Chemistry in the picture

Peter Harris explores how modern art draws on chemistry for its inspiration

As the 20th century drew to a close there were signs that science was at last becoming cool. Popular science books topped the bestseller lists, scientists appeared in TV commercials, and novelists and playwrights increasingly looked to science for inspiration. In the visual arts too, there were signs of a new openness to science, with artists turning their attention to the human body and art galleries exhibiting photographs from the Hubble Space Telescope and the Moon landings.

Chemistry, being generally less accessible to the non-scientist than biology or physics, has rarely been an inspiration for artists. But even here there were signs of change, with artists like Damien Hirst and Simon Patterson producing work with a chemical theme. In one sense, of course, there has always been a link between chemistry and art, since painters rely on chemists to formulate the pigments that make up their palettes.

The artist’s palette

The development of new pigments and new types of paint has always been an important part of the chemical industry. Indeed, the roots of industrial organic chemistry can be traced back to the synthesis of mauveine dye by William Perkin in 1856.

Advances in synthetic processes during the 20th century gave artists access to paints with an unprecedented range of properties and colours. One artist who exploited these possibilities to the full was the British abstract painter Patrick Heron (1920–1999). Heron was captivated by the range of paints available to the modern artist, often incorporating the names of the pigments in the titles of his pictures. "One reeks at the colour possibilities now", he said in 1962, "the varied and contrasting intensities, opacities, transparencies; the seeming density of weight, warmth, coolness, vibrancy." His most characteristic paintings, produced during the 1960s and 1970s, contain expanses of deep colour, separated by jagged lines, reminiscent of the rugged Cornish landscape around his house near Penzance.

A particularly important development for artists was the introduction of acrylic paint. Acrylics were first prepared in 1880 and patented for use in industrial paints in 1915. As early as the 1920s, Mexican muralists experimented with acrylic paint when looking for durable materials for outdoor use. However, it was not until the 1950s and 1960s that artists started to use acrylics more widely.

The new paint had many advantages over oil, which was the favoured medium for most painters in the first half of the 20th century. It was available in a huge range of brilliant, vivid colours, and dried quickly to form a hard, glossy finish, which appealed to those working in the 'hard-edged' abstract style and to Pop artists like Roy Lichtenstein (1923–1997). Lichtenstein's paintings—which have become modern classics—mimicked comic strip images through the use of bold primary colours, prominent black outlines, and meticulously applied patterns of dots. Because acrylic paint, unlike oil, does not crack or yellow with time, these exuberant canvasses remain as fresh today as when they were painted in the 1960s.

The so-called ‘colour field’ painter Morris Louis (1912–1962) used acrylic paint in a quite different way. By thinning the paint down and applying it to bare, untreated canvases, Louis allowed the colours to bleed into the surface, and into each other, to produce an effect that resembled watercolour stain. The resulting pictures, which were often enormous in scale, could be strikingly beautiful. Similar techniques were used by Mark Rothko (1903–1970) to produce large canvases containing blurry rectangular blocks of colour, which are considered to be some of the most spiritual works in 20th-century art.

If developments in pigment and paint technology have had a significant impact on modern art, few artists have actually depicted chemical structures in their work. An exception is the Spanish surrealist Salvador Dalí (1904–1989). Dalí’s canvases often contained images that alluded to developments in science, perhaps most famously in The persistence of memory (1931), where the melting clocks apparently refer to Einstein’s theory of relativity. The explosion of the atom bomb in 1945 made a deep impression on Dalí, and many of his subsequent paintings contain references to atomic or nuclear structures.

Dalí was also fascinated by the discovery of DNA, and the way in which it might explain the transmission of hereditary traits, like madness.¹ In 1962–63, about the time that Crick and Watson received the Nobel prize, Dalí produced a painting with the indigestible title Galactosedosorsenicbenzo-acetic. This picture, which now hangs in the Salvador Dalí
Salvador Dali, Galacidalacidexosorbinucleicacid, (1962–63) Oil on canvas

Artists' materials

During the 20th century, sculptors made use of every imaginable kind of material in their work, from 'found' objects to bodily fluids. At the same time, industrial processes led to the production of a huge range of new synthetic materials. An artist who took a particular interest in the possibilities offered by synthetic plastics was the scientifically-trained Russian–American sculptor Naum Gabo (1890–1977). Gabo was a leading practitioner of Constructivism, a movement that advocated the use of industrial materials in art and professed an enthusiastic acceptance of modernity and progress.

In his sculpture, Gabo used perspex rods and sheets and nylon threads to produce elegant, translucent constructions, which seem to embody scientific principles and reflect a positive view of the possibilities of science and engineering. Although his pieces often appear entirely abstract, in many cases they were influenced by natural forms such as those described by Dr Percy Wentworth Thompson in his classic book On growth and form. There are also parallels between Gabo’s sculpture and the complex bubble structures formed when wire cages are dipped into soap solutions. Gabo’s work has had a significant influence on architecture and design, as well as on other sculptors such as Barbara Hepworth.

Mendeleev’s matrix

Martin Kemp wrote about the aesthetic and intellectual appeal of the Periodic Table, and a number of artists have produced work based on Mendeleev’s matrix. Among these is the American sculptor Carl Andre (b. 1935). Andre is best known in the UK for the controversy surrounding the purchase by the Tate Gallery in 1972 of his 'bricks' sculpture Equivalents VIII. He is a leading exponent of Minimalist art, but his work is by no means as cold and austere as that might suggest.

In 1996 the Oxford Museum of Modern Art staged an exhibition of Andre’s sculpture and installations that attracted large numbers of visitors. The works on display, constructed from cinder wood and metal plates as well as bricks, showed an artist concerned with conveying the sensuous pleasure he finds in these apparently mundane materials. Perhaps the most striking piece was an arrangement of metal plates entitled Metal Pourage (for Mendeleev). In this work, 1296 plates of aluminium, copper, steel, magnesium, lead and zinc were laid out on the floor according to the alphabetical sequence of their chemical symbols, forming a rectangle measuring more than 10 m². Visitors were encouraged to walk over the piece and explore the different colours and textures of the metal plates in this sculptural version of the Periodic Table. Work based on the Periodic Table has also been produced by the young British artist Simon Patterson, and by Ronald Leax, professor of sculpture at the University of Washington in St Louis.

In 1999 the Royal Society of Chemistry launched 109, a collaboration between scientists and artists, which aims to explore and reflect upon the diversity of elements that comprise matter in as unique and innovative manner as possible. As part of this project, the Society, in collaboration with the artist Murray Robertson, developed a new illustrated version of the Periodic Table called Visual elements, in which each element is represented by an artwork that reflects the properties of the element, its mythological connections and its impact on our lives. For example, the image for sodium shows a chip of the metal in parallel against the orange glow from street lighting.

In another initiative, chemists and visual artists have collaborated to create a series of Periodic landscapes. These computer-generated scenes express patterns in properties of the elements, such as their ionisation energies and densities, as mountainous panoramas. They incorporate the capability for real-time fly-through animations, which take the viewer on a spectacular journey through these virtual worlds. Both Visual elements and Periodic landscapes can now be viewed online at http://www.chemsoc.org/viselements/

Pickled art

Damien Hirst (b. 1965) is by far the most famous of the young British artists to have emerged in the past decade, and his installations featuring dead sharks and farm animals pickled in formaldehyde have attracted acclaim and derision in equal measure. But dead ani-

mals are just one of Hirst’s preoccupations. For many years he has been making work involving pharmaceuticals and other medical paraphernalia. In fact there are connections between this work and the pickled sheep: medicines, according to Hirst, lie between life and death. He also points out that art, like medicine, can be therapeutic. Since 1992, Hirst has been using what he calls a ‘scientific’ approach to produce a large series of pharmaceutical paintings, in which flat spots of colour (like coloured pills) are arranged in a regular grid on a white background. Each picture differs slightly from the previous one, in a way that echoes the differences between related chemicals. The resulting pictures, which have titles like Arbutinol and Carininosamine, have an undeniable appeal.

As well as being decorative, Hirst’s spot paintings are about to make a contribution to science. The European Space Agency announced in 1999 that one of Hirst’s pictures will be going to Mars on the British spacecraft, Beagle 2, at the request of the scientists involved in the mission. The painting will be used as a test card to calibrate the onboard instruments. So Hirst is now working towards creating a spot painting able to withstand the extreme conditions in space.

If artists are increasingly finding inspiration from chemistry and the other sciences, the story of buckminsterfullerene provides a rare example of art – or architecture – influencing science. Harry Kroto, Richard Smalley and their colleagues were studying the gas-phase clusters formed by the laser-vaporisation of graphite in 1985 when they made an unexpected discovery. They found that clusters of 60 carbon atoms were by far the dominant species among the gas-phase fragments detect-
by mass spectrometry. This was initially puzzling: there appeared to be nothing special about structures containing 60 atoms, and frantic model-making sessions at first failed to shed any light on the problem. The exact details of how the conundrum was eventually solved are disputed, but it appears that a trip to the library to study a book about Buckminster Fuller's architectural designs was involved. The final solution, of course, was that the 60-atom clusters owe their stability to a uniquely stable closed structure in which pentagonal rings introduce curvature in just the way they do in Fuller's geodesic domes.

The discovery of $C_{60}$, and subsequently of the related tubular structures known as carbon nanotubes, has opened up new areas of science that may have a profound impact on the technology of the 21st century. Researchers discussed the possibilities presented by the new carbon materials at a meeting at the University of Sussex in September 1999. To coincide with the meeting, an exhibition was held of pictures by the shadowy mathematician–artist who works under the name 'Sho Takahashi'. His images are said to be inspired by string theory and multi-dimensional space, as well as by Japanese aesthetic tradition. In many cases, however, they bear a distinct resemblance to the fullerene-related structures known as schwarzites. Perhaps the growing subject of fullerene and nanotube science will prove to be a fruitful area for future art–chemistry collaborations.

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References
5. D. Hirst, I went to spend the rest of my life everywhere, with everyone, one to one, always, forever, now. London: Booth-Clibborn, 1997.

Further reading