product), impact assessment and interpretation (conclusions drawn about results). The impact assessment includes 16 categories, Menegaldo said. "When we talk about sustainability, it is not only one problem like climate change, but we have several problems for the environment, such as toxicity for both human health and the environment, the use and the depletion of resources like mineral metals and fossil resources, the formation of particulate matter, water consumption, land use, land transformation and so on. It is quite a challenging assessment."

Next was a talk from Manfred Anders from Zentrum für Bucherhaltung (ZFB) in Leipzig, Germany, where conservation is done on paper-based materials for archives and libraries. Anders is specialist for paper, cellulose and textile chemistry. His talk covered intelligent and sustainable solutions for archival packaging. One of the most important aspects of packaging, they noted, is to create a protective environment for whatever is in the package to protect it from environmental fluctuations outside. In addition to using more sustainable materials to make the packaging, they cited the importance of "smart packaging" that stabilises the "microclimate" inside the box, including internal

— Pierre Naquin and Phillip Barcio

humidity sensors for packaging. This, he said, allows an institution to spend less resources on room climatisation. He reported progress in better package construction to create a tighter seal. One problem the company still faces is finding materials that will help them move away from trees, such as hemp, which grows back quickly. One challenge with hemp, however, is that the fibres are too long and they have a negative effect on the paper machines causing them to need additional clearing. These issues add to the cost and complexity of the technology.

Next was a presentation by Salvador Muñoz-Viñas [see p.108], Professor in the Universitat Politècnica de València, Spain and Head of the Paper Conservation group of the university's Instituto de Restauración del Patrimonio, and María Sobrino-Estalrich, who is pursuing a PhD in Conservation and Restoration at the Universitat Politècnica de Valencia. They offered a proposal for a "greener" mounting system for paper artworks. Their goal, they explained, is to develop a better solution for keeping "a paper drawing, map, poster or whatever, flat and nice" while on display in a museum. "The solution is usually to try to keep the room's relative humidity within a very tight range," they said, but that takes a lot of energy so is not sustainable. A better solution is to develop a mounting system that resists changes in humidity and temperature. With the help of GREENART products, the team developed a system that achieves this goal, even at extreme humidity levels. Their work was recently tested incidentally in real world conditions during the floods in Valencia, when posters mounted using their technique were partially submerged in water. Only the submerged parts showed damage — the rest were still in nearly pristine condition.

Session 2

The next session began with a presentation by Giseppe Cesare Lama, PhD, Marino Lavorgna, PhD, and Letizia Verdolotti, PhD, all from the Institute of Polymers, Composite, and Biomaterials of the National Research Council. Their talk was about eco-friendly and bio-based coatings and polyurethane foams used for packaging and transporting artworks. They discussed two applications: one that coats the artwork itself and one that protects it inside the packaging during shipping. They compared the first application to a *Torrone*, which they said is basically "an edible composite". Instead of chocolate, they use polymers, they said, and instead of pistachios, they use "mesoporous silica nanoparticles". For the second application, they reported progress on making packaging foams from food waste, in particular cashew nutshell liquid. This material can be used to create a perfect mould for the actual object in the packaging, and afterward can be reprocessed by compression moulding and used in another application.

Gabriella di Carlo, PhD, spoke next about bio-based multifunctional coatings for tailored and long-term protection of metal cultural objects. Di Carlo is a Senior Researcher at Istituto per lo Studio dei Materiali Nanostrutturati, Rome, Italy. The most important thing, she said, is to achieve high transparency with any coatings applied to metal objects so as not to alter the object's appearance. As part of her project, her team worked on the development of new solutions based on chitosan, which she said "is a biopolymer with a low cost, commercially produced from renewable sources, like for example, waste of the fishing industry." That coating succeeded in protecting metal objects on which it was tested and achieved high transparency at first, but after time a slight yellowing was observed. Di Carlo's team is working with researchers now to achieve longer term results.

Next was a presentation from Camila Rezende and Camilla Camargos, who have been studying nanocellulose-based coatings and hydrogels for cultural heritage conservation. Rezende is an Associate Professor at the Institute of Chemistry at UNICAMP. Camargos is an Assistant Professor in the Conservation and Restoration of Cultural Heritage program at the School of Fine Arts, UFMG. They reported progress in utilising plant-derived nanostructures extracted from sugarcane bagasse, an agro-industrial residue, to fabricate protective coatings and hydrogels for cleaning cultural heritage objects. The coatings still require some development in order to become colourless, they said. And the hydrogels were highly effective for cleaning. They concluded that these products have "high potential for cultural heritage conservation", "can offer high transparency, removability, antioxidant, antimicrobial and UV shielding properties, efficient and gentle cleaning performance" and "are potentially more accessible to conservation professionals in South America and beyond."

Next, Romain Bordes spoke about the development of green dispersion for the consolidation of encaustic paintings. Bordes leads a research group in the Applied Chemistry division at Chalmers University of Technology in Gothenburg, Sweden. He spoke about the particular challenges of conserving encaustic paintings and offered a report on his team's progress developing "a family of novel consolidants designed specifically for encaustic paintings, using a microstructured dispersion system of beeswax (BW), cellulose nanocrystals (CNC) and ethyl hydroxyethyl cellulose (EHEC)." Bordes reported that he was happy with the results, concluding that the system "has a good tendency to restore the mechanical properties of, first the encaustic painting —

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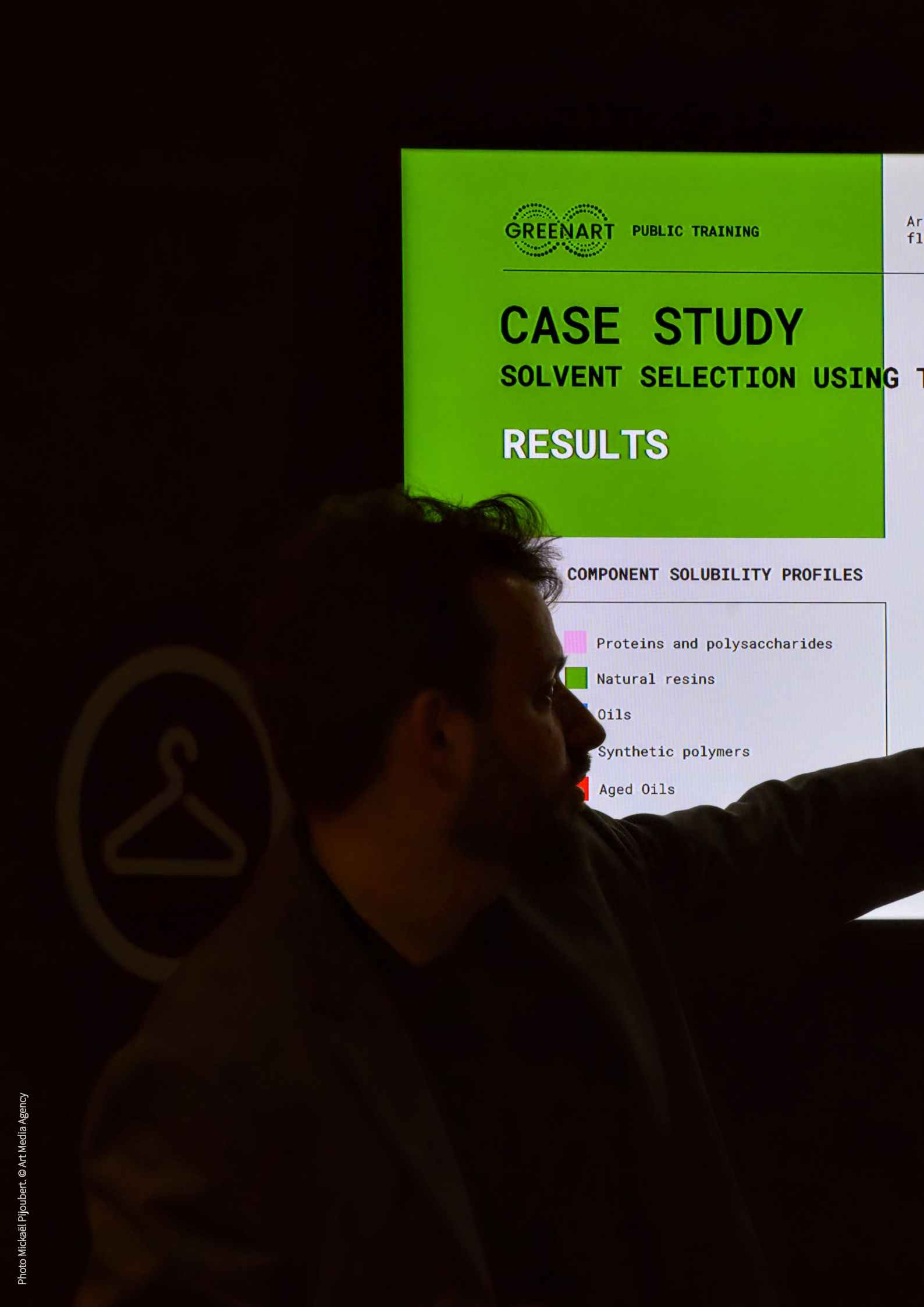

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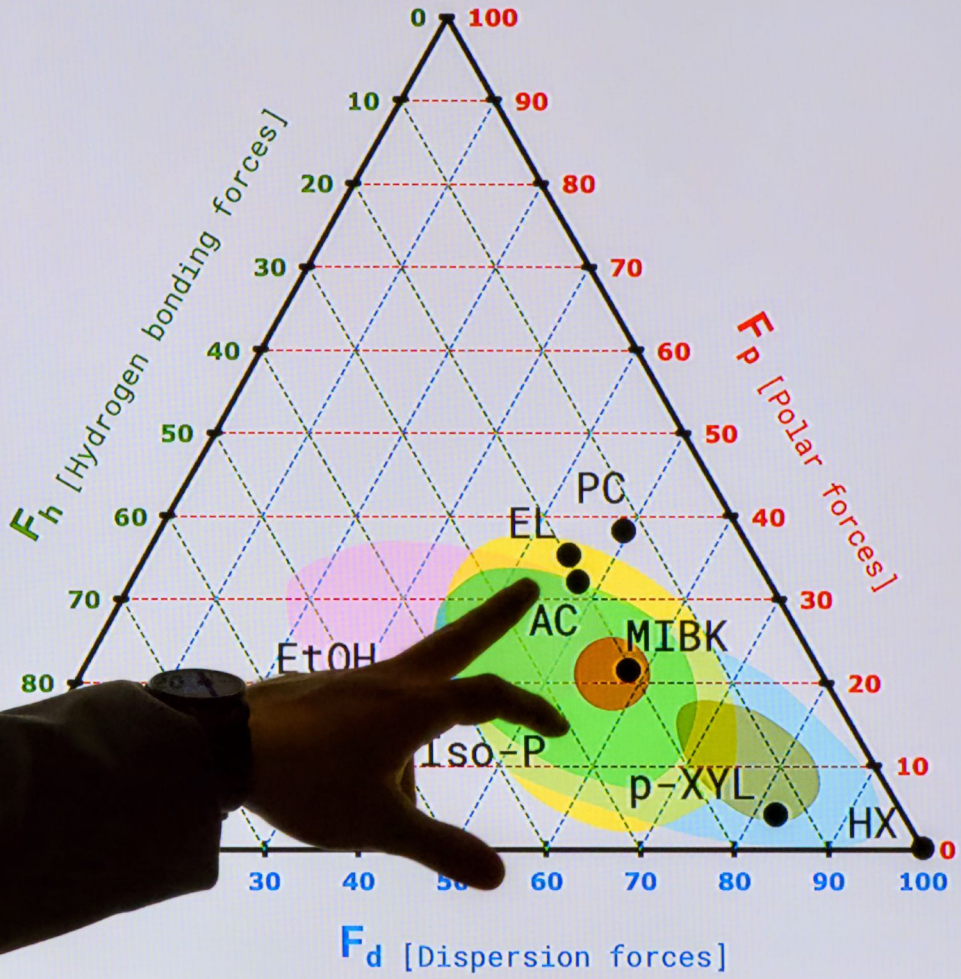
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Photo Mickaël Pijoubert. © Art Media Agency

it can work as a glue — but can also work for reinforcing textile like material."

Session 3

The third session began with a talk by Piero Baglioni on new green and sustainable materials for wet cleaning of artworks. Baglioni is Emeritus Professor of Physical Chemistry in the Department of Chemistry at the University of Florence. He discussed using colloids and soft matter solutions like gels and nanofluids "to selectively remove unwanted layers in sustainable and cost-effective interventions." He highlighted "twin-chain" polyvinyl alcohol gels, "which can be loaded with water or different water-based cleaning fluids" and concluded that much can be achieved with these new solutions that is far more difficult to achieve by traditional means.

Next, Bronwyn Ormsby, Principal Conservation Scientist at Tate, London, spoke about real world testing that the institution has been conducting on artworks in their collection. Their research is focused on the works of British painter Bridget Riley, whose paintings from the 1960s are currently undergoing conservation treatment for the first time. The two paintings they are working on are *Fall* (1964) and *Hesitate* (1963). Both are painted on Swedish hardboards using house paints and both have accumulated a layer of "gray yellow" soil which Ormsby said is common to the Tate. Preliminary testing of the gels has proven very effective in removing the soil, Ormsby said, although a complete and final cleaning and assessment has yet to be completed.

Athina Georgia Alexopoulou spoke next about the creation of more user-friendly methodologies for the evaluation of green materials. Alexopoulou is Professor at the Department of Conservation of Antiquities and works of art at the University of West Attica, Athens, Greece. She declared that "the heart of conservation restoration lies in answering critical questions. Did our treatment work? Was it the right approach? Were the appropriate materials used? And what is the impact of our treatment on the project?" Her main emphasis was on the importance of non-destructive methods of analyses prior to restoration, so that objects can be assessed *in situ* using tools such as hyperspectral imaging, colourimetry and glossimetry. These solutions, she notes, "do not require sampling, have quick *in situ* application, do not involve consumables or waste materials, have very low energy consumption as well as the ability of post-processing imaging data."

Session 4

Penelope Banou kicked off session four with a talk on varnish removal on works of art on paper. Banou is a lecturer in the MA Conservation of Fine Art program, Northumbria University, UK. Her research centres on a 17th century black and white intaglio print. GREENART's organogels and nanofluids were used in the trials. Her conclusion was that GREENART's organogels were very promising, "because they managed to swell or solubilise the varnish layers adequately to be removed." More testing is needed, she said, on a range of different types of works on paper.

Next, Martina Vuga and Lucija Močnik Ramovš from the Academy of Fine Arts and Design, University of Ljubljana presented their observations on GREENART's cleaning systems for varnish removal. Their trials were conducted on a 19th-century polychrome wooden sculpture and two oil paintings on canvas. They tested GREENART's nanofluids and organogels, using multiple solutions on each artwork, and testing for different durations. Their conclusions regarding the paintings were positive, noting that varnish was successfully removed." For the sculpture, they noted that the GREENART solutions were more time consuming, required more effort and were potentially more damaging to the artwork than traditional solutions.

The final speaker was Soraya Alcalá, head of the paintings conservation lab at the Museum of Fine Arts (MFA), Houston. She delivered an update on her team's use of GREENART's solutions to clean two paintings on unprimed canvases: Kenneth Noland's *Eyre* (1962) and Morris Louis's *Slides* (1962). Her team collaborated with a team at The Peggy Guggenheim Collection in Venice, which had works by the same artists that were experiencing similar conservation issues. The results were positive, she said, but revealed that success depends on how the solutions are applied. "A well-structured protocol is crucial in achieving effective results," Alcalá said.

After the talks, on the second day of the conference, a training session including five workshops was held, during which attendees were able to see the solutions in action and in some cases test the solutions out themselves. Giovanna Poggi led a workshop on green gels for cleaning works of art; Camila Rezende and Camilla Camargos led a workshop on nanocellulose / nanolignin protective coatings and nanocellulose / biopolymer hydrogess; Francesca Boccaccini's workshop dealt with the properties and application of sustainable protective coatings for metal cultural objects; Manfred Anders led a workshop on the integration of sustainable raw materials, novel regulators and sensing devices in archive box production; and Andrea Casini a workshop on sustainable cleaning fluids with low impact solvents and surfactants.


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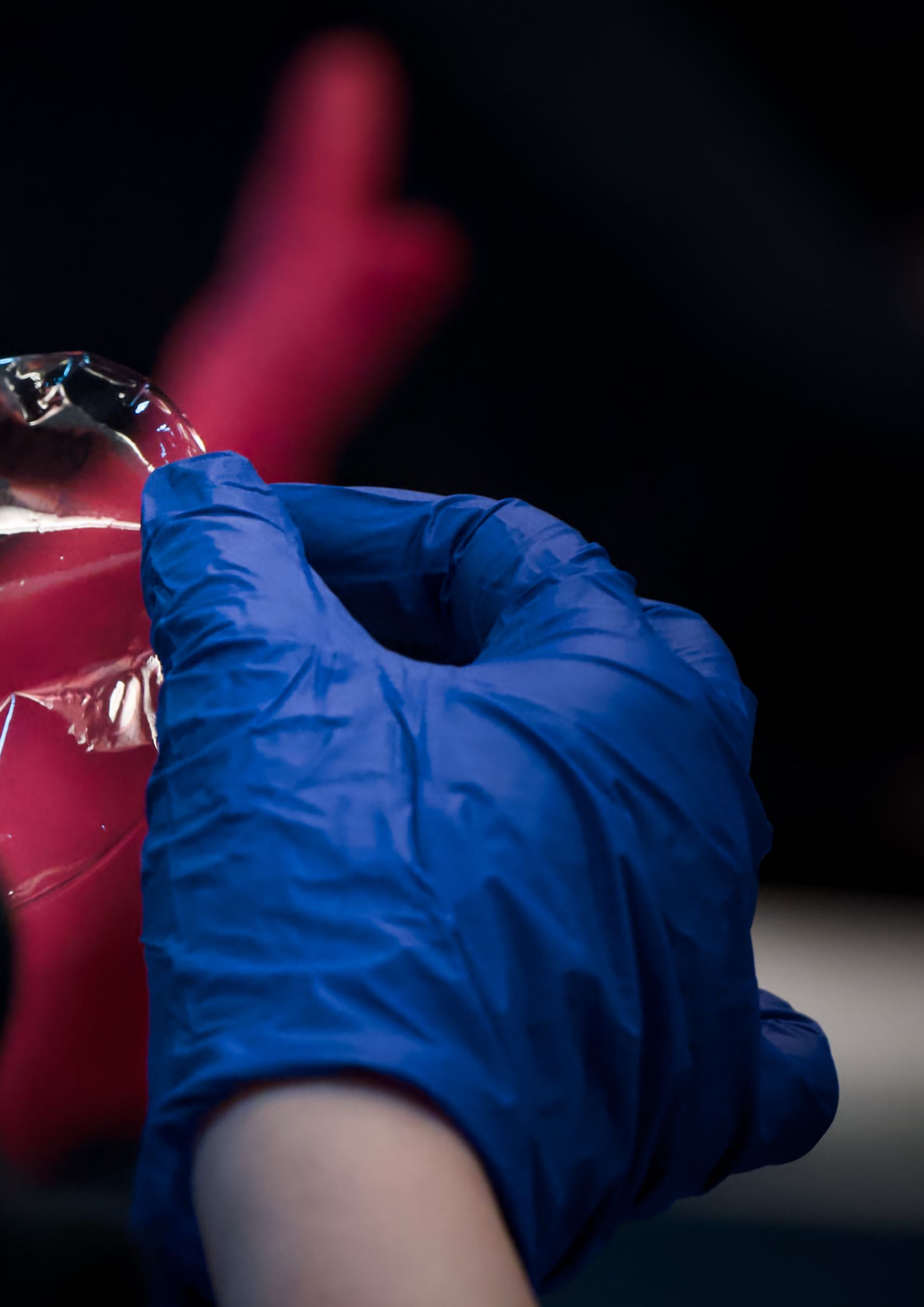

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