Chemistry in Art

Introduction to the Virtual Art Exhibition

by Tami I. Spector & Joachim Schummer

We are pleased and excited to present the virtual exhibition "Chemistry in Art" which continues and expands *HYLE's* aspiration to promote a dialogue among the disciplines by now including the work of practicing visual artists. With this exhibition *HYLE's* special issue on "Aesthetics and Visualization in Chemistry" (Nos. 9.1 & 9.2) transcends the usual boundaries of scholarly journals and provides an alternate mode for reflecting on the aesthetics of chemistry that might otherwise be neglected by academicians. It is our hope that the inclusion of artistic works will not only appeal to, and satisfy, the aesthetic impulses of those of us who are already involved in the study of chemistry, but also broaden the conversation to include others who might feel marginalized by scholarly discourse. Toward this end, we present fourteen contemporary visual artists who each reflect on chemistry with a distinct artistic and conceptual perspective.

Since 1986, when the entire Biennale di Venezia was devoted to "Arte e Scienza", the relationship between science and art has been the focus of the art world. Even if one excludes the various popularizations of science and electronic media art projects, which are often also classified under the heading 'art and science', the topic has been the recipient of extraordinary attention from curators, gallery directors, and cultural critics. There are museums, societies, journals, magazines, foundations, and annual awards, and there have been countless conferences, symposia, and exhibitions devoted to the exploration of the relationship between art and science. Examples of recent art exhibitions are *Laboratorium*, a participatory exhibition that took place throughout the city of Antwerpen, Belgium, in the summer of 1999 and which explored the convergence/divergence of art in science within the framework of the literal and conceptual laboratory (Obrist & Vanderlinden 2001); *Weird Science (*1999), an exhibition at the Cranbrook Art Museum in Bloomfield Hills, Michigan of four artists' work that adopt "the practices of science" in order to critique "the influence, authority, and effects of the scientific field" (Apel 1999, p. 11); *Unnatural Science* where artists presented quasi-science at the Massachusetts Museum of Contemporary Art (2000-

HYLE – International Journal for Philosophy of Chemistry, Vol. 9 (2003), No. 2, 225-232.

2001); and, perhaps, most infamously the exhibition *Gene(sis)* that is currently touring the US (Henry Art Gallery, Seattle, 2002, Berkeley Art Museum, Berkeley, 2003, Frederick Weisman Museum of Art, Minneapolis, 2004), and which created a media sensation with Eduardo Kac's Green Fluorescent Protein (GFP) bunny, Alba. Internet sites that focus on the relationship of art and science, such as *Art and Science Collaborations, Inc. (ASCI)*, *Rhizome*, and *Leonardo*, also provide access to information on many other exhibitions. Although these exhibitions are intriguing in their own right, what is most apparent is their overt exclusion of works related to chemistry – save the occasional allusion to alchemy or to what people believe alchemy was (*e.g.* Schwarz 1986). Indeed, a perusal of current and past exhibitions and texts on art and science makes it apparent that chemistry has been, at best, scantily considered.

The neglect of chemistry by artists, curators, and art critics is quite surprising, because artists, like chemists, have always been personally engaged in combining, transforming, and experimenting with materials. The relation of art to chemistry is, in fact, the most overt among all the scientific disciplines. Indeed, since the late nineteenth century the industrial production of paints and other classical artistic materials has encouraged modern artists to experiment with evermore new and unusual materials. (For an encyclopedic survey see Wagner *et al.* 2002.) Moreover, as new, process-orientated art genres were established in the second half of the twentieth century, chemical transformations became a central part of modern art. For instance, artists, like Yves Klein and Janis Kounellis, employed fire (the oxidation of combustible materials) either as artistic performances or as means for artistic production. Crossing the boundary between painting and photography, Sigmar Polke and Achim Duchow mixed their own photo emulsions to perform photochemical reactions on canvas and other media. Sometimes, as in César's *Expansions* of polyurethane, chemical reactions with polymers have been used to control the generation of sculptural forms. Chemical reactions (the qualitative transformation of materials) have been the subject of artistic and philosophical fascination ever since the early days of alchemy – so much that they have become an allegory of radical change and the dynamical essence of nature. Examples of this are the Arte Povera artist Gilberto Zorios, who staged chemical reactions in crucibles to elicit the flavor of the (al)chemical laboratory and evoke obvious allusions to hermetic philosophy; and artists like Joseph Beuys and Dieter Roth, who have deliberately used biochemical processes in their works, like the rotting of edible materials, to illustrate degeneration and decay. In other work related to chemical transformation, electrochemical reactions (the generation of electricity from chemical reactions in galvanic cells or batteries) have become a prominent artistic symbol for the dynamic nature of matter and for energetics in general. In addition, because the chemistry

laboratory has been symbolically associated with the image of *the* scientific laboratory, artists frequently depict fractions of chemical laboratory equipment to allude to science in general or to the miraculous world of radical change. From sixteenth-century depictions of alchemists (Principe & DeWitt 2002) to the *Laboratory Still Lives* of Tony Cragg, who incidentally started as a laboratory technician, the chemical laboratory is a recurrent topic in European iconography. Unlike chemical phenomenology, and as for other physical sciences, chemical theory and models are less present in contemporary art. Examples from chemistry include Kenneth Snelson's *Portrait of an Atom* and Murray Robertson's *Visual Representation of the Table of Elements*. More recently, David Goodsell and others have created a highly specialized art form using computer-generated images of actual or invented molecules.

Given the ubiquity of chemistry in art, one may wonder why this aspect of chemistry has been neglected. We assume that the marginalization of chemistry in curatorial art projects follows a broadly established trend in the humanities that favors the cultural examination of physics and biology over chemistry – despite the fact that the societal impact of chemistry arguably surpasses that of any other science. The neglect of chemistry can, in part, be accounted for by a certain culturally rooted 'chemophobia'. Thus, unlike mathematical physics, which has long been aestheticized in a Pythagorean fashion, or biology, with its inherent link to the aesthetics of the human body and 'nature', everyday associations to chemistry frequently do not reach beyond ideas of toxicity and modern industrialization.

Despite, or perhaps because of the exclusion of chemistry by the art world, there have been numerous efforts by individual chemists and the chemical industry to relate chemistry to art. These include the organization of general art exhibitions by chemical companies, including those at the annual chemical engineering fair ACHEMA in Frankfurt, Germany; educational projects on the chemistry of pigments and other artistic materials, such as the one at the ETH Zürich (Switzerland); lectures on how chemistry helps to analyze and conserve artworks, as found in "Chemie der Kunst" (Berlin, Germany, 2003) as well as the public lectures that chemistry professors advertise as 'art performances'; publications on how the history of chemistry or historical chemists were artistically represented, such as Beretta 2001, Greenberg 2002, Beyer & Behrends 2003; and most notably, collaborations between individual chemists and artists, such as Hoffmann & Torrence 1993.

In contrast to these previous efforts which try to establish indirect or specific links from chemistry to art, "Chemistry in Art" has provided a space for contemporary artist to broadly speak to and reflect on chemistry. Given this, and the neglect of chemistry in previous curatorial projects on art and science, "Chemistry in Art" is the first public exhibition ever to present a variety of artistic perspectives on chemistry. Through this project, we hope to

alter and expand the perception of both chemistry and art and inspire a community of artists to include chemistry as a legitimate and important subject of their inquiry. We believe such an exhibition will also begin to break down traditional barriers to the cultural and artistic examination of chemistry and ensure that this influential science is included in future exhibitions on the relationship between art and science.

With "Chemistry in Art" we have also explored new forms of selecting and presenting art. The way we have selected the artistic contributions combines 'double blind peer review', as known from the sciences, with the curatorial and jury models common in the arts. Similar and parallel to our 'Call for Papers', a broadly posted international 'Call for Artworks' invited artists to submit projects related to the general topic of "Aesthetics and Visualization in Chemistry". The many interesting projects we received far exceeded our expectations – expanding and altering our own perceptions of what constitutes art related to chemistry. From among the large pool of submissions, an international jury of artists and scholars from chemistry and art theory made a selection, based solely on criteria of quality and relevance. As in the sciences, our jurors did not know the names or any other details about the artists, nor did they know the choices of their fellow-jurors. Yet, despite their different backgrounds, their selections were surprisingly consistent. And since the jurors, almost in unison, ranked one project extraordinarily highly, we decided to give a special award to the artist, David Clark, from the Nova Scotia College of Art and Design, Canada.

In addition to the juried selection, "Chemistry in Art" also includes a curatorial project jointly directed by art critic David Spalding and Tami Spector. This curatorial project highlights chemistry-related artworks by renowned artists Susan Robb, Shirley Tse, Cai Guo Qiang, Kim Abeles, and Fred Tomaselli. The images for this portion of the exhibition are accompanied by a dialogue between the curators, which engages larger issues related to the intersections of art and chemistry. We believe that viewing these images in the context of chemistry and in dialogue with each other provides a new critical framework for understanding the work of these exceptional artists.

The artworks presented in the juried part of "Chemistry in Art" provide a variety of perspectives on chemistry. Since we asked the artists to speak for themselves by including a brief text in their art projects, we have confined this introduction to general remarks and relations between the different projects. In general, as we can conclude from the large amount of submissions we received, artists deal with chemistry from at least six different perspectives. (1) They deliberately use synthetic/chemical materials which they frequently oppose with 'natural' materials and, thus, work on the aesthetic difference between natural and synthetic. They employ chemical transformations either (2) in an experimental manner to generate novel phenomena,

or (3) as part of artistic performances or dynamical artworks that highlight processuality and change. (4) They put symbolically laden parts of chemical laboratory apparatus into new contexts and thereby create and analyze symbolic meaning. (5) By representing either the actors of chemistry or prominent products of chemistry in certain contexts, they reflect the public image and the cultural place of chemists and chemistry in society. (6) Finally, they examine the aesthetic dimension of chemical models and theories and their scientific representations, by means of re-emphasis, re-configuration, re-contextualization, or analogy.

Surprisingly, in the juried part of "Chemistry in Art", three of the artists use the Periodic Table of Chemical Elements as an inspiration for their work to quite different ends. New York artist BLAIR G. BRADSHAW isolates specific elements in his paintings, creating his works out of building blocks of small canvases that mirror the way in which atoms themselves serve as building blocks for our material world – yielding visible and recognizable structures from discreet and indeterminate particles. DAVID CLARK, from Canada, wittily subverts the image of the Periodic Table by using its familiar form, and the atomic symbols that make up the table, to reinvest other visually encoded systems in western culture with new meaning. With craftsman-like artistry, Clark's *Chemical Vision* literally translates the imagery of the periodic table into eye-charts and Ouija boards. In contrast to Bradshaw's and Clark's more formal use of the atomic symbols and Periodic Table, the installation of German artist ERICH FÜLLGRABE, the *Latin Periodic System*, seeks a psychological perspective on the Table's symbolic meaning and explores the analogy between chemistry and linguistics. With works such as *Reconstruction of a Representation of a Model of a Description of a Workplace of the Latin Periodic System of the Typographical Elements* Füllgrabe not only creates a range of pseudo-scientific labels, instruments, and environments to investigate and deconstruct the relationship between visual systems and conceptual understanding, but also communicates his vision of a formal analogy between scientific and artistic investigation.

Electrochemistry underlies the work of both PAULA L LEVINE from California and BRIGITTE HITSCHLER from Germany. With *Bible Battery*, Levine uses transparent interconnected jars to expose the inner workings of her battery and, metaphorically, the bible. In this piece, sections of the bible submerged in the electrolytic solution literally and symbolically drive its narrative intent. In contrast, Hitschler's *Energy Fields* uses electrochemistry to expose the toxicity under the surface of a soon to be recultivated potash waste site in Hannover, Germany. Like environmental beacons, Hitschler's field of 400 light emitting diodes poking their heads out of the earth like extra-terrestrial gophers provide an alarmingly beautiful signal for the hidden dangers created as by-products of chemical industry.

Both CHERYL SAFREN from New York and TAMAR SCHORI from Israel create works that expose the aesthetic potential of chemicals as artistic materials. With *Chemistry as Art* Safren uses chemical reactions on metal surfaces to create dynamic abstract images. With these works Safren brings to the fore the chemical materiality of painting and the intimacy of individual artist with their materials. Safren's 'paintings' interact with their viewers through the refractive and reflective nature of the chemicals applied to their surfaces, while Schori's *e.mia.me* documents the beautiful forms created in response to multi-human interaction with a tank full of slick black-brown ferromagnetic liquid (ferrifluid). Besides revealing the aesthetic nature of the ferrifluid, Schori uses *e.mia.me* to focus on the act of creating participatory and collectively generated art. In this way her work also mirrors and comments on the collaborative (and, at times, playful) nature of research in the chemical sciences.

Finally, CHRISTOPHER PUZIO from California and LANE E. LAST from Tennessee each present works that explore some of the concepts and constructs that underlie modern day chemistry. With *Unit Construction* Puzio has created fifty 'atomic building units' out of steel tubes (which, incidentally, have a remarkable visual similarity to the Dreiding models used by chemists) that he uses as building blocks for his sculptures. Conceptually, Puzio's atomic units are analogues to amino acids, which at the most basic level are molecular units created from the same atomic units (N-terminus, C-terminus, R group). Depending on the order in which they are linked together, amino acids yield an astonishing variety of proteins. In this same way, Puzio's atomic units, which like amino acids are all variations on the same basic form, can lead to an almost infinity of tertiary forms. The vibrantly colored computer graphics of Last's *Imagining the Aesthetic Metaphor* also employ imagery based on the models that chemists use to communicate chemical concepts. Using pseudo-atomic forms these graphical works imitate the style and stretch the limits of the chemist's cartoon-like visualizations. Delving deep into the imagined interior world of atoms, Lane's images make atomic and molecular concepts like electronegativity and valency come alive.

To us what is most remarkable about "Chemistry in Art" is not that the artists use chemistry in clever and engaging ways, but how their work reveals the ways chemistry has seeped into the world outside the laboratory and classroom. Using the icons and materials of chemistry, these artists generate and reflect many of the larger cultural concerns related to this often misunderstood science, whether environmental or metaphysical. Thus, from the perspective of "Chemistry in Art" the Periodic Table is at once a symbolic system with specific scientific meaning; an almost instantly recognizable cultural icon that encodes the idea of chemistry even to those who have no real understanding of its content; and a template for examining the nature of vis-

ual representation. Similarly, the dynamic, interactive nature of ferromagnetic material becomes a means for understanding scientific collaboration. With these and the other works in "Chemistry in Art", the artists in this exhibition have transcended the literal by pushing and prodding chemistry's symbols, materials, and processes to reveal its transformative core.

References

Apel, D. (ed.): 1999, *Weird Science: A Conflation of Art and Science*, Cranbrook Art Museum, Bloomfield Hills, Michigan.

Beretta, M.: 2001, *Imaging a Career in Science: The Iconography of Antoine Laurent Lavoisier*, Science History Publications, Canton, MA.

Beyer, L.; Behrends, R.: 2003, *De artes chemiae*, Passage-Verlag, Leipzig.

Greenberg, A.: 2002, *The Art of Chemistry*, Hoboken, NJ, Wiley.

Hoffmann, R. & Torrence V.: 1993, *Chemistry Imagined*, Smithsonian Institution Press, Washington.

Obrist H.U. & Vanderlinden, B. (eds.): 2001, *Laboratorium*, DuMont, Köln.

Principe, L.M. & DeWitt, L.: 2002, *Transmutations: Alchemy in Art*, Chemical Heritage Foundations, Philadelphia.

Schwarz, A.: 1986, 'Arte e Alchimia', in: *XLII Esposizione Internationale d' Arte. La Biennale di Venezia. Catalogo Generale*, Venezia, pp. 77-82.

Wagner, M.; Rübel, D. & Hackenschmidt S. (eds.): 2002, *Lexikon des künstlerischen Materials. Werkstoffe der modernen Kunst von Abfall bis Zinn*, C.H. Beck, München.

Internet References

(last visited 22 July 2003)

Art & Science Collaborations, Inc. (ASCI)
http://www.asci.org/

Chemie und Kunst: Pigmente, EducETH
http://www.educeth.ch/chemie/diverses/pigmente/

Gene(sis): Contemporary Art Explores Human Genomics
http://www.gene-sis.net/

Leonardo On-Line: the International Society for the Arts, Sciences and Technology
http://mitpress2.mit.edu/e-journals/Leonardo/

Molecular Art | Molecular Science, by David S. Goodsell
http://www.scripps.edu/pub/goodsell/

Rhizome.org: The new media art resource
http://www.rhizome.org/

Unnatural Science, Major New Exhibition, Massachusetts Museum of Contemporary Art, Press Release, February 14, 2000
http://www.massmoca.org/press_releases/02_2000/2_14_2000.html
Vortragsreihe – Chemie der Kunst, by Bundesanstalt für Materialforschung und -prüfung
http://www.bam.de/chemie-der-kunst.htm

Tami I. Spector:
University of San Francisco, Department of Chemistry, 2130 Fulton St., San Francisco, CA 94117-1080, USA; spector@usfca.edu

Joachim Schummer:
Department of Philosophy, University of South Carolina, Columbia SC 29208, U.S.A. & Institute of Philosophy, University of Karlsruhe, D-76128 Karlsruhe, Germany; js@hyle.org