

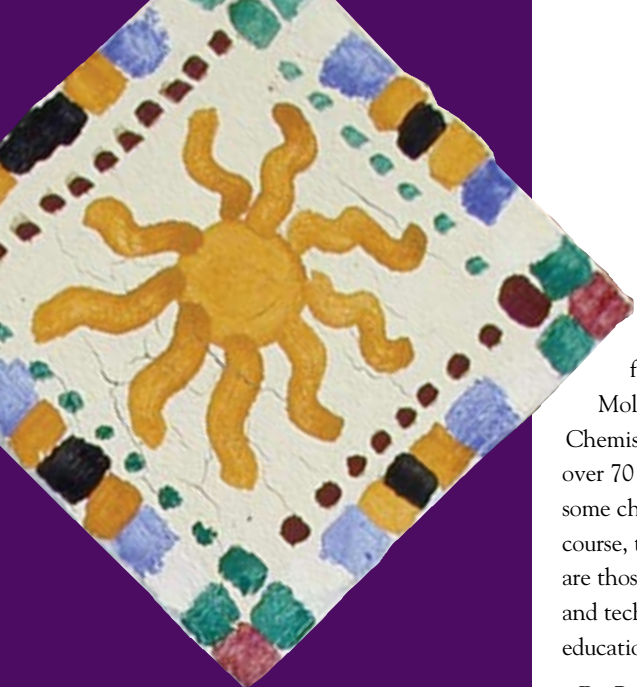


Chemistry of Art

STORY BY JENNIFER ERICSON

Left, Dr. Patricia Hill leads a popular chemistry course for non-science majors.

Right, hands-on workshops on the chemistry of art held during the summer attract college professors and teachers.



A class where students make paint, crayons and pastel chalks; etch glass; change the color of metals; paint frescos; and work with ceramics ... and surprisingly, it isn't offered by the art department. Actually, it is one of the University's most popular chemistry courses.

Designed

for non-science majors, The Molecular Basis of Color and Form: Chemistry in Art (Chemistry 205) attracts over 70 students every spring. Although some chemistry majors have taken the course, the majority of students who take it are those majoring in art education, industry and technology, graphic arts and elementary education.

Dr. Patricia Hill, chemistry professor at Millersville, developed and began teaching the course in 1991.

The class gets high praise from students. "It's the best science class or chemistry class that I've taken," said Briana Rohrer, a senior majoring in art education. Brian Giniewski, a senior majoring in art, said the class gave him a better appreciation for the art materials he uses. "If I had taken a regular chemistry class," he said, "I don't think I would have been as engaged in it."

Inspired by one of the course's labs on making glaze, Giniewski is now doing his own research into mixing different glazes for ceramics. He has also applied for a grant to take a class in glaze chemistry.

"Art students are generally very science and math phobic," said Dr. Barbara Bensus, art education professor. However, Hill makes the chemistry so accessible to students that "I think the students really get a lot out of [her class]," she said. But students aren't the only ones. After sitting in on one of Hill's lectures, Bensus said that the periodic table of elements finally began to make sense to her.

Art students find Chemistry 205 more comfortable than other chemistry courses because the topics are familiar and the labs have

them working with art materials. However, the course is just as challenging as other chemistry courses. The course textbook and lab manual – both written by Hill – are filled with chemical equations like those in what Giniewski would call a "regular" chemistry class.

The lab work for this course is extensive. In one lab, students learn how to identify which pen ink was used on a document. The process they learn is one of many used to detect forgeries. In another lab, students analyze paper to identify its chemical additives. They also learn about natural and synthetic poly-

mers, such as plastic and wool, respectively.

Throughout the course, students work with various art media, including paper, metal, ceramics and even photographic papers and films.

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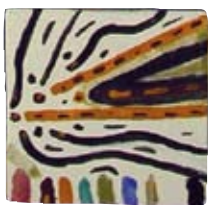
understand your materials so you can control them in your art form," Hill said.

If paint is runny, artists should know why. At the macroscopic level, the paint consistency is visible. But why? A chemical reaction or property at the microscopic level is making the paint runny. In order to understand the macroscopic properties, Hill said, artists have to understand the microscopic.

"Art students are generally very science and math phobic."

Dr. Barbara Bensus,
MU art professor





Chemistry and the Sistine Chapel

Although all of Chemistry 205's lab experiments help students do just that, the most popular experiment is the one involving fresco painting. A fresco painting is one painted on plaster while the plaster is still wet. The wet plaster absorbs the paint, which dries with the plaster, making the paint part of the plaster. Michelangelo's paintings on the ceiling of the Sistine Chapel are perhaps the world's most renowned frescoes.

Hill's students make their own frescoes on the backs of tiles. Then, to study the deterioration process, students douse them with sulfuric acid. When sulfuric acid mixes with the calcium carbonate of the plaster, it starts a reaction turning calcium carbonate into calcium sulphate. The calcium sulphate is a larger molecule than the carbonate and it causes the surface of the fresco to swell, crack, bubble up and then fall off.

This experiment illustrates the damage that sulfuric acid, created by burning of fossil fuels prevalent in the atmosphere, causes to frescoes. Michelangelo's frescoes in the Sistine Chapel, completed in 1512, suffered the same type of deterioration process over the cen-

turies. Moisture and acid in the atmosphere caused parts of these art treasures to swell, crack and crumble.

From 1979 to 1999, art restorers worked to save the Sistine Chapel's frescoes. Essentially, Hill said, they had to come up with a chemical mixture to reverse the reaction to transform the calcium sulphate back to carbonate calcium. This chemical mixture had to allow restorers to remove the sulphate without damaging the original paint. Hill is in the process of developing such a mixture for future Chemistry 205 students to use to restore their own tile-sized frescoes after they've been damaged with acid.

"Teachers are looking for more ways to make chemistry accessible to students."

National Workshops

Millersville students aren't the only ones who love the fresco acid lab; chemistry professors from across the country also enjoy it.

Since 1996, Hill has been working with Dr. Michael Henschman, emeritus professor of chemistry at Brandeis University, to lead workshops for college professors on the chemistry of art. These workshops help professors develop their own chemistry of art courses by walking them through the labs and lectures from Hill's course.

Left, Restoration of Michelangelo's frescoes involved reversing the chemical changes on the material. Above, students create mini-frescoes on tiles to conserve the chemical action and reversal.

The National Science Foundation (NSF) funded the first workshops, which were three-day short

courses held at Harvard University. These were so popular that NSF provided more funding to expand the workshop to run for an entire week.

Hill and Henschman's Chemistry of Art workshop is now offered every summer at Millersville University. It is part of the Center for Workshops in Chemical Sciences, a program sponsored by NSF and coordinated by Georgia State University.

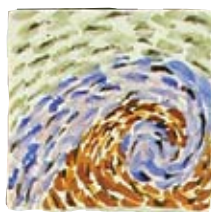
Of the 21 different workshops offered through the Center, Chemistry of Art is one of the most popular. In fact, Dr. Jerry Smith, the Center's workshop director, said it is "unusually well attended." Last summer, so many people wanted to take the workshop that Hill had to run it twice. But even with running two sessions, the Center still had to turn people away.

Henschman thinks the workshop is so popular because "teachers are looking for more ways to make chemistry accessible to students." This hands-on workshop tells them how to do just that.

Like most of the professors who have taken the workshop, Dr. Richard Hark, associate professor of chemistry at Juniata College in Pennsylvania, was already planning to develop a chemistry and art course when he signed up for the workshop.

"I had always thought of teaching such a course," he said. The workshop helped him to develop it by providing resources and sup-





port. “Chemists would say [the workshop] was like a catalyst,” he said.

Although there are many chemistry textbooks available, only a few focus on art. And, unfortunately, those few usually focus on one specific area of art. When Hill developed her own course, she was not able to find a general textbook that covered a variety of art topics, so she wrote her own as well as the accompanying lab manual. Every workshop participant gets a copy of both.

Dr. Suzanne Mabrouk, professor of chemistry at The Citadel in South Carolina, was particularly impressed with the list of resources Hill provided, including a list of art material suppliers. “I wouldn’t know where to buy pigments for instance,” Mabrouk said. The workshop also helped her to come up with topics for her own course.

Dr. Catalina Achim, assistant professor of chemistry at Carnegie Mellon University in Pennsylvania, took the workshop in 2004 and taught an art chemistry course for the first time last fall with colleague Clayton Merrell, associate professor of art. Achim suspected their new course would be popular, and it was. Only a few hours after course registration began, the course was filled. She said the students really enjoyed it.

Achim credits Hill’s workshop for helping to make her own course successful. “There are so many things in my course that I can trace back directly and indirectly to that workshop,” she said.

For several professors, taking the workshop not only helped them to develop a college course of their own but also changed the way they approached chemistry. “For me, the workshop breathed new life into chemistry,” said Dr. Anthony Lagalante, assistant profes-

sor of chemistry at Villanova University. “It gave me a new way to think about things.”

As a result of taking the workshop and then teaching her own course, Dr. Ruth Beeston, chair of the chemistry department at Davidson College in North Carolina, has completely changed her area of research. Before taking the workshop, her research focused on synthetic inorganic chemistry. However, while preparing her own course, *The Chemistry of Art and Artifacts*, she became interested in pottery from archeological sites. She now analyzes ancient pottery to determine what organic materials people may have stored in it.

More than 80 professors from colleges across the country have taken Hill’s workshop in preparation to teach their own chemistry and art course. Like Hill, many of the professors have long been interested in both chemistry and art.

Over the years, Hill has taken painting and ceramics classes. She also enjoys knitting and weaving. Not surprisingly, she even dyes her own wool, which



she shears from sheep she raises with a friend.

She is also collaborating with MU students to identify chemical properties of old works of art and to develop ways to safely clean and restore them.

Despite the fact that chemistry is a left-brained, or analytical, activity and art is a right-brained, or creative, activity, Hill sees little difference between a chemist and an artist. In fact, she believes, they operate in much the same way. “Both have to be good observers and both are trying to interpret the world based on their interactions with tools and materials.”

“It’s the best science class or chemistry class that I’ve taken.”



The daughter of a microbiologist and an art teacher, Dr. Pat Hill grew up loving both science and art.

“I could have gone either way – into art or science,” said Hill of her career choice.