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# Museums Use New Tools to Fix Old Works

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John Singer Sargent's "Madame X" developed strange tiny bumps under her right arm and along the back of her head. A set of drawings by Louis Comfort Tiffany was crumpled, frayed and stained by water and mold. The enamel on a fish pendant was not as old as it should have been, suggesting that the piece might be a fake.

With a collection exceeding two million works, the Metropolitan Museum of Art encounters such problems often enough to keep a staff of eight full-time scientists busy. Last year, they were consolidated into a department of scientific research, the second largest such department in the country, behind the National Gallery in Washington.

The scientists have an arsenal of tests - from microscopy and X-rays to more complicated ones with names like X-ray fluorescence and Raman spectroscopy - to analyze just what an object (or the grime on its surface) is made of, how it was made and what can be done to repair or stabilize a problem.

"The range of problems is so wide that you have to look at analogs, similar problems in other fields," said the head of the new department, Dr. Marco Leona, who moved to the Met from a similar post at the Los Angeles County Museum of Art. Comparable arenas include forensic labs and the oil and pharmaceutical industries, which use many of the same tests.

But scientists in those fields do not have the same constraints as those at the Met.

Art can be made from almost anything, including substances that have not been produced and used in ages, and it comes in all shapes and sizes. More important, scientists have to study art without affecting it, and that usually means limited, nondestructive tests.

If they have to take a sample, it must be as small as possible. In the objects conservation lab, the big samples look like the period at the end of this sentence. Small samples are microscopic.

The scientists have developed creative ways to deal with the constraints. Consider the case of the fish pendant. Gold with multicolored enamel, it was originally thought to date from the 16th century. But curators and conservators saw that the style was all wrong for that period. It was either mislabeled or a forgery.

Mark Wypyski, a glass specialist who runs the scanning electron microscope at the museum, took a tiny porcelainlike sample from a green part of the pendant and bombarded it with electrons, causing it to emit X-rays characteristic of the elements in it.

Mr. Wypyski interpreted the results as they popped up on a computer monitor. There was chromium, which was not used in glass or enamels until the 19th century. The chromium could have gotten into the enamel by accident, but if it had done so, there would be more iron present.

With these findings, bolstered by his knowledge of what should and should not be in 16th-century enamels, Mr. Wypyski confirmed the conservators' initial assessment. He plans to continue to study such pieces and publish his findings as a reference to help other scientists identify misdated pieces.

Next door, Dr. Crtomir Tavzes, a research fellow from Slovenia, is worried about two of art's great enemies, bugs and fungi. As the museum's resident expert in biodeterioration, Dr. Tavzes uses a special insect-extermination technique developed by Robert J. Koestler, his predecessor at the museum, that involves wrapping infested art in an airtight silver cocoon and replacing all the oxygen inside with argon gas. The argon is inert and does not react with the art. In time, the absence of oxygen suffocates any living thing inside.

Then there is mold. Since 1966, the Met has had a collection of more than 400 sketches by Tiffany, the stained-glass designer, from 1885 to 1930. Before the Met acquired the drawings, though, they had been improperly stored and had become wet. As a result, they were covered with different creeping speckled molds that destroyed some of the paper and stained much of the rest brown.

Dr. Tavzes is working on a new technique to synthesize the enzymatic action of another fungus, white rot fungus, to oxidize the stains and prepare the collection for display. He has established that it will work, but he now needs to find the right mixture and mode of application so the technique does not damage the original drawings.

Not all the works being studied are hidden in laboratories. Some remain on display. "Madame X," a strikingly sexual portrait that Sargent considered one of his finest works, developed tiny, almost microscopic, bumps under her right arm and along the back of her head, the deepest blacks of the painting.

When Dr. Silvia Centeno, a scientist who specializes in paintings and paper, looked at tiny cross-sections of the paint under a microscope, the bumps looked like tumors erupting through the surface, but she could not figure out what they were made of.

Three years ago, the Met became the first art museum in the country to acquire and install a Raman spectrometer, a device that analyzes how a material scatters laser light and, in doing so, determines its molecular makeup. With the fine laser beam, Dr. Centeno could focus on the center of the lump.

She was surprised by what she found - a compound of lead and linseed oil, two extremely common components of old paintings. Now, through a series of lab tests, Dr. Centeno is trying to unravel why these lumps appeared where they did, and not on other paintings with lead and linseed oil. She suspects that the culprit may be the ratio of lead to oil or the thickness of the paint.

The research efforts are a few of many at the museum. They often extend over many years, and it is up to Dr. Leona, 38, a chemist and crystallographer who was born, raised and educated in northern Italy, to oversee the operation and keep it in line with the larger research agenda of the museum.

Part of his vision is improving scientific capabilities. A tinkerer at heart, Dr. Leona takes time to work on refining new devices and techniques that will make existing analyses like Raman spectroscopy more powerful and versatile.

He was also chosen for this position for his ability to bring scientists working on diverse subjects together to interact.

"Scientists just don't work well if they have a little island," said Michael Schilling, who leads a well-established analytical science department at the Getty Conservation Institute in Los Angeles. "We need care and feeding, and we need stimulation from other people and other sources. Anything that brings them together to talk, to think, to act, to plan, that's going to be beneficial."

 