UD chemist investigates reactions that damage paintings

August 25 2011, By Ann Manser

In the days before artists could go to a store and buy commercial paints, they mixed their own, often combining pigments made of lead salts with such materials as egg whites and vegetable oils.

"They were seat-of-the-pants chemists," says Cecil Dybowski, professor of chemistry and biochemistry at the University of Delaware. "But they didn't understand the chemistry itself, and they didn't foresee what would happen to those pigments in the future as the paintings got older."

What generally happened is that internal chemical reactions gradually occurred in the dried paints, causing them to change in various ways and eventually damaging their works of art, no matter how carefully those paintings had been cared for over the years.

Now, supported by a National Science Foundation (NSF) grant, Dybowski and colleagues at New York's Metropolitan Museum of Art will create models of centuries-old paints and use special spectroscopic techniques to analyze the reactions that occur within them. Researchers at the Metropolitan came up with the idea for the project and contacted Dybowski because of his laboratory's international reputation in spectrometry and his own research focus on lead.

Specifically, Dybowski and other UD scientists use nuclear magnetic resonance (NMR) spectrometry, a powerful technique for analyzing a variety of materials ranging from natural substances to synthetic molecules to biological systems. NMR analysis provides detailed

information about a material's structure, composition and dynamics.

Last year, a team of researchers in the Department of Chemistry and Biochemistry, including Dybowski, received a $2.2 million grant to acquire a highly specialized NMR spectrometer that will be used by scientists throughout the University and the region.

"This project builds on the expertise that we have here and that the Met has there, so it's very collaborative," Dybowski says. "I wouldn't be able to attack this problem on my own, and I don't think the Met could either. The NSF likes collaborative projects like this, which looks at art as science and science as art."

The chemical makeup of paints and pigments has been studied extensively over the years in art conservation work, but this project seeks to duplicate the chemistry of the old paints and then analyze those chemical reactions with the most modern technology. NMR can't yet easily study the surface of a painting, and the analysis requires a relatively large sample, which is why the researchers will be creating their own paints to use as models.

"We can't remove large samples of paint from works of art without damaging the paintings, so we'll use these models to study the internal chemistry," Dybowski says. The team's plans call for a shared postdoctoral researcher to prepare materials at the Met—using the known chemical makeup of old paints and then subjecting them to an accelerated aging process—and then bring them to UD for NMR analysis.

The three-year project will begin in September. The Metropolitan's researchers are Silvia Centeno, a physical chemist who specializes in a type of analysis known as Raman spectroscopy, and Nicholas Zumbulyadis, a retired NMR spectroscopist from the Eastman Kodak

Research Laboratories who is also a consulting expert on the chemistry of paints and glazes.

"I never set out to study artworks," Dybowski says. "I was interested in the fundamental spectroscopic properties of lead, and I've been studying that for about 10 years. Then, out of the blue, I got the call from the Met. I think it shows the amazing diversity of chemistry and how knowledge that might seem theoretical suddenly becomes extremely pertinent to problems one might not have envisioned."

Provided by University of Delaware

Citation: UD chemist investigates reactions that damage paintings (2011, August 25) retrieved 19 April 2024 from https://phys.org/news/2011-08-ud-chemist-reactions.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.