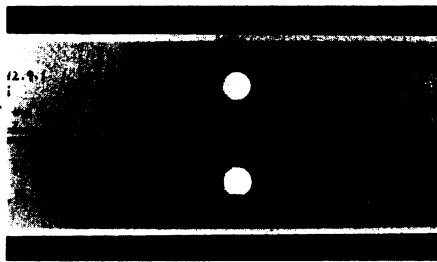


cated as some of the scientists who test for forgeries.

For example, a technique called thermoluminescence can determine the time elapsed since a piece of pottery was last fired. By measuring the amount of light emitted from a ceramic object when it's heated, scientists can get an idea of the amount of radiation to which it has been exposed—a measure of its age. According to van Zelst, forgers in Italy are now taking recent pottery pieces to their dentists for a dose of X-rays that will make it look as if the pot has been exposed to radiation since antiquity. If done right, he says, this procedure could fool a routine thermoluminescence test.

And even when scientific evidence of forgery is presented, the art world doesn't always listen. Perhaps the most famous example of this is a series of paintings passed off during World War II as being works of 17th-century Dutch Master Jan Vermeer. In spite of the fact that traces of 19th-century pigments were detected in the works and that the real artist, a Dutch painter named Han van Meegeren, insisted the paintings were his, many collectors simply refused to believe they were fakes. Van Meegeren, who was on trial for collaborating with the Germans by selling them some of these works, finally settled the issue by creating a new painting while in jail. Looking at these paintings today, says van Zelst, one would find it hard to



The pattern X-rays make when they are diffracted by a crystalline material can be used to "fingerprint" different pigments. From the diffraction patterns shown here, scientists know that the sample of white paint (above) taken from Giovanni Bellini's "Feast of the Gods" is made of basic lead carbonate (below).

believe they were Vermeer's, but at the time that's all the collectors who had bought the works could see.

While science is only one of many tools in the art historian's box, it is a tool that is becoming more precise and powerful as innovative techniques from the traditional fields of science gradually find their way into the art world. Working with immunologist Rose Mage at the National Institutes of Health in Bethesda, Md., for example, chemist Barbara Berrie has developed a series of antibodies, labeled with colloidal gold, which will tag egg yolk. This immunological approach can help them decide if a picture was painted

in egg tempera rather than with oils — information that is important to a conservator, who must choose the proper kinds of solvents for cleaning the painting. It may also aid art historians who are trying to trace how rapidly oil painting spread from the 15th-century northern European painters, who perfected oil techniques, to schools of artists elsewhere in the world.

In addition, many curators and conservators are interested in using digital image analysis of paintings to detect and record the slight differences that come from aging, fading and preservation in order to document and better understand how artworks deteriorate. This computer technique, which divides a painting into hundreds of tiny zones, could also be used to compare the different kinds of information gleaned from a variety of imaging techniques such as X-ray and infrared analysis. One CAL researcher hopes to use this approach as a way to catalogue and look for underlying themes in the designs painted on Hopi Indian pottery. At the Freer Gallery, Thomas Chase wants to use holography to study how lead solder joints on metal objects degrade as a function of temperature and stress, and he'd like to see more non-destructive techniques developed to determine how fast metals cooled and other microstructural details of how objects were made.

Such tools might be applied to modern materials as well. "Often modern pieces are falling apart already because people are using materials that haven't been shown to stand up to time," says the National Gallery of Art's Berrie. "Some artists also mix together materials that adversely affect one another's longevity. . . . [Only a portion of artists today seem] interested in making their art last a long time without having to rely on old tried-and-true materials such as oil paint."

And modern materials in art are not the only ones that could stand the scrutiny of science. Some of the items for study on van Zelst's agenda are the space suits at the Air and Space Museum. Like many 20th-century materials, the suits were not designed to last for eons in museums, he says. "They're crumbling and falling apart already, but we haven't had the resources to get to them yet."

As is often the case when any two seemingly disparate traditions merge, there have been those who are leery of using science in art. "Some art historians are quite resistant to [scientific information]," notes Berrie. "But then there are others who won't do a thing until [scientists] put their two cents in."

And just as the art world has opened up a bit to science, some scientists find themselves changed by working with art. Says Berrie, "I've learned to look much more closely at a picture once I've thought about how and from what it's made." □

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Crossing Open Ground — Barry Lopez. A collection of 14 essays by this award-winning author that explore the bond between humans and the land and humans' betrayal of that bond. These essays, originally published in various magazines, have been rewritten for inclusion in this collection. Scribner, 1988, 208 p., \$17.95.

Let's Grow! 72 Gardening Adventures with Children — Linda Tilgner. Dozens of projects to help parents, grandparents and teachers give children a knowledge of nature and a love of gardening. The well-illustrated book includes projects concerned with growing vegetables, flowers, herbs, indoor gardens, balcony gardens and window boxes. The projects range in complexity from those to be used with the very young (such as growing sunflowers) to those suitable for preteens (such as starting seedlings and creating a patchwork quilt salad garden). Family and group projects are included. Activities are classified by age group and season. Storey Comm Inc, 1988, 208 p., illus. paper, \$10.95.

The Perfect Puppy: How to Choose Your Dog by Its Behavior — Benjamin L. Hart and Lynette A. Hart. Intended to help prospective dog owners select the breed and gender of dog best suited to their lifestyle and environment. Here animal behavior specialists look beyond appearance and size to the behavior of 56 popular dog breeds. Their profiles of each breed focus on 13 key behavioral traits, such as excitability, barking, ease of housebreaking, demand for affection and playfulness. W H Freeman, 1988, 182 p., illus., paper, \$9.95.

Rationing Medicine — Robert H. Blank. The American health care system faces, according to the author, an ethical and economic crisis in the coming decades of immense proportions. New medical technologies, an aging population and changing attitudes toward medical care have increased the nation's already astronomical health spending. The author traces four aspects of health care — organ transplantation, treatment of seriously ill newborns, reproductive technology and fetal health — to illustrate the problems facing our health care system. Columbia U Pr, 1988, 290 p., \$25.

The Scientific Companion: Exploring the Physical World with Facts, Figures, and Formulas — Cesare Emiliani. "Our world," says this geologist, "is an incredibly coherent system endowed with a rich braid of evolutionary paths from its fiery beginning 15 billion years ago to the evolution of humans on Earth." This well-illustrated book describes how our world originated and evolved, focusing on the quantitative to give the reader a feeling for the dimensions involved. Wiley, 1988, 287 p., illus., paper, \$14.95.

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