Book Review

The Science of Paintings,

W. Stanley Taft, Jr. and James W. Mayer (Springer-Verlag, 2000) 236 pp., ISBN 0-387-98722-3; $50.00

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We chemists are prolific in our couplings. Think of biochemistry, biological chemistry, chemical biology , bio-organic chemistry, bio-inorganic chemistry, and so on. These couplings reveal nothing of the material world, only the ways we poor chemists choose to think about the material world. In this vein, the book under review The Science of Paintings considers the unlikely coupling between science and art, which many reject as being non-existent.

Scientists, they claim, construct a singular view of the material world, a view common to all and universal in its scope. As for art, there are as many viewpoints as there are works of art. Between these two extremes—the objective and the subjective—no common ground may be perceived. Correct (almost) as far as it goes, this judgment considers only the ends but not the means. When we consider the means, we find science and art to be linked inextricably.

Artists fashion works of art out of something and that something is material. What materials are available? How can materials best be used? What can happen to materials over time? How, subsequently, can materials be fixed? Every artist must be part materials scientist, part environmental scientist, and part conservation scientist. Herein lies one major link between science and art.

For chemists, art has an ongoing link with analytical chemistry, especially as new techniques are continually being developed. [Beielby has shown us how to construct an exciting course in Instrumental Analysis using examples from art and archaeology.[1]] A long and rich tradition links analytical techniques and their use in art. Almost a century ago in Rutherford's laboratory, paintings were already being examined using X-rays. Further examples include radiocarbon dating (1950), thermoluminescence (1960) and computational decomposition of a painting's surface image to identify the painter (2004)[2]. Science continues to serve the study of art in increasingly sensational (and useful) ways.

The Science of Paintings treats the physics and chemistry of the materials science underlying paintings. It is a text developed for the interdisciplinary undergraduate course at Cornell Art, Isotopes and Analysis by Stanley Taft (an artist) and James Mayer (a materials scientist). [Cornell has pioneered in this area, their most illustrious practitioner having been the late Walter McCrone, he of Turin Shroud and Vinland Map fame.] Guest lecturers for the Cornell course and guest contributors to this volume are Peter Kuniholm, a Cornell dendrochronologist, Dusan Stulik from the Getty Conservation Institute, and Richard Newman, the senior scientist at the MFA. The first half of the book addresses several topics in 9 short chapters: structure and analysis of paintings, paint, organic binders, color and light, optics of paint films, identifying pigments and detecting fakes. The second half, consisting of 12 appendices, covers both basic science — photons, electrons, X-rays, energy levels, crystal structure, optics, nuclear reactions — and scientific techniques — autoradiography, polarized light microscopy, radiocarbon dating, dendrochronology, FTIR and chromatography. An average of 10 pages for each chapter and appendix makes a succinct 200-page text. Superior color plates of some 30 paintings provide essential art (alas raising the price of the book to $50). Problem sets, exams and solution are apparently available from the publisher.

So what is the authors' purpose? The book adheres to the title *The Science of Paintings* explicitly. It is not a book about art or paintings: it is a scientific primer for the scientific examination of paintings. It is a collection of basic science, on the one hand, and of scientific techniques, on the other. No unifying theme can be developed systematically throughout the book. No logical links are possible between one section and the next. It is really a scientific reference book for readers interested in the science of paintings.

The text is written for arts students, studying the science of art, and for science students, studying the application of science to art. As a reference text, the form and content of the science are intimidating. And it makes insufficient use of its valuable material for what is the primary pedagogical purpose. The primary purpose should not focus on the science (although that must be identified and understood). Instead the primary focus has to be on the art and on the role played by science in illuminating the art.

Consider, for example, how painting was transformed during the Renaissance, from the flat aspect of Botticelli (painted in egg tempera) to the brilliance of Rembrandt (painted in oils). We study the optics of thin films to be able to understand Rembrandt's technical genius. Understanding the role played by science in the actual art is the rationale for this subject. Sometimes the authors attempt this (e.g. neoimpressionism) but often they do not (e.g. afterimages); and it is not their principal focus. One creative approach to writing a book like this is to question what science can explain about art ... and then answer it.

Science helps us to describe and understand the look of art. We scientists have more and more to contribute to this study. New techniques spawn new data. Very recently, Farid's work[2] suggests how the computer might complement, and perhaps even supplant, the connoisseur. It is in this context that we need to consider the relation- ship between science and art.

(1). "Art, archaeology and analytical chemistry", A. L. Beilby, J. Chem. Ed. 69, 437 (1992).

(2). "A digital technique for art authentication", S. Lyu, D. Rockmore and H. Farid, PNAS 101, 17006 (2004).