Between Chemistry and Art

Tami I. Spector and David Spalding in Dialogue

Tami Spector (TS): I would like to begin by discussing why you and I chose the artists that we did. Unlike the artists who submitted work for the refereed portion of the "Chemistry in Art" exhibition, who presumably intended to explicitly reference chemistry in their work, this part of "Chemistry in Art" is really based on our own conceptions of art and chemistry. I am curious about what types of things you were thinking about when you first tried to come up with artists that fit the theme. In other words, what did chemistry in this context mean to you?

David Spalding (DS): When we first began discussing the possibility of identifying artists whose work relates to chemistry, I was immediately interested in artworks that stretched curatorial parameters and defied expectations. I had not given much thought to chemistry, but had recently been writing about art and the human genome project. During my research, I was struck by the way that the ethical dilemmas that science generates can be both neutralized and amplified by artists.

One of my first impulses was to consider artists that address the phenomenological aspects of chemistry, like Cai Guo Qiang's explosions, or the drug trips evoked by Fred Tomaselli's pill paintings. From the outset, we both agreed that it was important to select artists who present work from a range of cultural vantages. Clearly, representations of chemistry and chemical processes, of the conceptual concerns evoked by chemistry, of the promises and dangers of chemistry – all these things would be imagined and imaged differently in a variety of cultural contexts. I was also thinking about this during the preliminary selections.

Many of the artists came to mind while I was reading one of the introductory chemistry texts that you lent me. Looking at the pictures and reading about what chemists actually do in laboratories made me think more about the material aspects of chemistry. It was then that Shirley Tse's work came to mind – the way she transforms polymers and synthetic packaging materials raises so many interesting conceptual questions. The materials that she uses are clearly chemical, but her work is also linked to chemistry because it embodies the notion of transformation.

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Initially, I wanted to see what would happen if we brought together artists whose work is not usually associated with chemistry or science. By conceptually reframing the work and putting it in dialogue with other unlikely candidates, could we broaden the way these artists are understood? I did not want to see sculptures of giant beakers. I was interested in works that are more ambivalent. Ideally, I wanted to challenge the ways that art and chemistry have typically been linked, asking viewers to make connections that are not always obvious. This would not only transform the chosen artworks; it might change the way we imagine the conceptual, ethical, and material dimensions of chemistry.

TS: I must admit that when we first started I had some initial reluctance about many of the artists that you suggested. On the surface, they seemed to mostly speak to the negative aspects of chemistry in society, or at least to the more industrially driven domains of chemistry. I suspected that many chemists might also have a similar knee-jerk response to the artists that we decided to include, which made me a bit hesitant. It is not that I thought that we should not include anything on this aspect of chemistry; rather I did not want it to be the only focus. From this perspective, I viewed Fred Tomaselli's work as a response to the pharmaceutical industry and drug addiction, Kim Abeles' to industrial pollution, Cai Guo Qiang's to weaponry, and Shirley Tse's to the impact of plastics on the environment. My initial hope was that the artists we included would not necessarily glorify chemistry, but perhaps get inside the metaphorical aspects of chemistry – the transformation, synthesis, and production of products – and perhaps the symbolic language and the experimental vocabulary and apparatus of chemistry. Also, I wanted to clearly distinguish chemistry from biology, which is often mixed up with chemistry by non-chemists.

Looking deeper, however, I realized that the artists that we were thinking of including do address what I initially had in mind, but they also reflect the larger tensions that are embedded within the chemistry community. There is an inherent tension in chemistry between the doing of chemistry and its applications – in the way the products of chemistry can at once be scientifically and/or aesthetically compelling and fraught with societal implications. I believe that many chemists conceptually separate the chemistry they do from its potential applications, whether the chemistry they are doing is socially benign or not. On a day-to-day level chemists tend to steep themselves in the intricacies of their work, whether it be developing plastics with new material properties, new pharmaceuticals for AIDS, new explosives, or something potentially quite boring, like developing a new soap, without much thought about the ultimate application of the materials. I am not saying that chemistry as a discipline and culture is neutral to its place and impact on society. But

in the day-to-day world of chemistry, it is the chemistry that captures a chemist's imagination and that there is often an inherent tension between the allure of the work that they are doing and its ultimate outcome.

With this in mind I realized that the artists we selected for this exhibition are representative of the intersection of chemistry and art because they explicitly mirror these tensions in their work. What I mean is that the works like Abeles' *Presidential Commemorative Smog Plates* (1992) or Tse's *Diaspora? Touristry?* (1999) both carry with them the intricacies of art and chemistry *and* serve as social commentaries on chemistry. For me this perspective provides a groundwork for understanding these artists in relation to chemistry, and also, as you suggest, in relation to one another. Your comments also make me realize how overly sensitive I am to negative associations with chemistry – so that, where for you Tomaselli's and Cai's work has to do with the phenomenology of chemistry, I immediately leapt to nastier interpretations of their work.

DS: When we began selecting artists, it never occurred to me to impose a viewpoint that would glorify or demonize chemistry. Chemistry seems so immediate and diverse in its incarnations that it would be impossible to reduce its multiple meanings in this way. That is part of what made this project so interesting. Since chemicals are literally everywhere, which aspects should we choose to isolate and highlight? As you have said, chemistry does give form to a number of provocative tensions. Is it a helpful science, or a dangerous one? Of course, it is both. Some artworks embody these tensions by delaying their resolution, while others are quicker to take sides. Shirley Tse's work certainly embraces this kind of multiplicity. Her sculptural installation, *Shelf Life* (2002), uses various kinds of polymers – from Styrofoam to 'memory foam' – to confront viewers with a constellation of associations. Climbing the steps cut into the side of the enormous structure, one enters a hybrid space: part amusement park ride, part spa, and part futuristic medical center. The title suggests packaging and its ability to extend expiration dates, but sitting inside a flesh-colored tub makes one wonder what (or who) is being packaged. One of the things the installation implies is that it is our conceptual categories that are culturally given, enveloping us in a strangely hermetic embrace. The more we stay open to the multiple meanings suggested by *Shelf Life* (2002), the closer we get to chemistry as a way of thinking. This is not to say that chemistry is a screen that is ready for any and all of our projections. But Tse's work begins to create a series of heterogeneous associations that can exist simultaneously. For this reason, her work best addresses the way I imagine chemistry.

TS: Can you say more about this? What is it that you mean by chemistry as a way of thinking?

DS: Though I have a very limited understanding of chemistry, I want to venture that transformation – changes in the molecular structure of matter, for example – is central to many of chemistry's applications and incarnations. Seen in this way, chemistry itself, with its myriad productive and non-productive applications, becomes analogous to its central tenant of transformation. This interests me because it creates a set of parallel structures whose alignment rests on the idea of multiplicity – simultaneous possibilities that do not void each other. For this reason, chemistry is illustrative of certain models of thinking. Rather than reductive, oppositional, or binary logic, which can consolidate meanings through the minimization of internal differences within each conceptual category (*i.e.*, 'natural' and 'artificial'), chemistry's focus on and embodiment of multiplicity and transformation suggests other, more inclusive and complex ways of organizing information. It is surprising that chemistry can take us outside the bounds of more traditional notions of scientific reason, offering up a model that might accommodates that flux of our lived experiences.

I wonder if your experience as a chemist resonates with this investment in transformation and multiplicity.

TS: One way to think about this is that for any chemical product there are multiple approaches to its synthesis or, from a reverse perspective, chemical entities hold in them multiple transformative possibilities, multiple means to an end, and multiple ends.

On the level of practice this means that a number of chemists might work toward the exact same ends using different synthetic processes and different starting materials. As a result it is the choices made by both chemists and chemicals that inform and define our understanding of the final product and not just the product itself. I think this is probably true for art also, but in art the process may or may not be relevant to the artistic product, while in chemistry the synthetic process takes precedent in many ways over the end product and the process is always explicitly revealed. I think this is somewhat different from what you are suggesting about Tse's work, where it is the end product of the artistic process, the piece of art that embodies its multiplicity. I suppose that this is also true for chemical products but for me what defines chemistry's complexity and irreducibility is how process, transformation, and product are inextricably linked to each other.

Because of its transformative nature, much of chemistry also opens itself up to the unexpected and serendipity. A chemist might plan and perform a particular transformation but in actuality a different process occurs as re-

vealed by the end product. In that way chemistry seems parallel to the artistic process, where there is often a disjunction between an artist's conception and the art she produces. Among the artists that we are featuring here, I think Cai Guo Qiang's work is most readily understood in this regard because of its performative nature (*i.e.*, its focus on process) and in its unpredictable, yet circumscribed, outcome.

DS: I wonder how much of Cai's work with fireworks and gunpowder is unpredictable. Many of his performances appear so well planned, particularly those involving fireworks. *Transient Rainbow* (2002) was commissioned by Cai and the Museum of Modern Art in New York to celebrate the opening in its temporary location in Queens. Grucci, a family owned pyrotechnic company based in New York, was actually responsible for the execution of the project. If you look at the preliminary study, it is clear that very little was left to chance. Remember that the event took place on June 29, 2002, when New Yorkers were still recovering from the events of September 11. Explosions in the night sky – however beautiful – could alarm the public. My sense is that the project was very exacting and controlled. It is interesting to think of fireworks as staged chemical reactions that have to maintain a careful balance between safety and spectacle.

TS: I agree in some ways with what you are saying, but at the same time I think that there is an inherent unpredictability in this work, since it relies on the chemistry working properly each time. If I were Cai, I would not be worried about the uncontrollability of the work but about whether it would be a dud – in chemistry parlance, whether it would be 'crap-out'. Maybe a better way of expressing it is that it is not completely reproducible.

In order to shift things slightly I will refocus our conversation onto Fred Tomaselli's work. I think it is important that viewers know that he is using pharmaceuticals in his work – that he is actually applying pills, cannabis leaves, *etc.* to the canvases. When you look at reproductions of his work, that is not necessarily apparent. *Bambogenesis* (1992) uses hemp leaves, saccharin, and other assorted pills, while the 'lines' in *13,000* (1991) are made of aspirin tablets. At first glance, people might not realize this, so viewers need to look closely at the images, particularly in a screen-based exhibition. More importantly, I think the fact that Tomaselli uses real drugs in his work is ripe for interpretation in the context of chemistry.

The production of pharmaceuticals and the ways in which pharmaceuticals interact with the human body and mind are huge parts of chemistry. From an overly reductive perspective, drugs are chemicals that are synthesized or isolated by chemists and that people ingest to induce a biochemical reaction(s) that yield a physiological effect. By using the pills as materials for

his paintings, Tomaselli literalizes this connection between pharmaceuticals and physiology and, more specifically, gets at the aesthetic qualities of drug induced biochemical states like hallucination. As exemplified by *Bambogenesis* (1992), his images are often reminiscent of the work of 1960's psychedelic poster artists; but unlike these artists, he appears to approach his work with an ample dose of self-consciousness. Looking over Tomaselli's output over the years, it seems clear that he likes to play with genre, but at the same time his work seems very obsessive. In that way it reflects our cultural obsession with drugs, both legal (proscribed and over the counter) and illicit. The work also mirrors how drugs cause obsession through addiction.

DS: Like the psychedelic posters and Op art that he is referencing, Tomaselli's work relies on repetition and patterning. The interlocking, concentric circles of tablets in *Bambogenesis* (1992) suggest stellar constellations, fiery starbursts radiating with rings of light. The work also evokes the kind of geometric abstraction found in Islamic art and architecture. Like drugs, the decorative designs found in mosques can be understood as helping the devout to transcend the everyday.

In short, I am wondering if these circular patterns – which recur in so many images or patterns that are meant to take us beyond the senses – are related to the electrochemical nature of vision, the chemical processes that enable sight. While maintaining the important distinction between chemistry and biology, I think that the chemistry of vision might open up another, less obvious reading about Tomaselli's obsessive arrangements of pills. How does focusing on the chemistry of vision move us away from the objects of sight, retraining our focus on the spectacular process of seeing?

TS: Visualizing the invisible is very much a part of what chemistry is about – where spectral data and the visible manifestations of chemical reactions, such as color changes, light emissions, or smoke, encode what is happening on an atomic or molecular level. For example, a color change can tell us that something is being reduced or oxidized – that an electron is being moved around from one atom/molecule to another. For chemists, there is a constant interpretation of the atomic scale phenomena based on macroscale properties. These interpretations are then transcribed into symbolic forms, such as written chemical structures and molecular models. In this way the question of 'seeing' is opened up even further. What is seeing? Is it the direct observation of an object or phenomenon or is it an interpretative and contextual act that becomes transcribed by the scientist or artist? For me, Cai Guo Qiang's work clearly makes this connection between chemistry and art, since he uses the spectacular nature of chemical explosions and fireworks to create a visually spectacular (chemical) image. In a way, he reverses the practices of chemis-

try – using chemistry to create visual effects, while chemists use the visual effects of reactions to create chemistry.

I also think that Kim Abeles' work addresses this very well. Her work literally makes the invisible visible by capturing the stealth particulates that swim along in what seems like innocuous air. Air is interesting that way – how we can only see it indirectly through the wind, the residues it leaves behind, or chemical analysis. It is a good analogy for the interpretive nature of seeing.

DS: I am drawn to the way that Abeles' *Presidential Commemorative Smog Plates* (1992) use chemical processes to initiate dialogues about chemical air pollution. There is tremendous humor in the series, but it also invites serious contemplation. As she explains:

> *Presidential Commemorative Smog Plates* are portraits of U.S. Presidents from McKinley to Bush created from particulate matter in the polluted air. The cut stencils on dinner plates were placed on my rooftop for varying lengths of time depending on the extent of their violation or apathy toward the distressed environment. Upon removal of the stencil, the Presidents' visages in smog are revealed, accompanied by their historical quotes about the environment and business.

The aesthetic created by the smog is wonderfully icky, more grimy than ghostly. There is pleasure in seeing certain Presidents rendered in the pollution that they helped to facilitate. Yet, if one considers the series as a whole, the plates become less about pointing fingers and more about visualizing a continuum of environmental neglect.

That is not to say that chemistry is inherently dangerous. In fact, just as certain synthetic chemicals may adversely effect the environment, the environment is also filled with many naturally occurring chemical substances that we find useful. This is often used as an argument for preservation (*i.e.*, the rainforests may contain undiscovered medicines that will save lives). Are not many of the psychotropic pharmaceuticals prescribed today derived from natural sources?

TS: Yes. The isolation and synthesis of natural products is a major aspect of the pharmaceutical chemistry of psychotropic drugs, and many other drugs, too. For me what is most interesting about this is the tension between natural and artificial that the chemistry of these drugs exemplifies and how these tensions are mirrored in the art included here. Is a chemical that is synthesized in the lab as an exact replica of a chemical that exists in nature natural or artificial? Is it ethically/culturally better or worse than its natural analogue? Is the rainbow of Cai Guo Qiang's *Transient Rainbow* (2002) natural or artificial? And what about Susan Robb's *Macro-fauxology* series (2000)?

Are her photographs original works of art or imitations of scientific artifacts? These issues are also addressed by Tomaselli's work since he uses the synthetic products of chemistry to create synthetic images of natural phenomena, like his work entitled *Bambogensis* (1992), which, as you mentioned to me, appears to be a visual and verbal play on the meteorological phenomena called bombogenesis. At the same time he seems to be asking what is natural about the nature of seeing, since his work appears to be the result of ingesting psychoactive chemicals that generate their own synthetic visual perspective.

DS: I think the strict opposition between the natural and the artificial – an historical product of forces that preceded the 18th century – begins to require reconfiguration at the points where art and chemistry intersect. Since science is often accused of being instrumental in facilitating the split between the natural and the artificial, I would like to suggest that through chemistry they can begin to reconcile in surprising ways, as indicated by Cai's *Rainbow* (2002) and Robb's experiments. In fact, many artists have worked to reveal the 'natural' as historically and culturally contingent, raising questions about science and identity.

TS: Yes. The question of the split between the artificial and the natural is nicely addressed by chemistry since, unlike physics and biology, it is very much a science of the synthetic. Much of the identity of chemistry as a discipline is related to the generation of materials that have not existed before and have no natural equivalent, rather than to understanding what exists in the natural world – what chemists like to call 'novel' molecules, compounds, or materials. To me, all of these issues of natural/synthetic/imitation/novel also relate to issues of originality, which is another point of connection between chemistry and the art included in this part of the *Chemistry in Art* exhibition. Tomaselli's work *13,000* (1991) speaks well to this since it appears to be a play on minimalism – a non-representational, easily imitated style of art that has evoked debates about originality in art – yet it is made of aspirin tablets. Indeed, it is not the image or the aspirin that are original in this piece but the reinterpretation of minimalist art through the recontextualization of common aspirin that makes this piece new and compelling.

DS: Robb's *Macro-fauxology* (2000) series also addresses the aesthetics of chemistry, suggesting that the ways in which chemistry is visualized are culturally coded. The photographs in her series (and their petri dish frames) are both works of art and imitations of scientific documentation. Art often approximates or even replicates other cultural practices; it distinguishes itself by reflecting critically on the disciplines and languages from which is borrows.

When I spoke with Robb, she joked about creating images that looked contemporary, rather than something that appeared too dated, too 'Science 2000' or 'Science 1999'. When she showed part of the series at the University of Seattle, the artist was approached by a biochemist who presumed that Robb's photographs documented typical biochemical experiments, when they are really close-ups of things like Tic-Tacs and Play-Doh. Robb is very interested in the fact that, as she put it, 'science has a style'. She wonders about what motivates changes in the way science and chemistry is imaged in textbooks and science journals. We can all imagine a 1950s, cold-war stylization of atomic science that appears paternalistic and authoritative. At the same time, atomic science also entered the popular imagination through design sensibilities, with images of whirling electrons informing everything from textiles to furniture design. (See, for instance, the movie clip *A is for Atom* (1953), by Sutherland Productions.) Certainly, emerging imaging technologies transform the ways that chemistry is made visible. But what about the cultural forces? What has made chemistry look the way it does in our current moment? I would love to hear your thoughts on this.

TS: The most overt way that chemistry has recently entered the culture in the US is through pharmaceutical and cosmetics advertising. Since 1997, when the Food and Drug Administration (FDA) approved commercials for pharmaceuticals, there has been a drastic shift in the use of molecular forms and chemical or chemical-sounding words in popular US media. It is now common to hear and see words like 'retinol A', 'alpha-hydroxy acid', 'Ephedrine', and 'anti-oxidant' rather than words like 'superelasticdoubleplastic', which were quite popular in the fifties and sixties. Commercials now use real (or quite realistic) chemical terminology. In terms of non-linguistic forms, the images of atoms from the fifties that you mention have also morphed into molecular forms that are, or resemble, the actual types of molecular forms that chemists use to communicate within the scientific community. So they are less iconic and scientifically more accurate.

I think this ubiquitous use of chemical symbols and vocabulary in popular media naturalizes and neutralizes chemistry in the cultural discourse. By using the words and images of chemistry, these commercials have the patina of scientific authenticity but are emptied of their scientific content. Thinking about this makes me wonder what it means when chemical nomenclature is applied to objects outside of the realm of actual science. In particular, Robb appears to be exploring these ideas in her work by the way she titles her pieces. Her use of titles also reveals how chemical nomenclature within the chemistry (science) community is integral to the scientific aesthetic that it communicates.

It seems to me that Robb's work is more dependent on its titles to communicate its chemical 'content' than the other artists we are discussing. What do you think?

DS: Perhaps because I first saw Robb's series in a show about the human genome project, I did not find it necessary to reference the photographs' titles in order to link them to chemistry. Instead, it was an understanding of Robb's process that changed the way I saw the photos. She stages actual chemistry experiments in her studio, using household materials rather than chemicals; she photographs the results with a macro lens. Of course, the experiments are modified as needed. Perhaps it is because I am not a chemist, but names life *Quadrihatrimineglucose* (2000) – Robb's photo that poetically visualizes the molecules in phenylethylamine, the chemical that produces the feeling of love – are not so informative for me. Robb's titles speak to an audience that recognizes the language of chemistry. But with its strangely electric colors and gooey sensibility, the series would evoke chemistry and biochemistry even if it were untitled.

I am curious, too, about the title of Tomaselli's, *Bambogenesis* (1992). It sounds like bombogensis, a meteorological phenomenon in which sudden cyclones 'bomb' the earth, suggesting a tempestuous association between psychotropic drugs and the spontaneous, destructive forces of the natural world. But again, the title is quite opaque: how many viewers will know what it means?

TS: I do not think that the precise meanings of their titles are so important to Robb and Tomaselli, as long as the titles have scientific or chemical sounds. To the best of my knowledge, *Quadrihatrimineglucose* (2000) is not an actual chemical compound nor is *Bambogenesis* (1992) an actual scientific phenomenon – so their precise scientific meanings are unintelligible even to a scientist. Like the pharmaceutical companies that name their drugs like Viagra® and Nexium®, Robb and Tomaselli's are using neologisms that have the air of science in order to purposely elicit certain associations from their audiences.

DS: We often hear about science influencing art, but rarely about how art has influenced science. Has putting together this exhibition and thinking about the artwork changed the ways you understand chemistry? How?

TS: By engaging in the *Chemistry in Art* exhibit, I feel like I have been able to tap into an understanding of the conceptual expansiveness of chemistry in a way that I never have before, which has been quite compelling, even exhilarating, on a personal level. Often, when I mention my own work on aesthetics and chemistry to people, the response that I immediately elicit involves

vague notions about the beauty of mathematics and physics – the elegant proof, *etc.*, rather than any particular associations with chemistry itself. This has always struck me as odd, since chemistry is such a visual, tactile, and odiferous science, but I have never quite been able to get a handle on the specifics of its unique relationship to art beyond the obviousness of its materiality. As you could probably tell from my initial responses in our conversation, I had an ideal of using the underlying tenets of chemistry as a metaphorical springboard into the arts; but in actuality I was caught up in a reading of the artwork as a somewhat reductive social commentary on chemistry. For me, your opening comments on how chemistry could inform our understanding of the art were particularly illuminating. Working on this exhibit has pushed me to be more aware and precise about how chemistry distinguishes itself as a science – that is, what makes it conceptually distinct from other sciences. In fact, I feel like the intersection of our conversation with the art itself has taught me a lot about the philosophical richness of chemistry and heightened my own intellectual connection to it as a discipline.

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